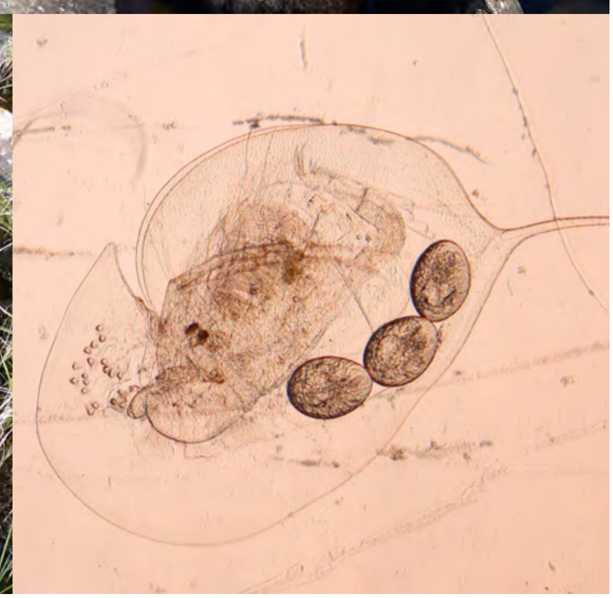
Ekati Diamond Mine

2014 Aquatic Effects Monitoring Program
Part 3 - Statistical Report





Volume I
Koala Watershed and Lac de Gras
King-Cujo Watershed and Lac du Sauvage

DOMINION DIAMOND™

Dominion Diamond Ekati Corporation

EKATI DIAMOND MINE

2014 Aquatic Effects Monitoring Program Part 3 - Statistical Report

March 2015

Project #0211136-0017

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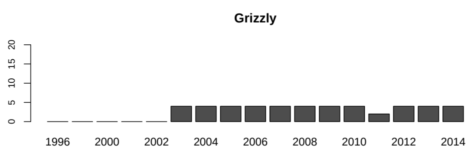
Analysis of April pH in Lakes of the Koala Watershed and Lac de Gras

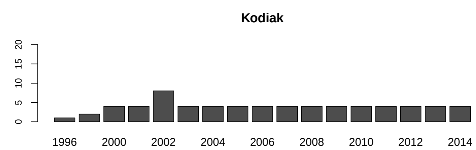
November 10, 2014

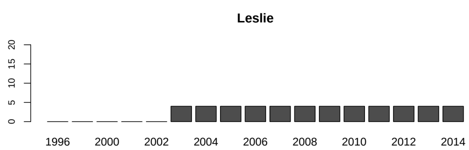
1 Censored Values:

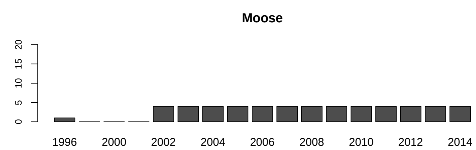
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

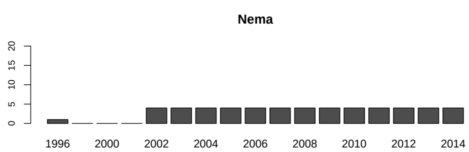
1.1 Monitored

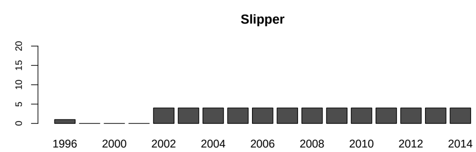


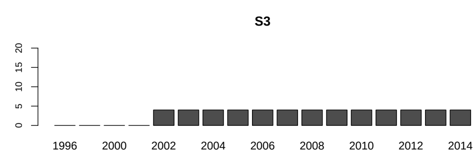




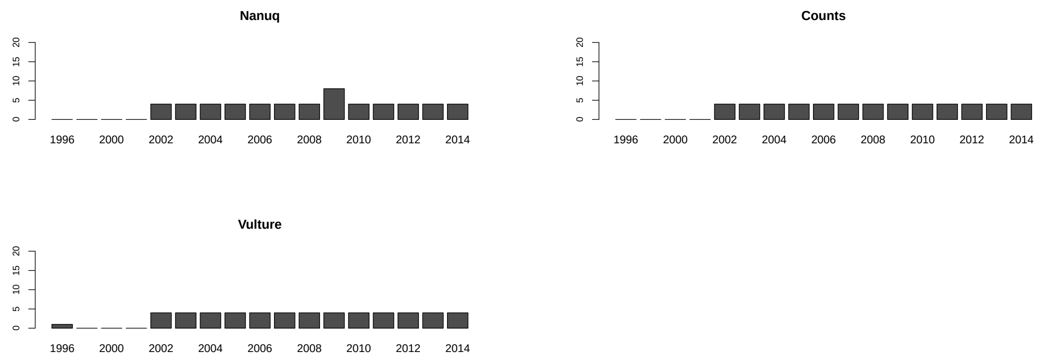






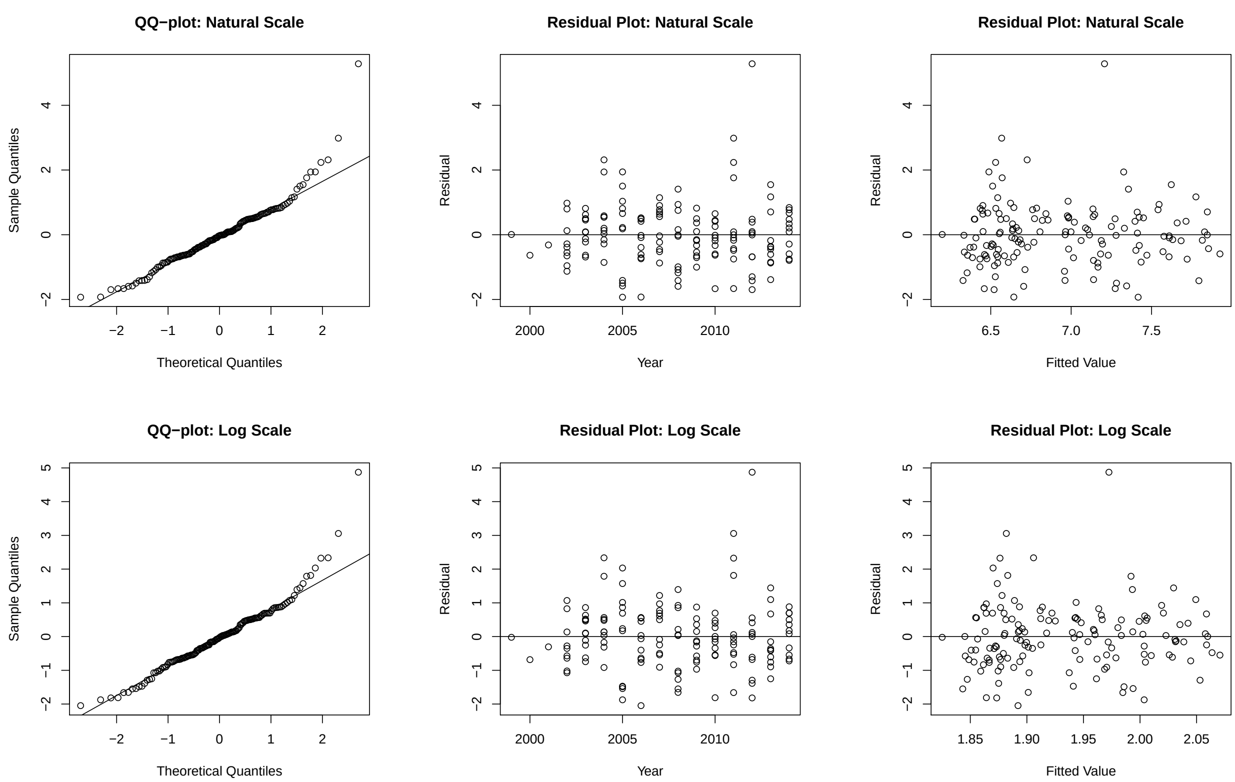


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
82	Kodiak	2012	8.30	7.21	5.28

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
82	Kodiak	2012	8.30	1.97	4.87
249	Vulture	2011	7.18	1.88	3.06

AIC weights and model comparison:

Natural Model	Log Model	Best Model
3.20E-122	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log transformed models. Although AIC reveals that the data is modeled best after log transformation, pH is already log scale and should not be transformed. Proceeding with analysis using untransformed, "natural" model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
3690.36	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.66	4.00	0.96

- Conclusions:
  The slopes do not differ significantly among reference lakes.

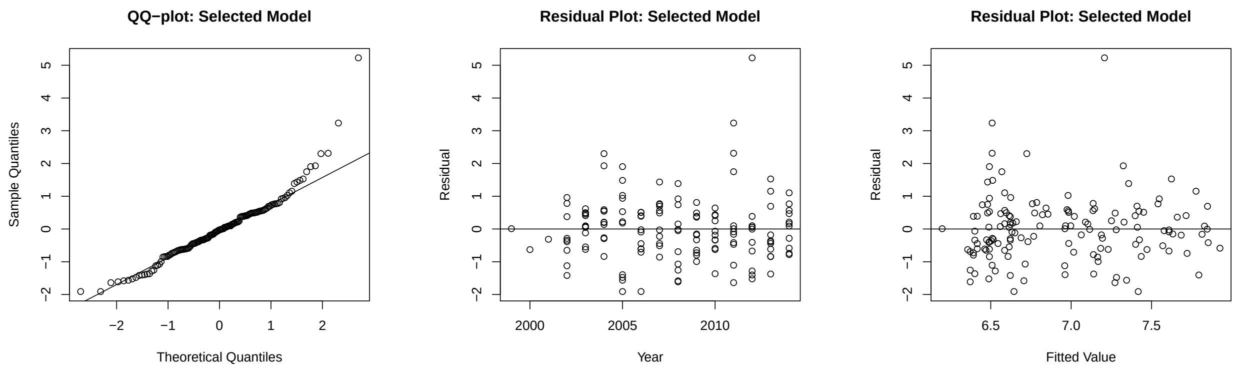
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.010	0.000	0.990	Ref. Model 3

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled with a common slope and intercept, contrasts suggest that reference lakes share only a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
82	Kodiak	2012	8.30	7.21	5.23
249	Vulture	2011	7.18	6.51	3.23

No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.27	2.00	0.87
Kodiak	8.93	2.00	0.01
Leslie	7.44	2.00	0.02
Moose	11.97	2.00	0.00
Nema	4.97	2.00	0.08
Slipper	9.12	2.00	0.01
S2	5.00	2.00	0.08
S3	4.80	2.00	0.09

- Conclusions:
  All monitored lakes except Grizzly, Nema, S2, and S3 show significant deviation from the common slope of reference lakes.

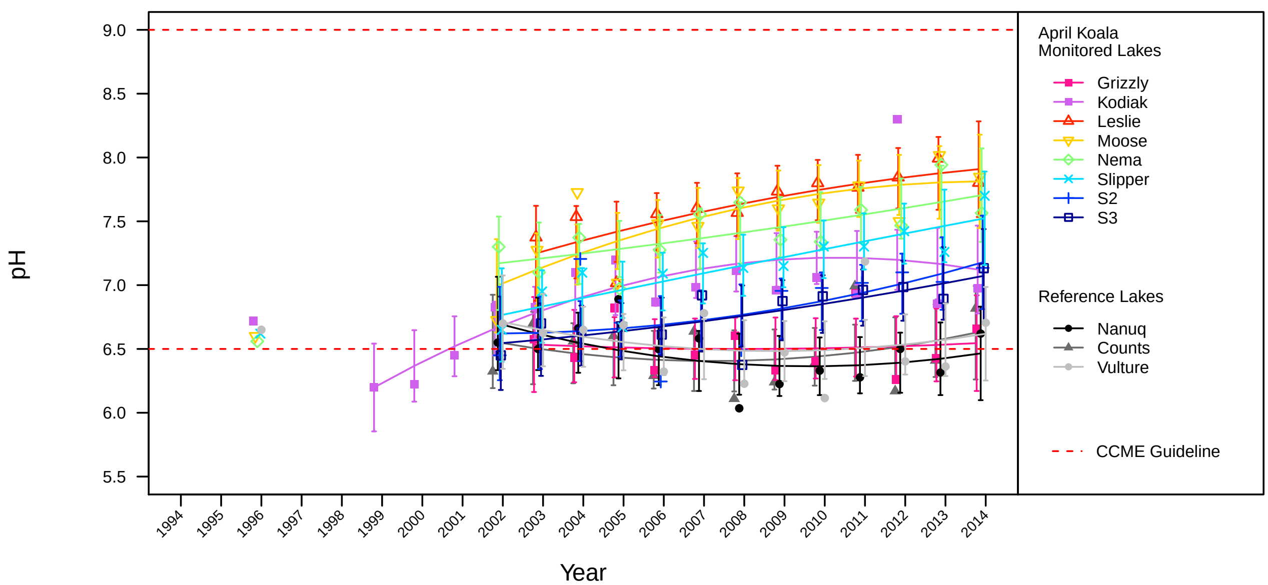
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0810
Monitored Lake	Grizzly	0.0060
Monitored Lake	Kodiak	0.4900
Monitored Lake	Leslie	0.6710
Monitored Lake	Moose	0.6000
Monitored Lake	Nema	0.4770
Monitored Lake	S2	0.3840
Monitored Lake	S3	0.5870
Monitored Lake	Slipper	0.7340

- Conclusions:
  Model fit for Kodiak Lake, Nema Lake, and site S2 is weak. Model fit for pooled reference lakes and Grizzly Lake is poor.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean pH for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	6.66E+00	6.55E+00	1.91E-01	6.17E+00	6.92E+00	5.59E-01
Kodiak	6.97E+00	7.12E+00	1.75E-01	6.78E+00	7.47E+00	5.13E-01
Leslie	7.80E+00	7.91E+00	1.91E-01	7.53E+00	8.28E+00	5.59E-01
Moose	7.85E+00	7.81E+00	1.87E-01	7.45E+00	8.18E+00	5.47E-01
Nema	7.56E+00	7.70E+00	1.87E-01	7.34E+00	8.07E+00	5.47E-01
Slipper	7.70E+00	7.52E+00	1.87E-01	7.16E+00	7.89E+00	5.47E-01
S2	7.13E+00	7.18E+00	1.87E-01	6.81E+00	7.54E+00	5.47E-01
S3	7.13E+00	7.07E+00	1.87E-01	6.71E+00	7.44E+00	5.47E-01
Nanuq	6.62E+00	6.46E+00	1.87E-01	6.10E+00	6.83E+00	
Counts	6.82E+00	6.63E+00	1.87E-01	6.26E+00	6.99E+00	
Vulture	6.71E+00	6.62E+00	1.87E-01	6.25E+00	6.99E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
pH	April	Koala	Lake	Water	none	none	linear mixed effects regression	#2 shared slopes	6.5/ 9	Kodiak Leslie Moose Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

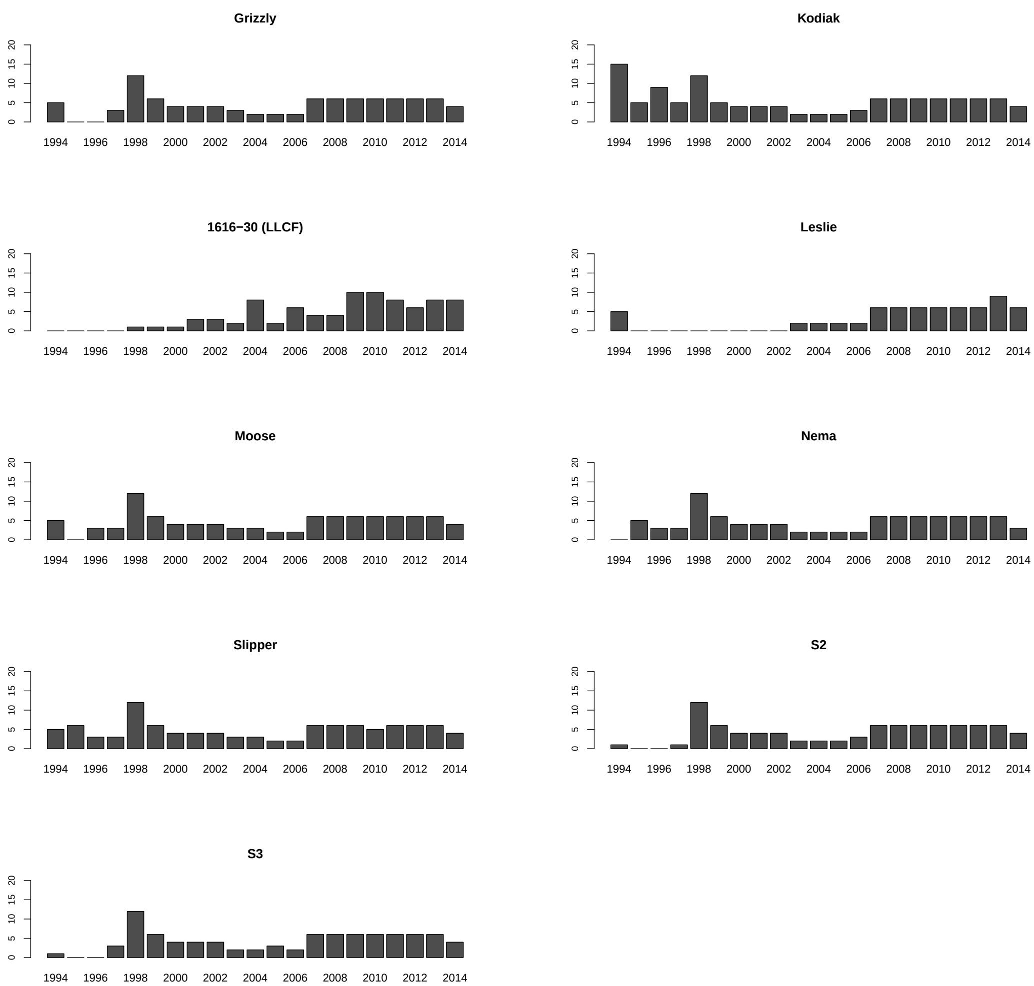
Analysis of August pH in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

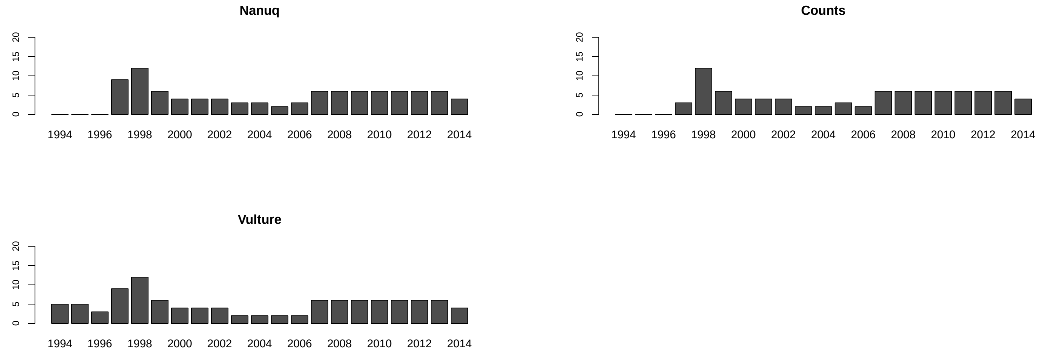
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

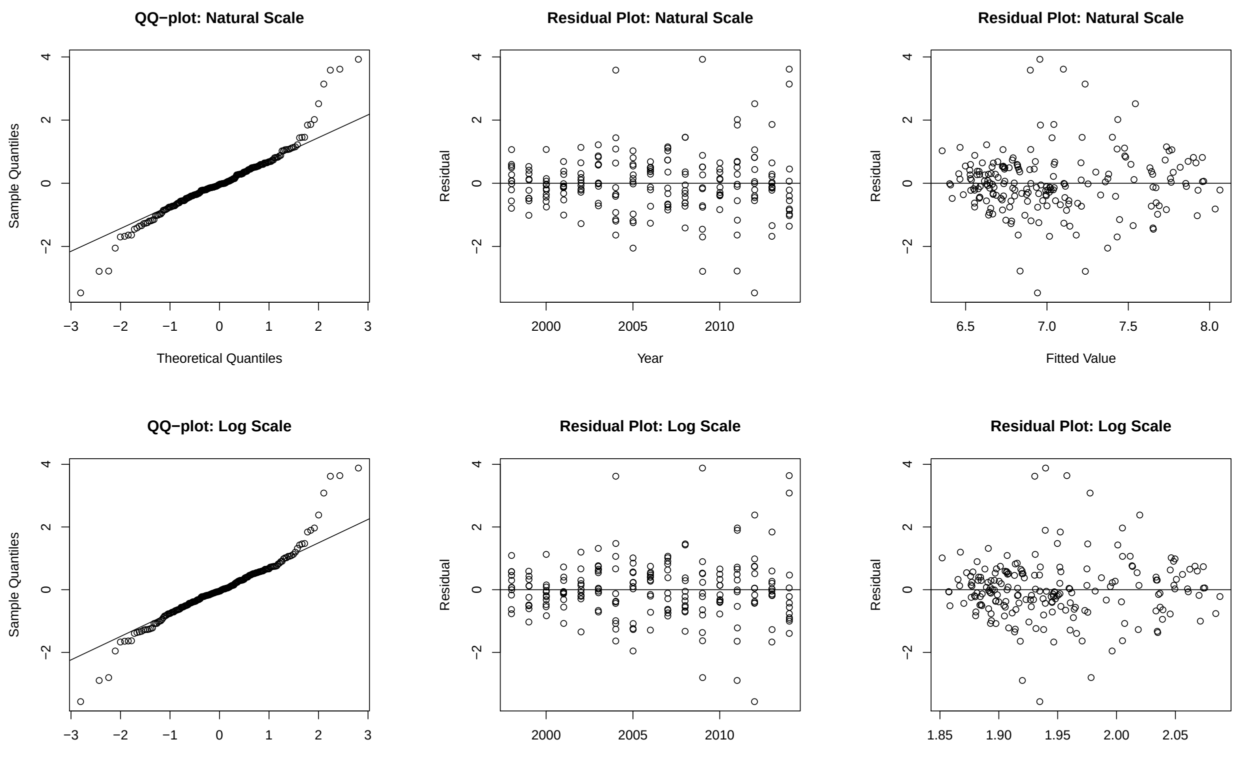


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
40	Counts	2012	6.46	6.94	-3.47
42	Counts	2014	7.61	7.10	3.61
63	Grizzly	2014	7.67	7.23	3.14
79	Kodiak	2009	7.51	6.96	3.92
179	S2	2004	7.40	6.90	3.58

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
40	Counts	2012	6.46	1.93	-3.57
42	Counts	2014	7.61	1.96	3.64
63	Grizzly	2014	7.67	1.98	3.08
79	Kodiak	2009	7.51	1.94	3.88
179	S2	2004	7.40	1.93	3.62

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log transformed models. Although AIC reveals that the data is modeled best after log transformation, pH is already log scale and should not be transformed. Proceeding with analysis using untransformed, "natural" model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
7.26	6.00	0.30

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

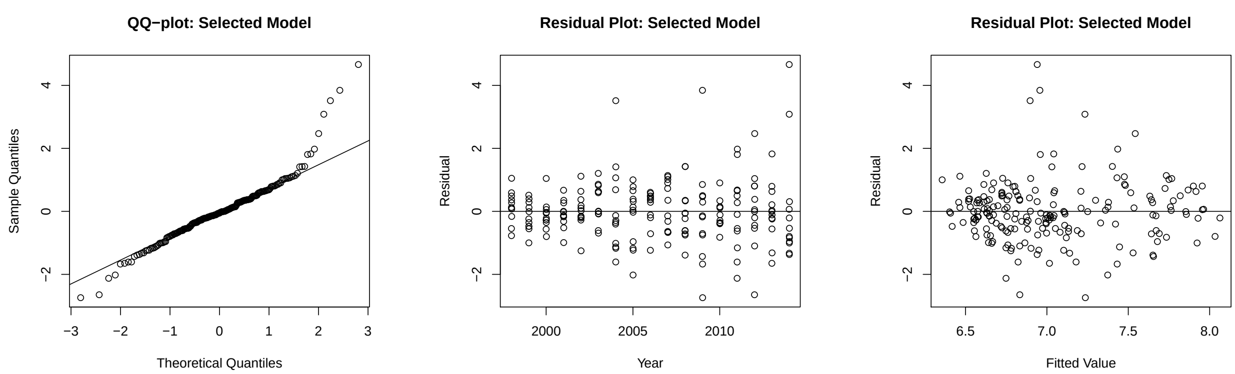
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.080	0.000	0.920	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
42	Counts	2014	7.61	6.94	4.66
63	Grizzly	2014	7.67	7.23	3.08
79	Kodiak	2009	7.51	6.96	3.84
179	S2	2004	7.40	6.90	3.52

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
Grizzly	14.7546	3	0.0020
Kodiak	69.1240	3	0.0000
1616-30 (LLCF)	20.0280	3	0.0002
Leslie	442.4133	3	0.0000
Moose	464.2074	3	0.0000
Nema	277.7499	3	0.0000
Slipper	155.7856	3	0.0000
S2	37.0442	3	0.0000
S3	15.5931	3	0.0014

- Conclusions:
  All monitored lakes show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	13.0259	2	0.0015
Kodiak	1.7485	2	0.4172
1616-30 (LLCF)	19.4071	2	0.0001
Leslie	9.2004	2	0.0100
Moose	78.1127	2	0.0000
Nema	61.6914	2	0.0000
Slipper	45.3403	2	0.0000
S2	14.5585	2	0.0007
S3	7.5409	2	0.0230

When allowing for differences in intercept, all monitored lakes except Kodiak show significant deviation from the common slope of reference lakes.

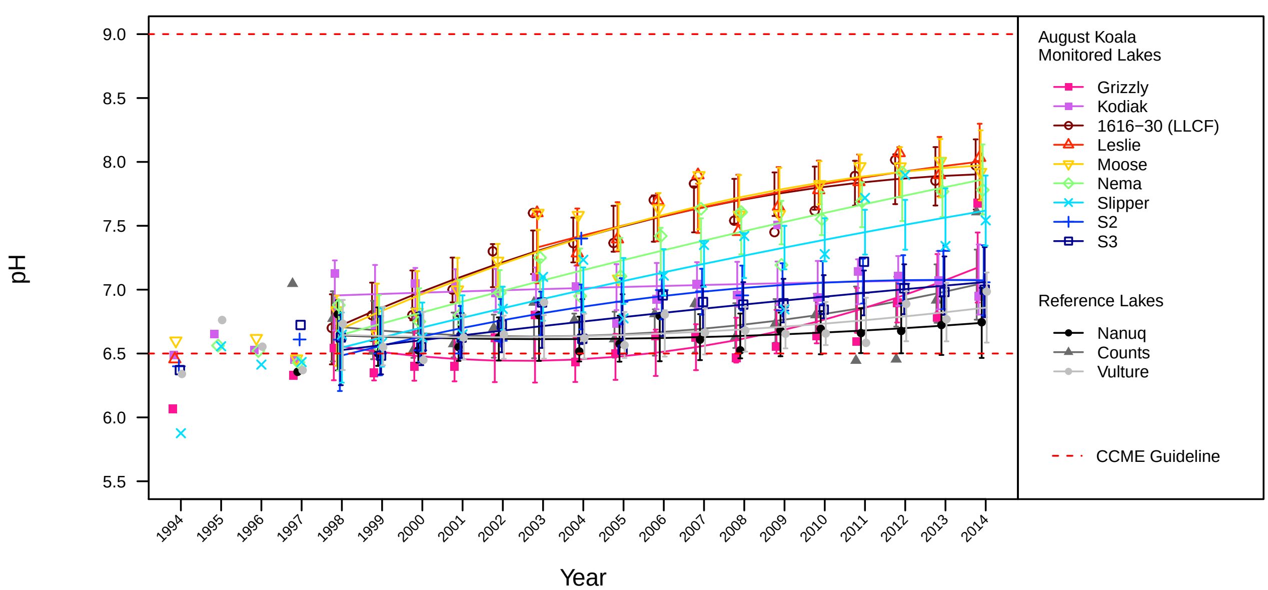
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1770
Monitored Lake	1616-30 (LLCF)	0.8650
Monitored Lake	Grizzly	0.5620
Monitored Lake	Kodiak	0.0520
Monitored Lake	Leslie	0.6530
Monitored Lake	Moose	0.8480
Monitored Lake	Nema	0.8420
Monitored Lake	S2	0.5480
Monitored Lake	S3	0.6560
Monitored Lake	Slipper	0.7030

- Conclusions:
  Model fit for pooled reference lakes and Kodiak Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean pH for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	7.67E+00	7.17E+00	1.40E-01	6.90E+00	7.45E+00	4.10E-01
Kodiak	6.95E+00	7.08E+00	1.40E-01	6.80E+00	7.35E+00	4.10E-01
Leslie	8.03E+00	8.00E+00	1.52E-01	7.70E+00	8.30E+00	4.43E-01
1616-30 (LLCF)	7.97E+00	7.90E+00	1.40E-01	7.63E+00	8.18E+00	4.10E-01
Moose	7.92E+00	7.97E+00	1.40E-01	7.70E+00	8.25E+00	4.10E-01
Nema	7.78E+00	7.86E+00	1.40E-01	7.59E+00	8.14E+00	4.10E-01
Slipper	7.54E+00	7.62E+00	1.40E-01	7.34E+00	7.89E+00	4.10E-01
S2	7.06E+00	7.07E+00	1.40E-01	6.80E+00	7.35E+00	4.10E-01
S3	7.00E+00	7.06E+00	1.40E-01	6.78E+00	7.33E+00	4.10E-01
Nanuq	6.75E+00	6.74E+00	1.40E-01	6.47E+00	7.01E+00	
Counts	7.61E+00	7.04E+00	1.40E-01	6.76E+00	7.31E+00	
Vulture	6.98E+00	6.86E+00	1.40E-01	6.59E+00	7.13E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
pH	August	Koala	Lake	Water	none	none	linear mixed effects regression	#3 shared intercept & slope	6.5/ 9	Grizzly Kodiak 1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

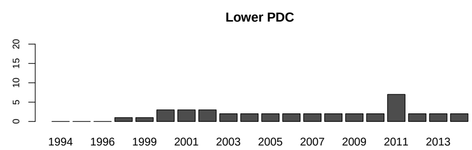
Analysis of August pH in Koala Watershed Streams

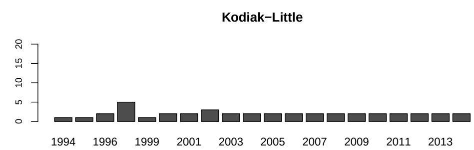
November 10, 2014

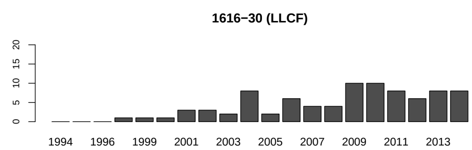
1 Censored Values:

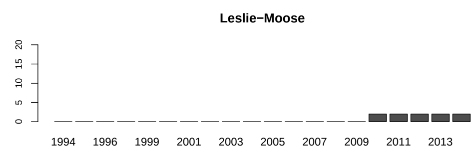
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

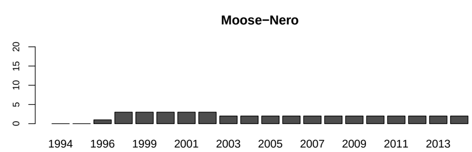
1.1 Monitored

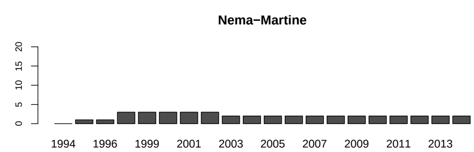


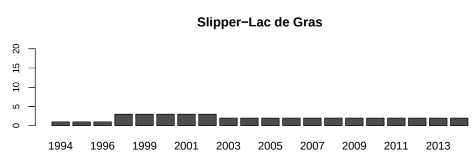




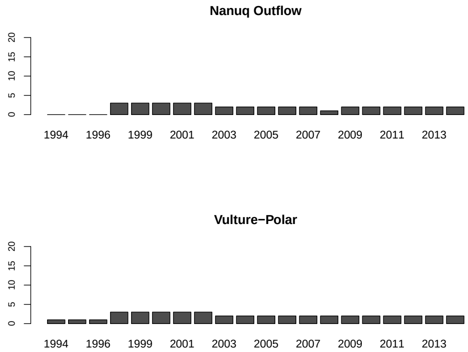






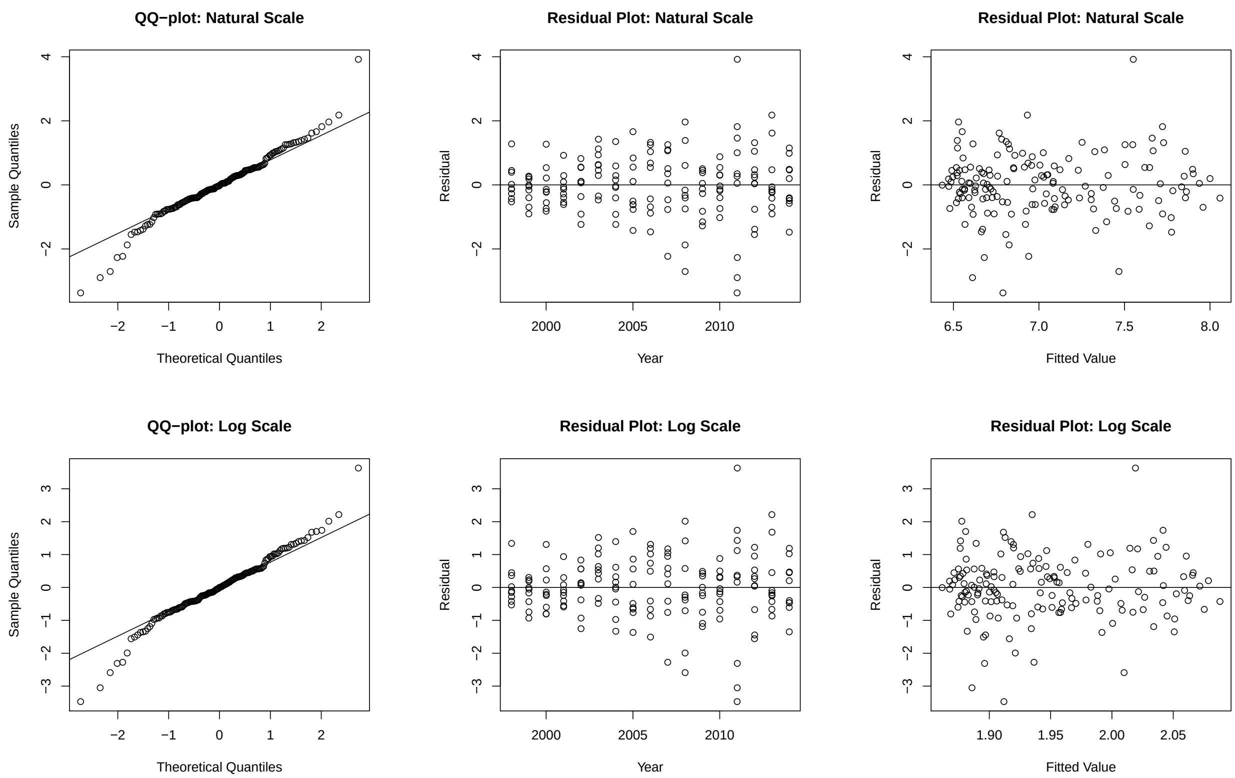


1.2 Reference



Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
39	Counts Outflow	2011	6.28	6.79	-3.37
186	Slipper-Lac de Gras	2011	8.15	7.55	3.92

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
39	Counts Outflow	2011	6.28	1.91	-3.47
144	Nanuq Outflow	2011	6.17	1.89	-3.05
186	Slipper-Lac de Gras	2011	8.15	2.02	3.63

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log transformed models. Although AIC reveals that the data is modeled best after log transformation, pH is already log scale and should not be transformed. Proceeding with analysis using untransformed, "natural" model.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
20.93	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
20.23	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.119	0.000	0.881	Ref. Model 3

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference streams are best modeled with a common slope and intercept, results of contrasts suggest that slopes and intercepts differ among reference streams. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	6.2303	2	0.0444
Kodiak-Little	3.4332	2	0.1797
Leslie-Moose	0.9075	2	0.6352
1616-30 (LLCF)	82.0017	2	0.0000
Moose-Nero	46.9028	2	0.0000
Nema-Martine	55.7752	2	0.0000
Slipper-Lac de Gras	53.2986	2	0.0000

- Conclusions:
  All monitored streams except Kodiak-Little and Leslie-Moose show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each remaining monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Lower PDC-vs-Nanuq Outflow	35.6935	3	0.0000
Lower PDC-vs-Counts Outflow	19.8999	3	0.0002
Lower PDC-vs-Vulture-Polar	28.0725	3	0.0000
1616-30 (LLCF)-vs-Nanuq Outflow	22.5618	3	0.0000
1616-30 (LLCF)-vs-Counts Outflow	11.6351	3	0.0087
1616-30 (LLCF)-vs-Vulture-Polar	16.8222	3	0.0008
Moose-Nero-vs-Nanuq Outflow	255.0413	3	0.0000
Moose-Nero-vs-Counts Outflow	206.1079	3	0.0000
Moose-Nero-vs-Vulture-Polar	236.4297	3	0.0000
Nema-Martine-vs-Nanuq Outflow	211.3687	3	0.0000
Nema-Martine-vs-Counts Outflow	159.5333	3	0.0000
Nema-Martine-vs-Vulture-Polar	190.4041	3	0.0000
Slipper-Lac de Gras-vs-Nanuq Outflow	164.5637	3	0.0000
Slipper-Lac de Gras-vs-Counts Outflow	118.4919	3	0.0000
Slipper-Lac de Gras-vs-Vulture-Polar	145.9329	3	0.0000

- Conclusions:
  All remaining monitored streams show significant deviation from the slopes of individual reference streams.

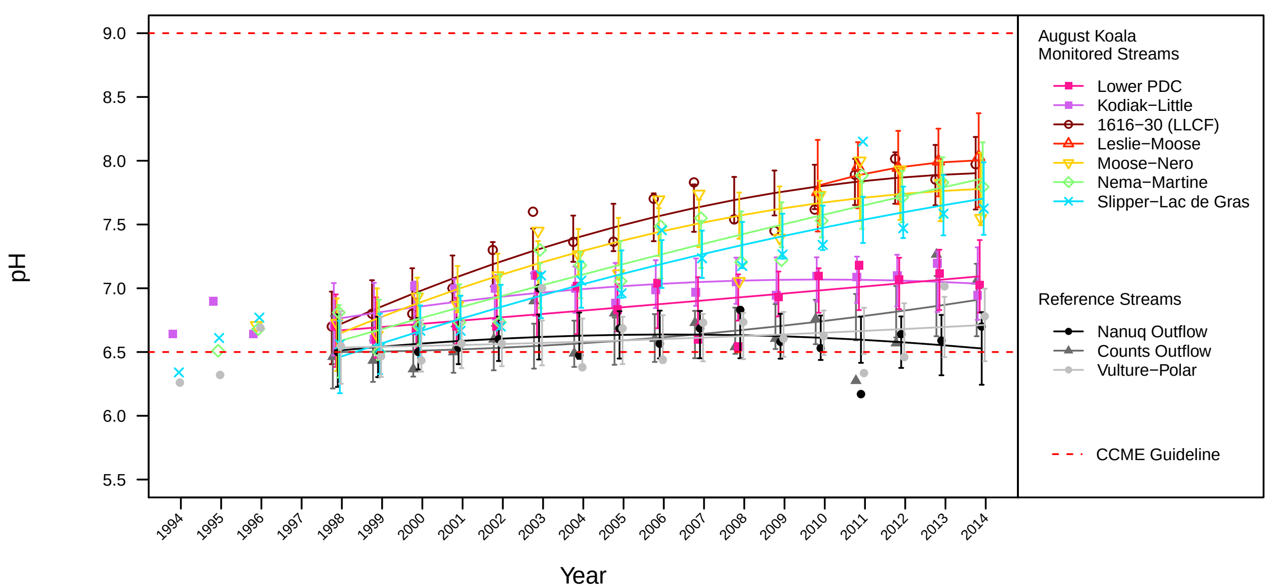
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.2770
Reference Stream	Nanuq Outflow	0.0560
Reference Stream	Vulture-Polar	0.0820
Monitored Stream	1616-30 (LLCF)	0.8650
Monitored Stream	Kodiak-Little	0.4720
Monitored Stream	Leslie-Moose	0.7730
Monitored Stream	Lower PDC	0.3830
Monitored Stream	Moose-Nero	0.7350
Monitored Stream	Nema-Martine	0.8330
Monitored Stream	Slipper-Lac de Gras	0.7970

- Conclusions:
  Model fit for Counts Outflow, Kodiak-Little, and Lower PDC is weak. Model fit for Nanuq Outflow and Vulture-Polar is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean pH for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	7.03E+00	7.09E+00	1.45E-01	6.81E+00	7.38E+00	4.24E-01
Kodiak-Little	6.95E+00	7.04E+00	1.45E-01	6.75E+00	7.32E+00	4.24E-01
Leslie-Moose	8.03E+00	8.00E+00	1.88E-01	7.63E+00	8.37E+00	5.51E-01
1616-30 (LLCF)	7.97E+00	7.90E+00	1.45E-01	7.62E+00	8.19E+00	4.24E-01
Moose-Nero	7.55E+00	7.78E+00	1.45E-01	7.49E+00	8.06E+00	4.24E-01
Nema-Martine	7.79E+00	7.86E+00	1.45E-01	7.58E+00	8.14E+00	4.24E-01
Slipper-Lac de Gras	7.62E+00	7.70E+00	1.45E-01	7.42E+00	7.99E+00	4.24E-01
Nanuq Outflow	6.70E+00	6.53E+00	1.45E-01	6.24E+00	6.81E+00	
Counts Outflow	7.05E+00	6.91E+00	1.45E-01	6.62E+00	7.19E+00	
Vulture-Polar	6.78E+00	6.71E+00	1.45E-01	6.43E+00	7.00E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
pH	August	Koala	Stream	Water	none	none	linear mixed effects regression	#1b separate intercepts & slopes	6.5/ 9	Lower PDC 1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

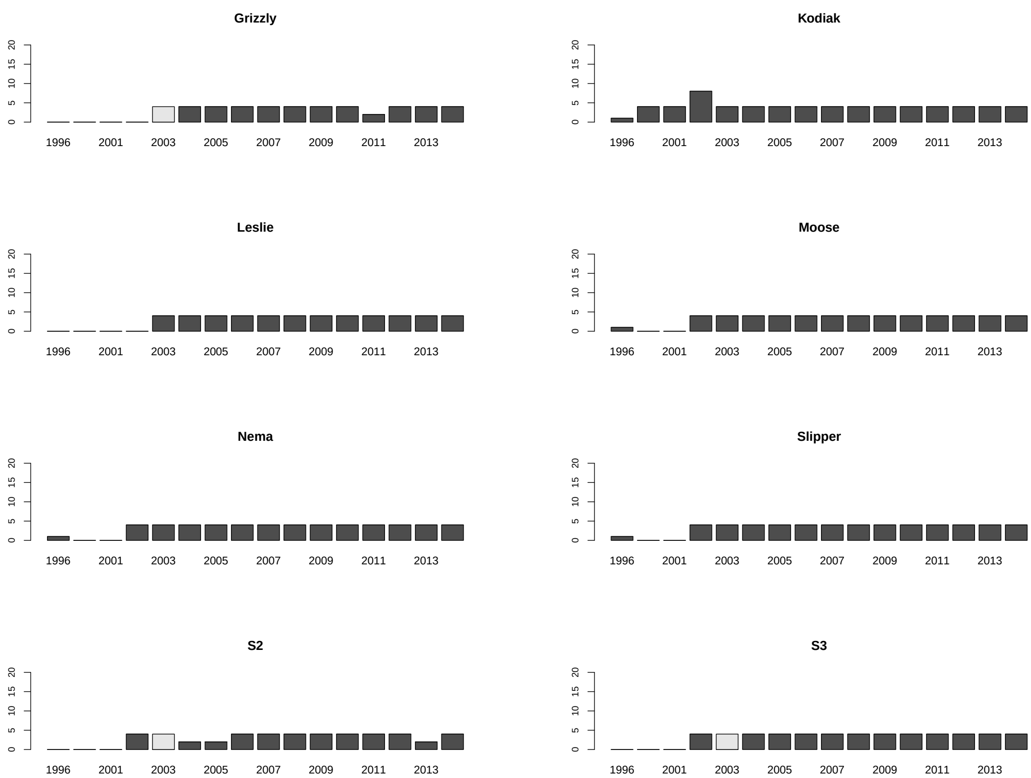
Analysis of April Total Alkalinity in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

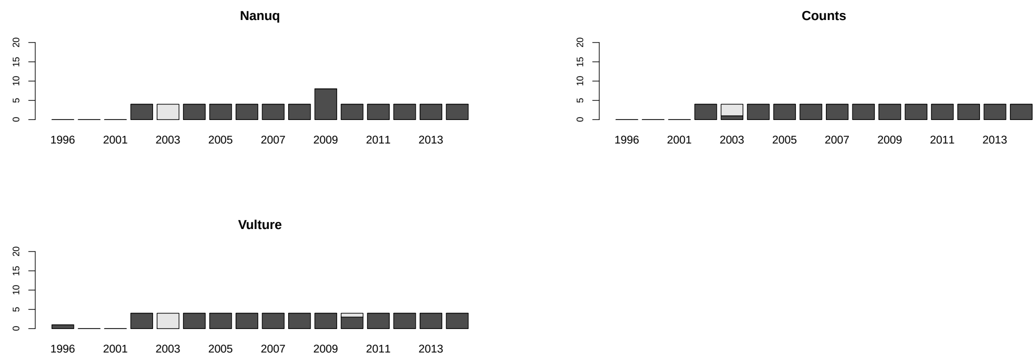
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

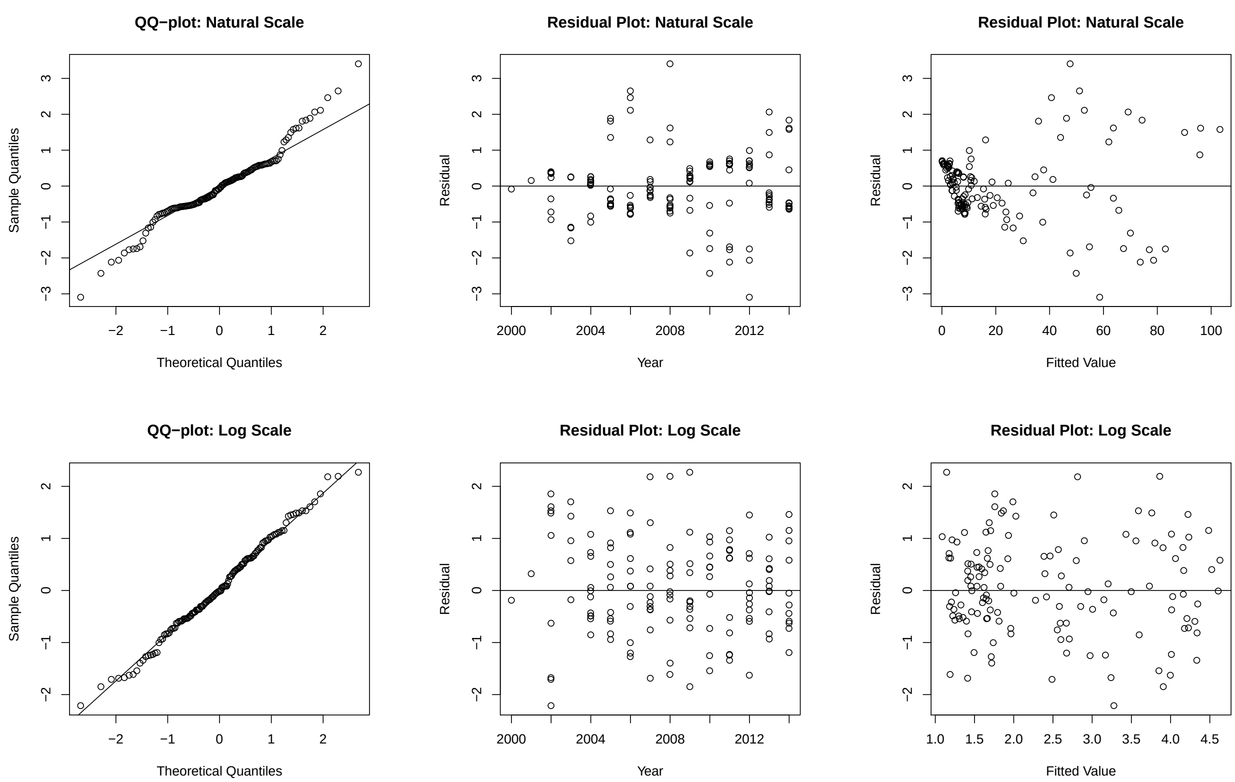


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	64.35	47.63	3.41
166	Nema	2012	43.42	58.61	-3.09

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
4.76E-219	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
766.22	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
2.28	4.00	0.69

- Conclusions:
  The slopes do not differ significantly among reference lakes.

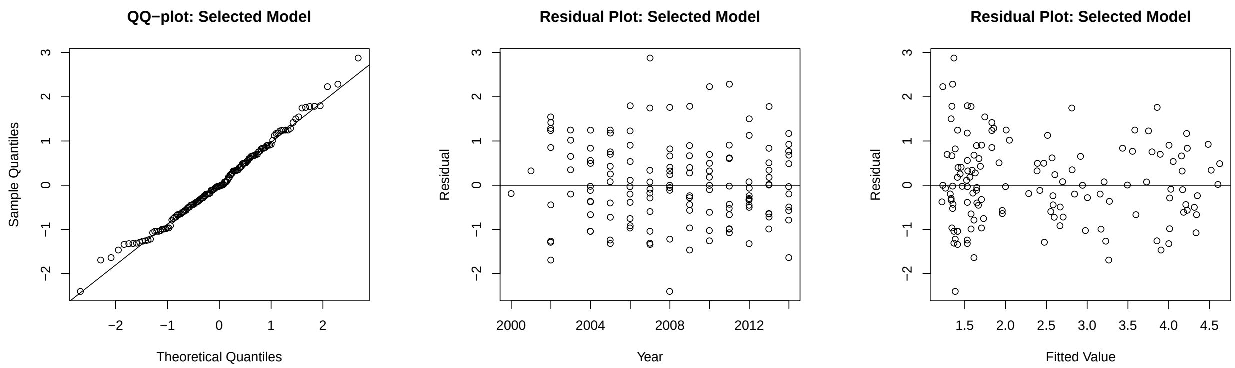
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	3.27	2.00	0.19
Kodiak	3.03	2.00	0.22
Leslie	19.94	2.00	0.00
Moose	36.85	2.00	0.00
Nema	25.06	2.00	0.00
Slipper	25.27	2.00	0.00
S2	1.59	2.00	0.45
S3	3.43	2.00	0.18

- Conclusions:
  Leslie, Moose, Nema, and Slipper lakes show significant deviation from the common slope of reference lakes.

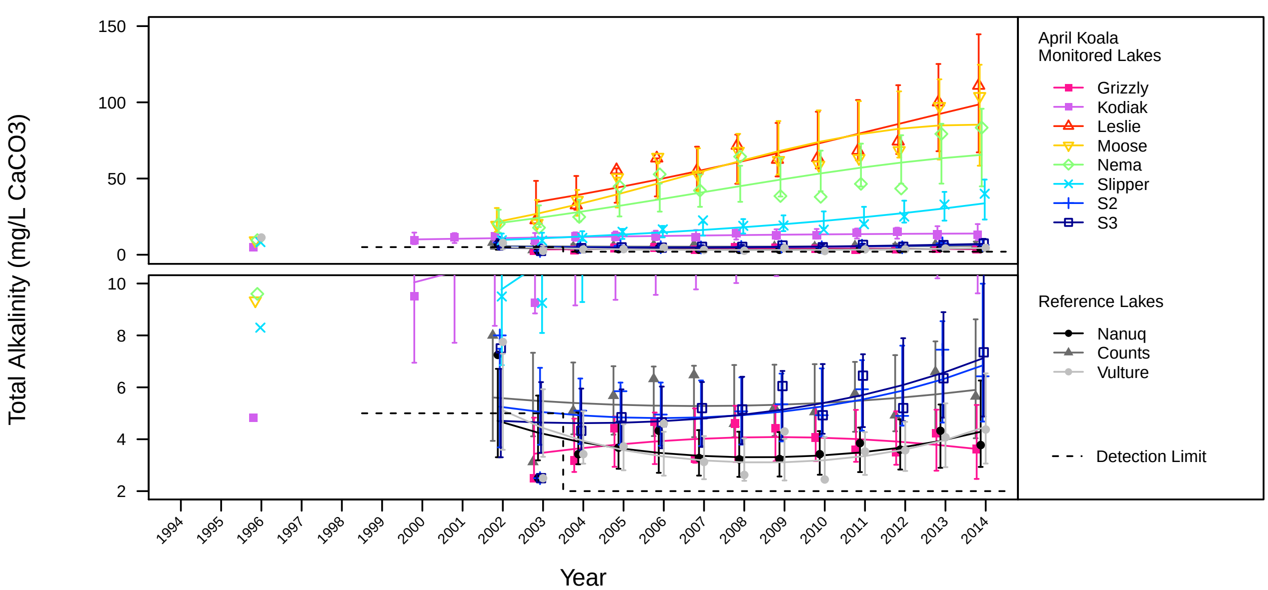
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0940
Monitored Lake	Grizzly	0.1360
Monitored Lake	Kodiak	0.6090
Monitored Lake	Leslie	0.7560
Monitored Lake	Moose	0.8500
Monitored Lake	Nema	0.6530
Monitored Lake	S2	0.1590
Monitored Lake	S3	0.2710
Monitored Lake	Slipper	0.8480

- Conclusions:
  Model fit for S3 Lake is weak. Model fit for pooled reference lakes, Grizzly Lake, and site S2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total alkalinity for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.62E+00	3.63E+00	7.09E-01	2.47E+00	5.32E+00	2.08E+00
Kodiak	1.32E+01	1.39E+01	2.62E+00	9.62E+00	2.01E+01	7.65E+00
Leslie	1.11E+02	9.86E+01	1.93E+01	6.72E+01	1.45E+02	5.64E+01
Moose	1.04E+02	8.53E+01	1.65E+01	5.84E+01	1.25E+02	4.83E+01
Nema	8.34E+01	6.56E+01	1.27E+01	4.49E+01	9.58E+01	3.71E+01
Slipper	4.00E+01	3.38E+01	6.53E+00	2.31E+01	4.93E+01	1.91E+01
S2	6.42E+00	6.84E+00	1.32E+00	4.68E+00	9.99E+00	3.87E+00
S3	7.35E+00	7.12E+00	1.38E+00	4.88E+00	1.04E+01	4.03E+00
Nanuq	3.77E+00	4.29E+00	8.29E-01	2.93E+00	6.26E+00	
Counts	5.65E+00	5.90E+00	1.14E+00	4.04E+00	8.62E+00	
Vulture	4.38E+00	4.48E+00	8.66E-01	3.06E+00	6.54E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Alkalinity	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

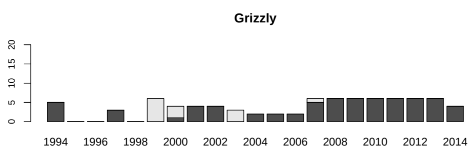
Analysis of August Total Alkalinity in Lakes of the Koala Watershed and Lac de Gras

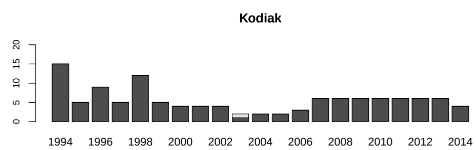
November 10, 2014

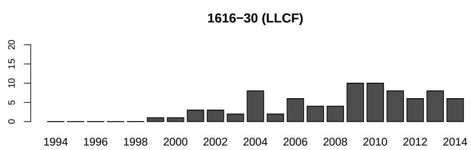
1 Censored Values:

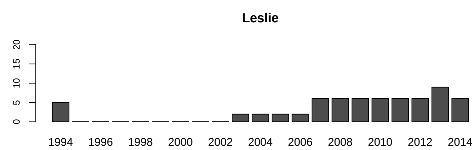
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

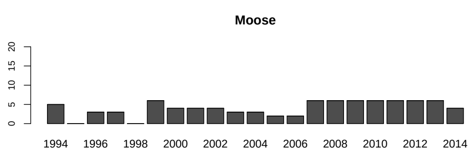
1.1 Monitored

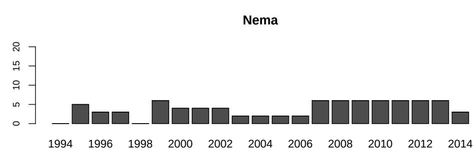


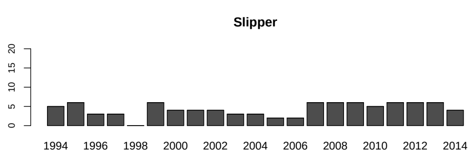


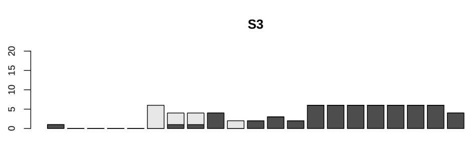




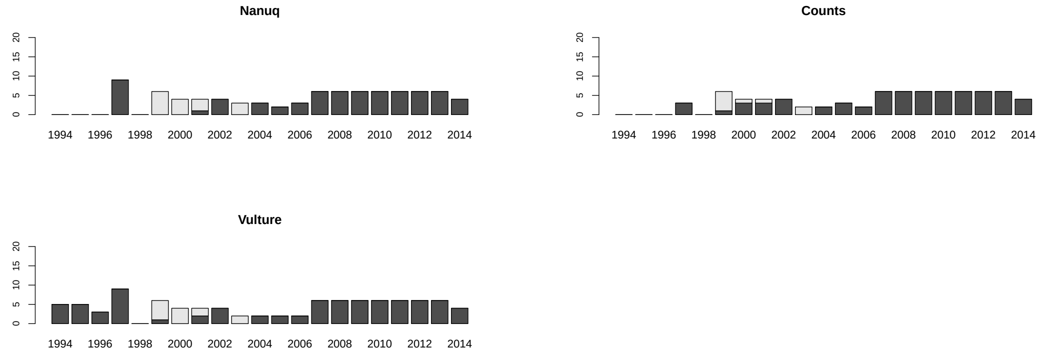






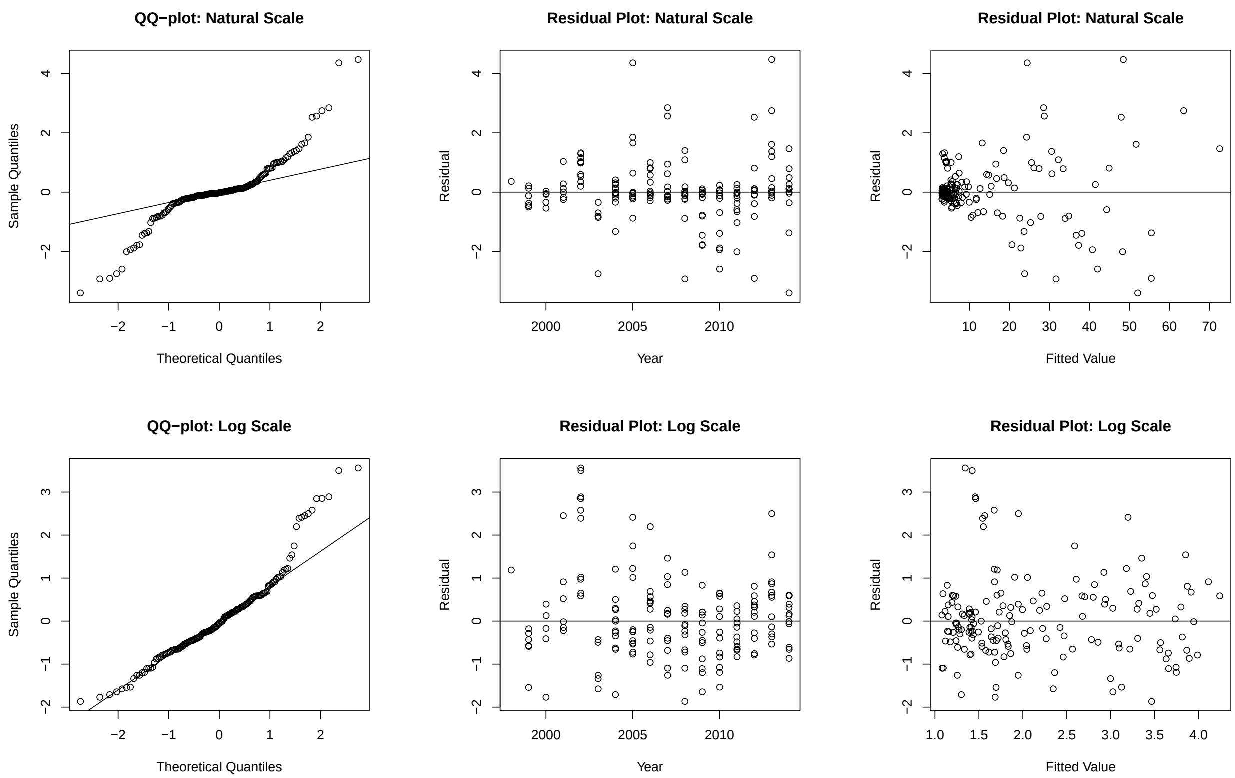


1.2 Reference



Comment:
10-60% of data in Counts, Nanuq, Vulture, Grizzly, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
96	Leslie	2005	36.80	24.44	4.36
125	Moose	2013	61.13	48.45	4.47
126	Moose	2014	42.42	52.07	-3.40

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
135	Nanuq	2002	7.00	1.34	3.56
240	Vulture	2002	7.50	1.42	3.50

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
14.35	6.00	0.03

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
2.60	4.00	0.63

- Conclusions:
  The slopes do not differ significantly among reference lakes.

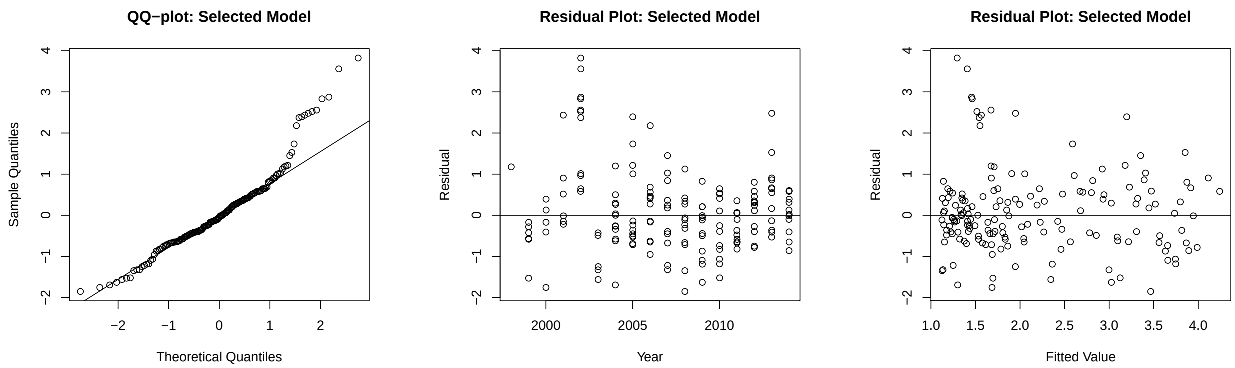
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.061	0.913	0.026	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
135	Nanuq	2002	7.00	1.29	3.82
240	Vulture	2002	7.50	1.41	3.56

No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	2.8692	2	0.2382
Kodiak	8.0802	2	0.0176
1616-30 (LLCF)	175.0177	2	0.0000
Leslie	51.5458	2	0.0000
Moose	168.8500	2	0.0000
Nema	132.8343	2	0.0000
Slipper	65.0648	2	0.0000
S2	14.9454	2	0.0006
S3	4.5370	2	0.1035

- Conclusions:
  All monitored lakes except Grizzly and S3 show significant deviation from the common slope of reference lakes.

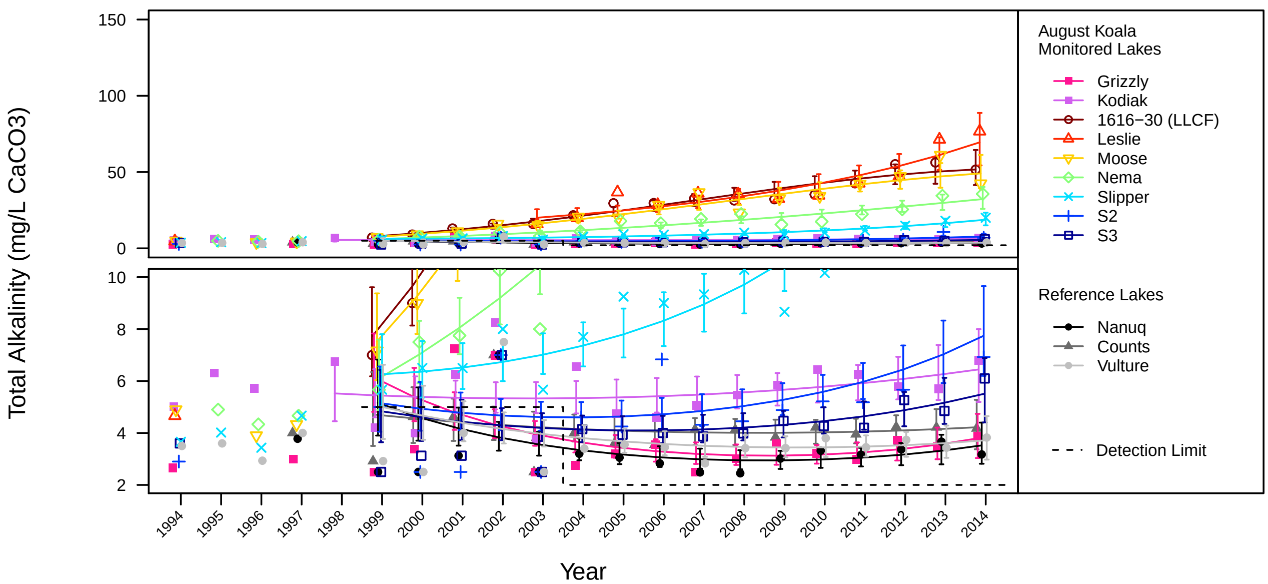
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.2550
Monitored Lake	1616-30 (LLCF)	0.9650
Monitored Lake	Grizzly	0.2890
Monitored Lake	Kodiak	0.0810
Monitored Lake	Leslie	0.8240
Monitored Lake	Moose	0.9420
Monitored Lake	Nema	0.9050
Monitored Lake	S2	0.2320
Monitored Lake	S3	0.1810
Monitored Lake	Slipper	0.8990

- Conclusions:
  Model fit for pooled reference lakes, Grizzly Lake, and site S2 is weak. Model fit for Kodiak and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total alkalinity for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.88E+00	3.79E+00	4.30E-01	3.04E+00	4.74E+00	1.26E+00
Kodiak	6.80E+00	6.45E+00	7.09E-01	5.19E+00	8.00E+00	2.08E+00
Leslie	7.67E+01	6.95E+01	8.68E+00	5.44E+01	8.88E+01	2.54E+01
1616-30 (LLCF)	5.16E+01	5.17E+01	5.81E+00	4.15E+01	6.45E+01	1.70E+01
Moose	4.24E+01	4.91E+01	5.52E+00	3.94E+01	6.12E+01	1.62E+01
Nema	3.57E+01	3.23E+01	3.63E+00	2.59E+01	4.02E+01	1.06E+01
Slipper	2.01E+01	1.88E+01	2.11E+00	1.50E+01	2.34E+01	6.17E+00
S2	6.92E+00	7.74E+00	8.73E-01	6.20E+00	9.65E+00	2.56E+00
S3	6.10E+00	5.51E+00	6.27E-01	4.41E+00	6.89E+00	1.84E+00
Nanuq	3.17E+00	3.52E+00	4.01E-01	2.82E+00	4.40E+00	
Counts	4.17E+00	4.22E+00	4.81E-01	3.37E+00	5.28E+00	
Vulture	3.83E+00	3.72E+00	4.23E-01	2.98E+00	4.65E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Alkalinity	August	Koala	Lake	Water	none	log e	Tobit regression	#2 shared slopes	NA	Kodiak 1616-30 (LLCF) Leslie Moose Nema Slipper S2

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

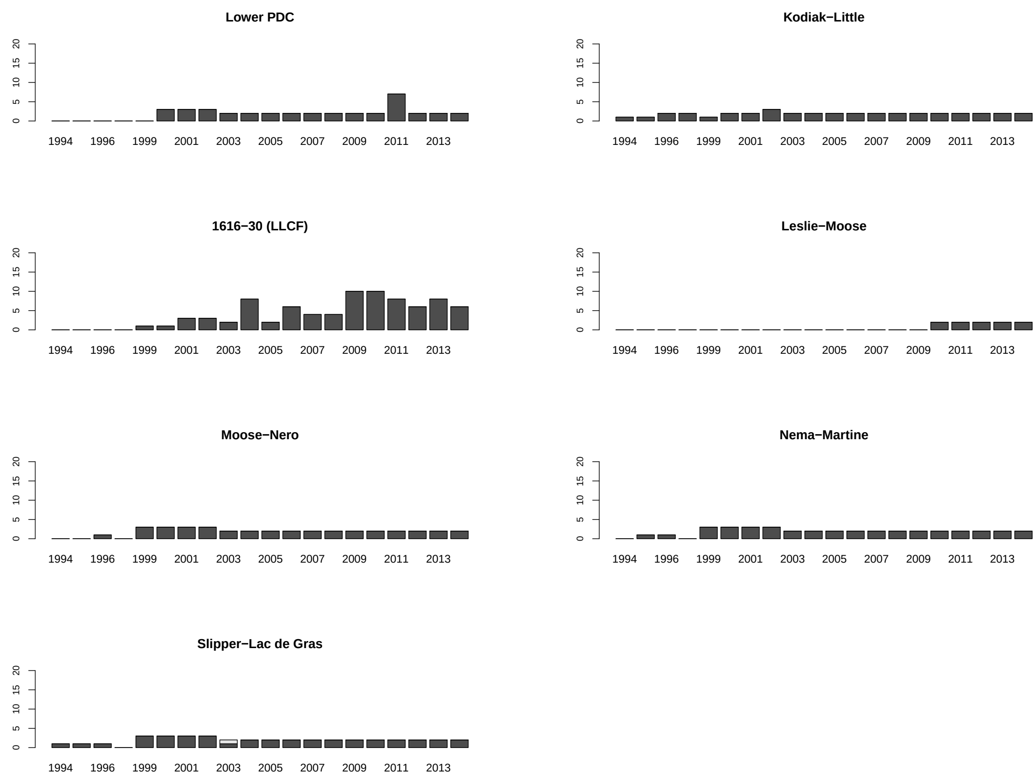
Analysis of August Total Alkalinity in Koala Watershed Streams

November 10, 2014

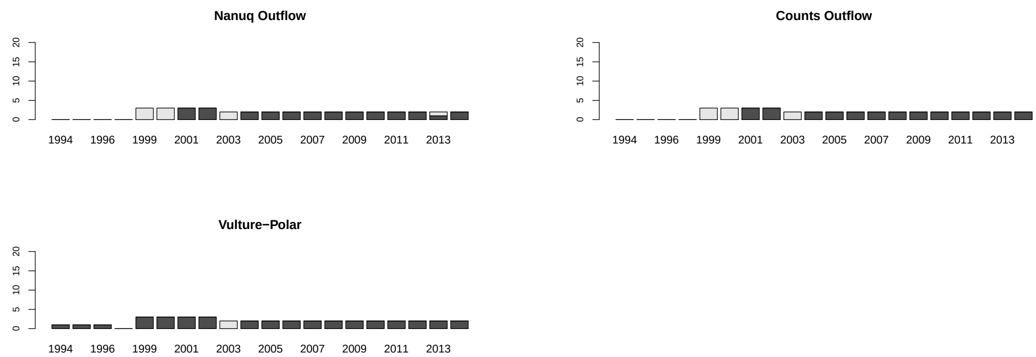
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

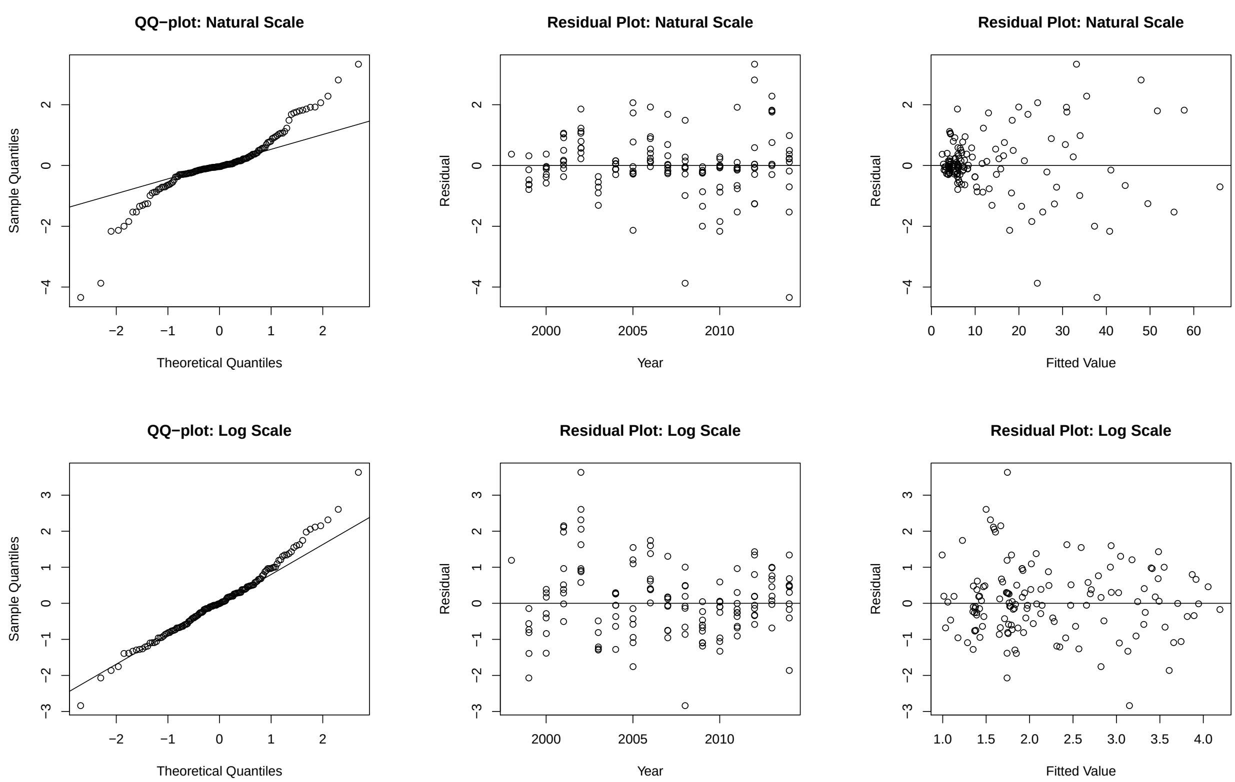


1.2 Reference



Comment:
10-60% of data in Counts Outflow and Nanuq Outflow was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	14.35	24.21	-3.87
124	Moose-Nero	2012	41.65	33.16	3.33
126	Moose-Nero	2014	26.80	37.85	-4.34

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
51	Kodiak-Little	2002	10.67	1.74	3.63

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year or fitted value. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using the log-transformed model. Results should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
22.85	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
6.94	4.00	0.14

  Comment on the results of the tests.

- Conclusions:
  The slopes do not differ significantly among reference streams.

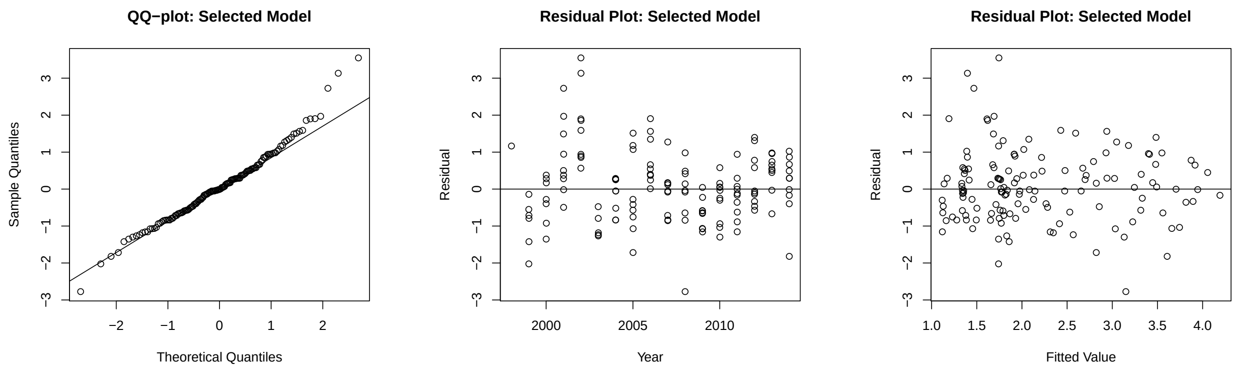
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.353	0.644	0.003	Indistinguishable support for 2 & 1; choose Model 2.

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
51	Kodiak-Little	2002	10.67	1.74	3.55
135	Nanuq Outflow	2002	7.00	1.40	3.13

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference stream slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
Lower PDC	2.8988	2	0.2347
Kodiak-Little	17.0010	2	0.0002
Leslie-Moose	7.9628	2	0.0187
Moose-Nero	165.9343	2	0.0000
Nema-Martine	170.1855	2	0.0000
Slipper-Lac de Gras	78.4299	2	0.0000

- Conclusions:
  All monitored streams except Lower PDC show significant deviation from the common slope of reference streams.

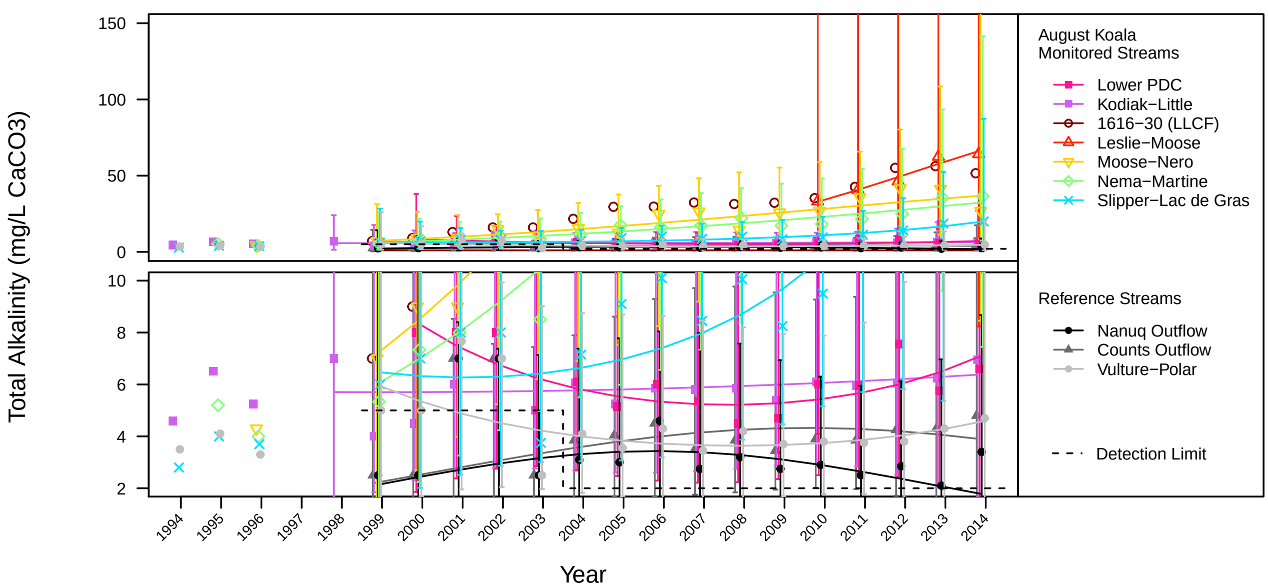
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.2890
Monitored Stream	1616-30 (LLCF)	0.9650
Monitored Stream	Kodiak-Little	0.0310
Monitored Stream	Leslie-Moose	0.9670
Monitored Stream	Lower PDC	0.5720
Monitored Stream	Moose-Nero	0.8360
Monitored Stream	Nema-Martine	0.9240
Monitored Stream	Slipper-Lac de Gras	0.7260

- Conclusions:
  Model fit for pooled reference streams is weak. Model fit for Kodiak-Little is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total alkalinity for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	6.60e+00	7.08e+00	5.45e+00	1.56e+00	3.20e+01	1.59e+01
Kodiak-Little	6.95e+00	6.38e+00	4.68e+00	1.51e+00	2.69e+01	1.37e+01
Leslie-Moose	6.42e+01	6.61e+01	7.03e+01	8.23e+00	5.31e+02	2.06e+02
Moose-Nero	2.68e+01	3.69e+01	2.77e+01	8.46e+00	1.61e+02	8.10e+01
Nema-Martine	3.65e+01	3.25e+01	2.44e+01	7.45e+00	1.42e+02	7.14e+01
Slipper-Lac de Gras	1.99e+01	2.00e+01	1.50e+01	4.57e+00	8.72e+01	4.40e+01
Nanuq Outflow	3.40e+00	1.78e+00	1.44e+00	3.66e-01	8.67e+00	NA
Counts Outflow	4.80e+00	3.91e+00	2.98e+00	8.76e-01	1.75e+01	NA
Vulture-Polar	4.70e+00	4.59e+00	3.46e+00	1.05e+00	2.01e+01	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Alkalinity	August	Koala	Stream	Water	none	log e	Tobit regression	#2 shared slopes	NA	Kodiak-Little Leslie-Moose Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

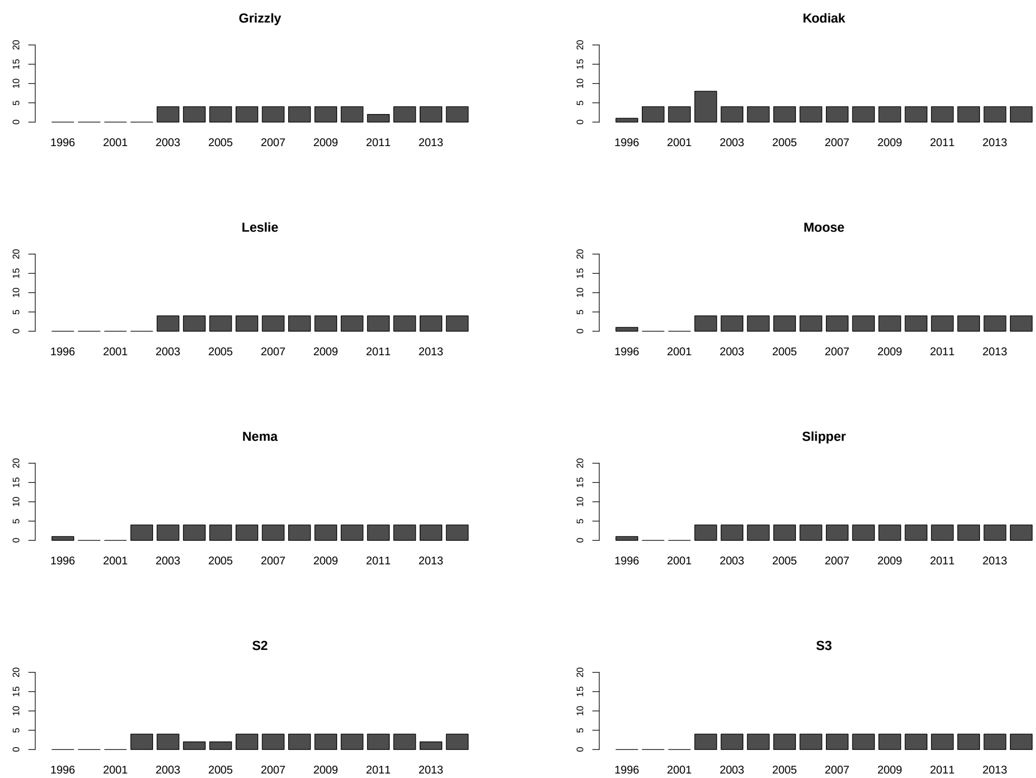
Analysis of April Water Hardness in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

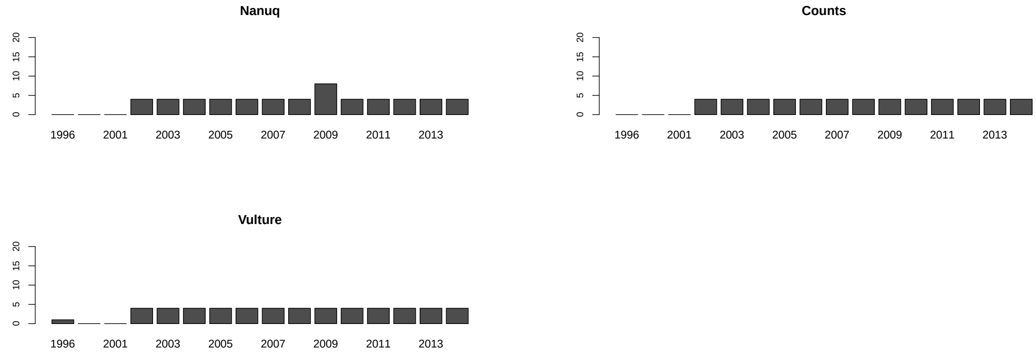
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

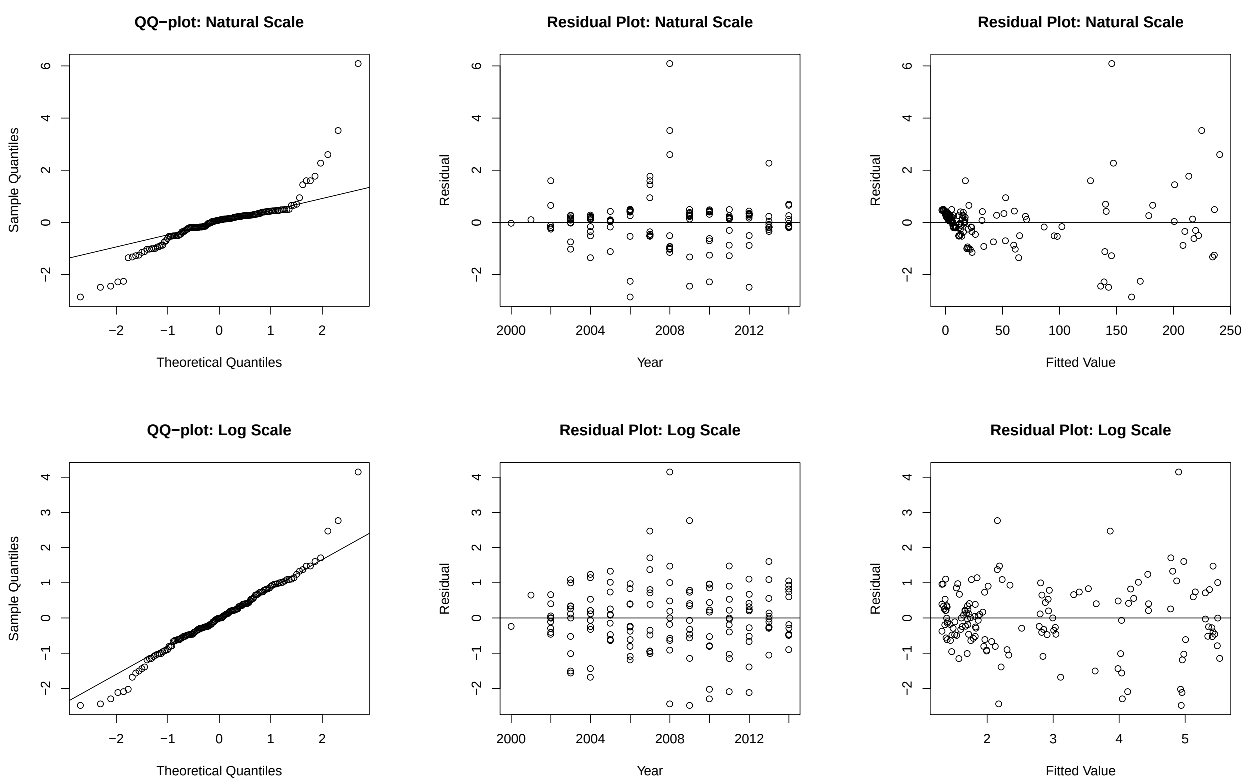


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	276.25	224.63	3.52
162	Nema	2008	235.00	145.75	6.09

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	235.00	4.90	4.15

AIC weights and model comparison:

Natural Model	Log Model	Best Model
2.80E-292	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
823.84	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.11	4.00	1.00

- Conclusions:
  The slopes do not differ significantly among reference lakes.

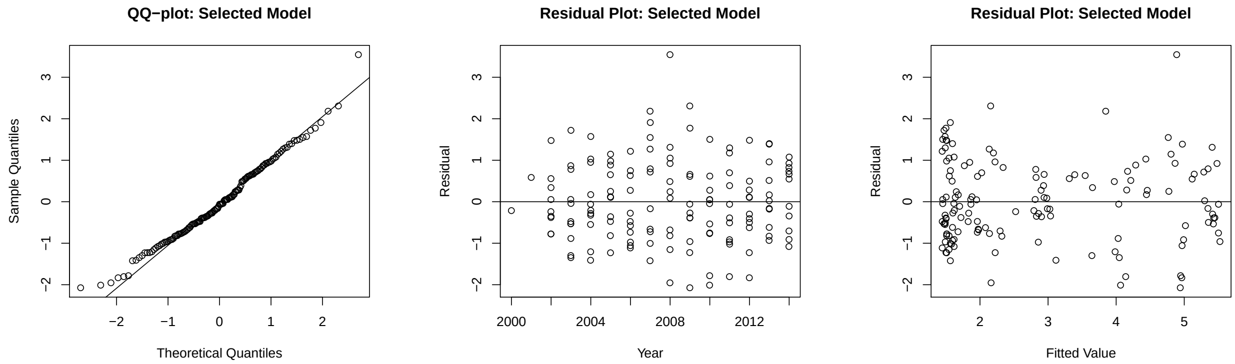
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	235.00	4.89	3.54

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.09	2.00	0.96
Kodiak	0.38	2.00	0.83
Leslie	51.96	2.00	0.00
Moose	63.49	2.00	0.00
Nema	58.24	2.00	0.00
Slipper	57.39	2.00	0.00
S2	2.25	2.00	0.33
S3	5.81	2.00	0.05

- Conclusions:
Leslie, Moose, Nema, Slipper, and S3 show significant deviation from the common slope of reference lakes.

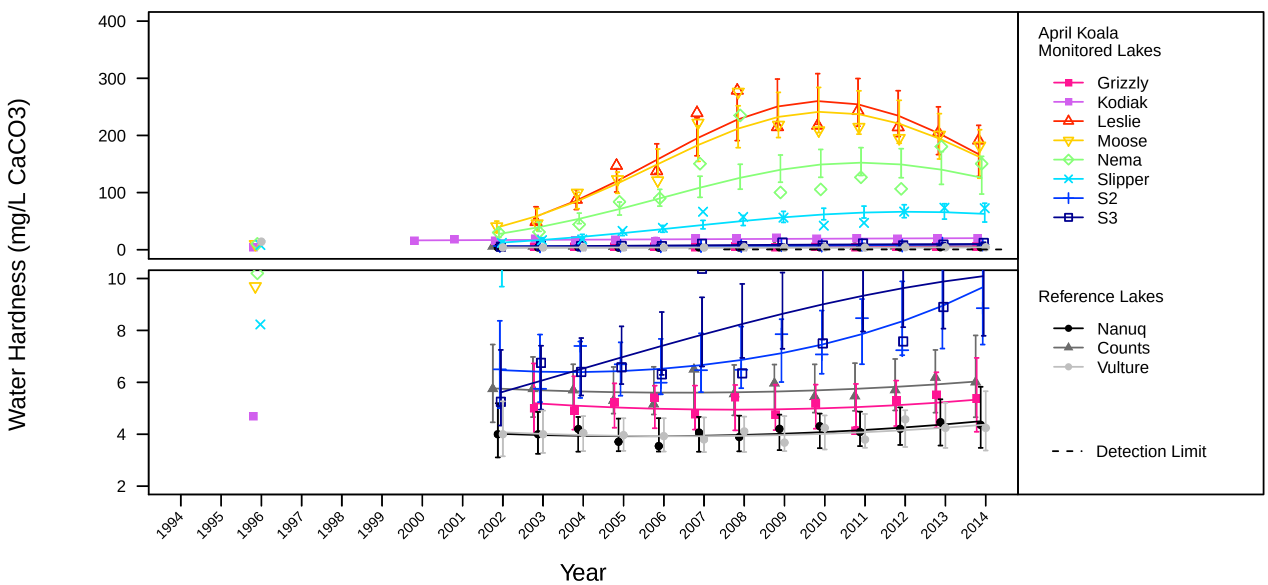
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0340
Monitored Lake	Grizzly	0.0790
Monitored Lake	Kodiak	0.4230
Monitored Lake	Leslie	0.9060
Monitored Lake	Moose	0.9300
Monitored Lake	Nema	0.7760
Monitored Lake	S2	0.6500
Monitored Lake	S3	0.4850
Monitored Lake	Slipper	0.8710

- Conclusions:
  Model fit for Kodiak Lake and S3 is weak. Model fit for pooled reference lakes and Grizzly Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean water hardness for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	5.38E+00	5.33E+00	7.18E-01	4.09E+00	6.94E+00	2.10E+00
Kodiak	1.97E+01	2.02E+01	2.56E+00	1.58E+01	2.59E+01	7.50E+00
Leslie	1.91E+02	1.67E+02	2.25E+01	1.28E+02	2.18E+02	6.59E+01
Moose	1.82E+02	1.62E+02	2.14E+01	1.25E+02	2.10E+02	6.26E+01
Nema	1.50E+02	1.26E+02	1.66E+01	9.74E+01	1.63E+02	4.87E+01
Slipper	7.26E+01	6.28E+01	8.28E+00	4.85E+01	8.13E+01	2.42E+01
S2	8.86E+00	9.65E+00	1.27E+00	7.45E+00	1.25E+01	3.73E+00
S3	1.18E+01	1.01E+01	1.33E+00	7.79E+00	1.31E+01	3.90E+00
Nanuq	4.36E+00	4.50E+00	5.94E-01	3.47E+00	5.83E+00	
Counts	6.00E+00	6.03E+00	7.95E-01	4.66E+00	7.81E+00	
Vulture	4.24E+00	4.37E+00	5.76E-01	3.37E+00	5.66E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Hardness	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	Leslie Moose Nema Slipper S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

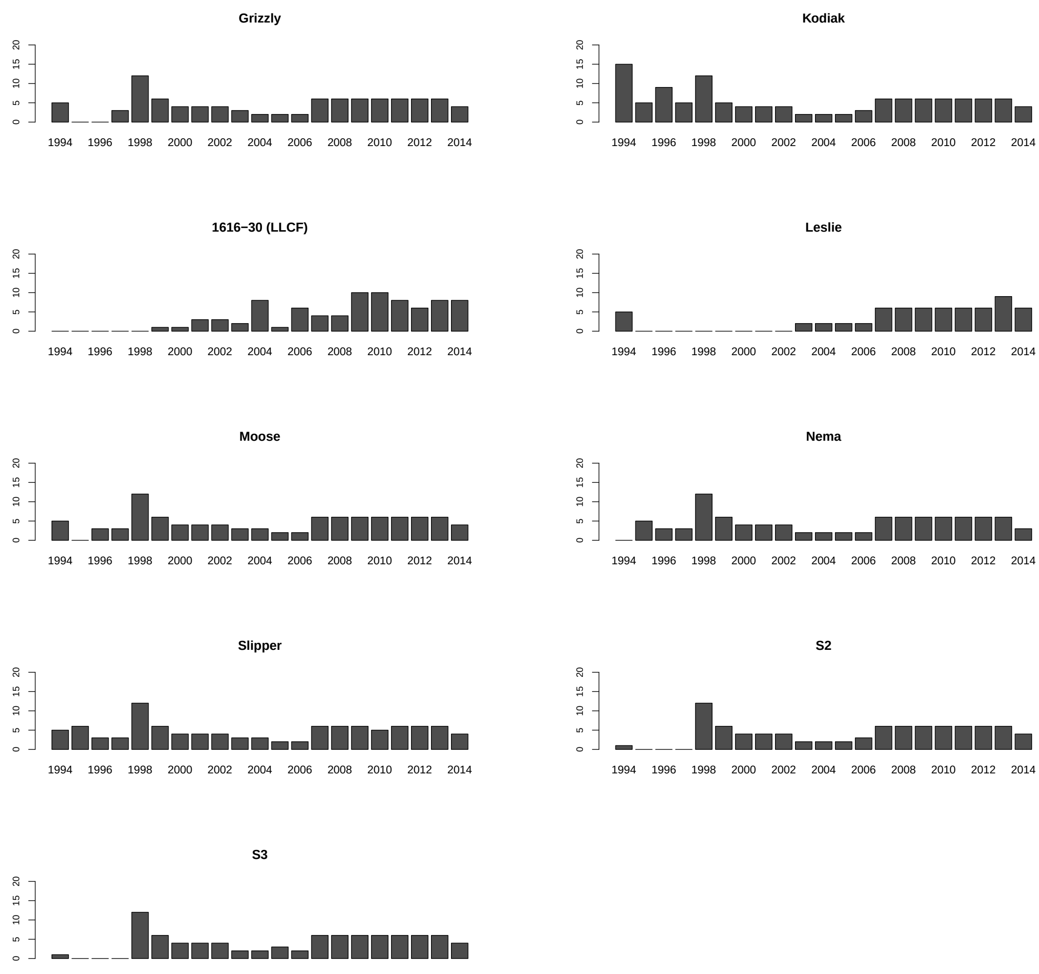
Analysis of August Water Hardness in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

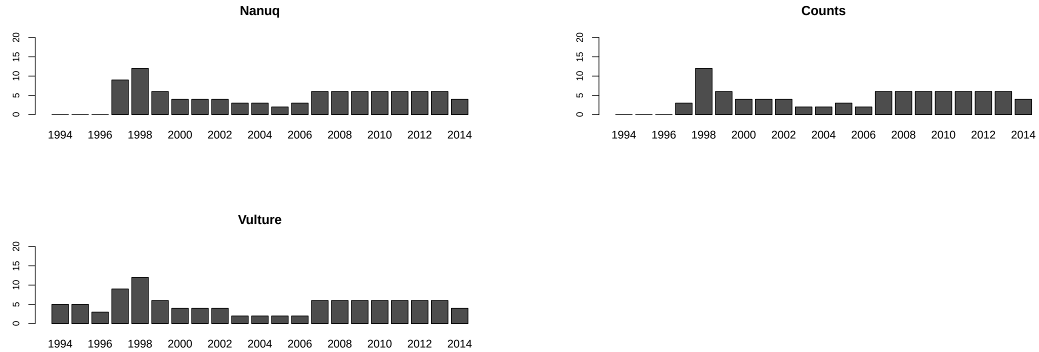
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

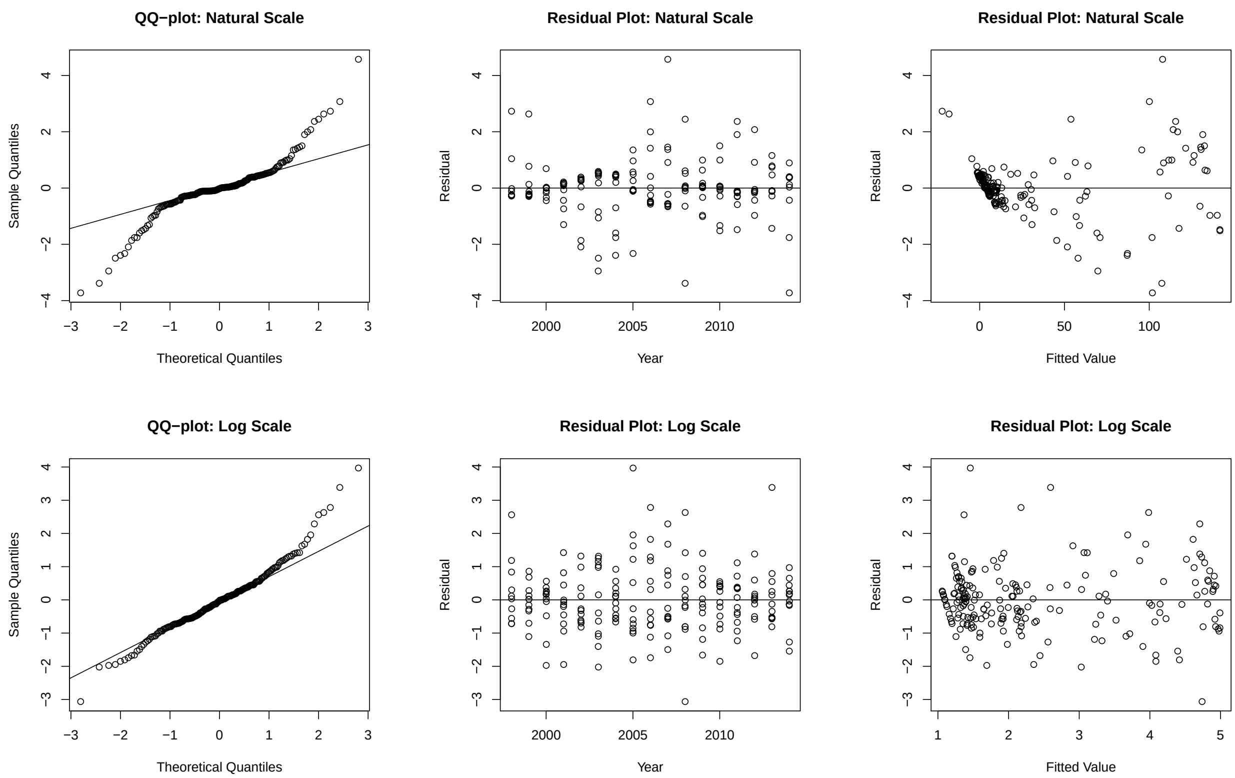


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
118	Moose	2006	130.50	100.09	3.07
119	Moose	2007	153.17	107.88	4.58
120	Moose	2008	73.92	107.43	-3.39
126	Moose	2014	64.97	101.86	-3.73

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	73.92	4.74	-3.06
138	Nanuq	2005	7.57	1.46	3.97
188	S2	2013	21.68	2.59	3.38

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
2.39	6.00	0.88

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

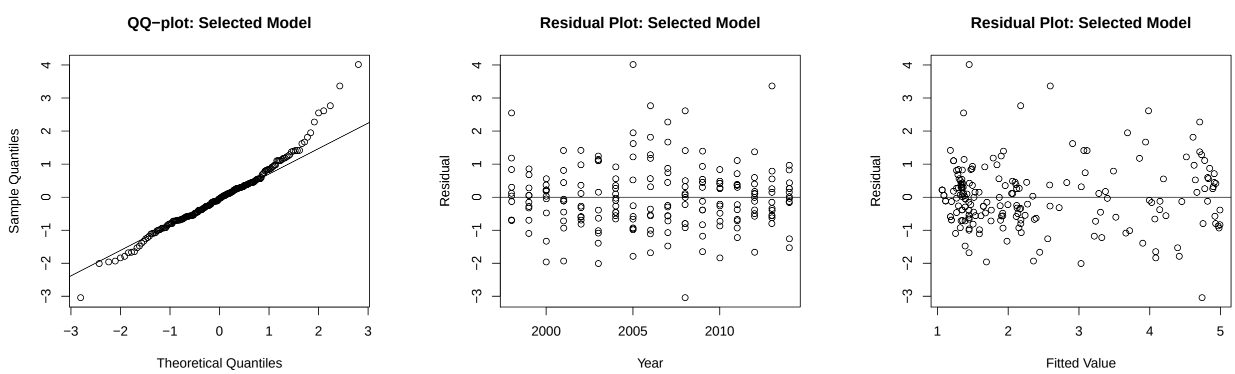
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.008	0.000	0.992	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	73.92	4.74	-3.04
138	Nanuq	2005	7.57	1.45	4.01
188	S2	2013	21.68	2.59	3.36

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
Grizzly	15.3167	3	0.0016
Kodiak	314.0692	3	0.0000
1616-30 (LLCF)	106.8126	3	0.0000
Leslie	4940.2454	3	0.0000
Moose	4796.4677	3	0.0000
Nema	3011.4796	3	0.0000
Slipper	1449.4887	3	0.0000
S2	379.3319	3	0.0000
S3	159.0845	3	0.0000

- Conclusions:
  All monitored lakes show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.0629	2	0.9690
Kodiak	2.6728	2	0.2628
1616-30 (LLCF)	106.7787	2	0.0000
Leslie	66.3631	2	0.0000
Moose	602.0966	2	0.0000
Nema	431.6457	2	0.0000
Slipper	222.0275	2	0.0000
S2	60.9285	2	0.0000
S3	21.6472	2	0.0000

- Conclusions:
  When allowing for differences in intercept, all monitored lakes except Grizzly and Kodiak show significant deviation from the common slope of reference lakes.

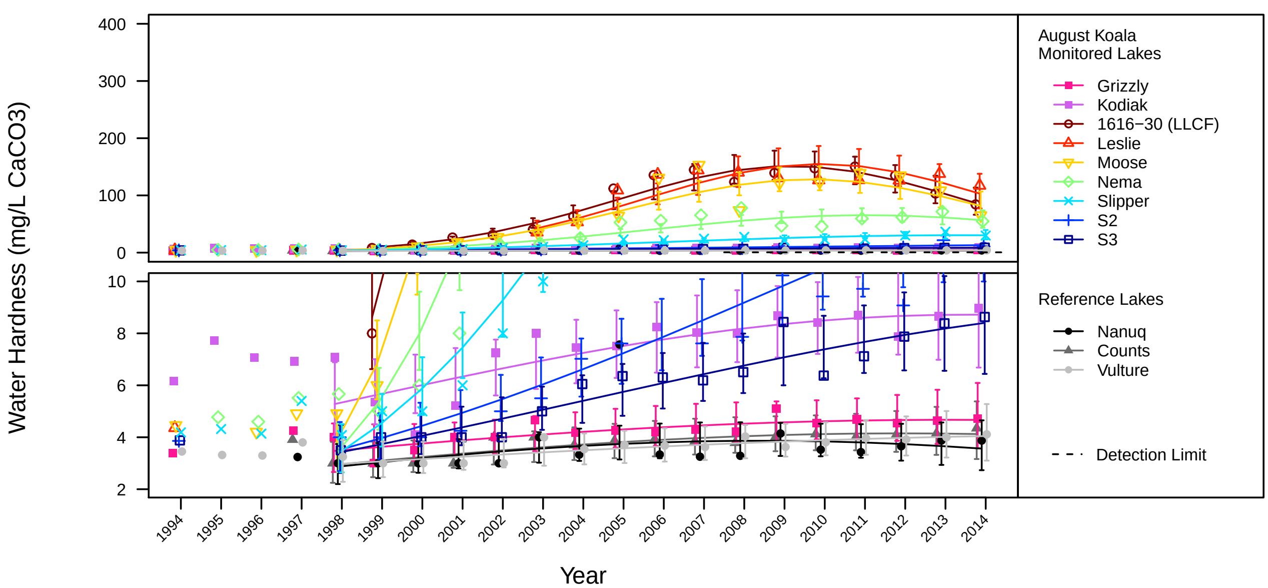
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3600
Monitored Lake	1616-30 (LLCF)	0.9810
Monitored Lake	Grizzly	0.6080
Monitored Lake	Kodiak	0.5830
Monitored Lake	Leslie	0.8240
Monitored Lake	Moose	0.9640
Monitored Lake	Nema	0.9220
Monitored Lake	S2	0.7730
Monitored Lake	S3	0.9120
Monitored Lake	Slipper	0.9410

- Conclusions:
  Model fit for pooled reference lakes is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean water hardness for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	4.72E+00	4.67E+00	6.33E-01	3.58E+00	6.09E+00	1.85E+00
Kodiak	8.96E+00	8.72E+00	1.18E+00	6.68E+00	1.14E+01	3.46E+00
Leslie	1.17E+02	1.03E+02	1.52E+01	7.72E+01	1.38E+02	4.46E+01
1616-30 (LLCF)	8.42E+01	8.68E+01	1.19E+01	6.62E+01	1.14E+02	3.50E+01
Moose	6.50E+01	8.18E+01	1.11E+01	6.27E+01	1.07E+02	3.25E+01
Nema	5.48E+01	5.66E+01	7.68E+00	4.34E+01	7.39E+01	2.25E+01
Slipper	2.98E+01	3.03E+01	4.11E+00	2.32E+01	3.95E+01	1.20E+01
S2	1.08E+01	1.30E+01	1.77E+00	1.00E+01	1.70E+01	5.18E+00
S3	8.63E+00	8.40E+00	1.14E+00	6.44E+00	1.10E+01	3.34E+00
Nanuq	3.87E+00	3.57E+00	4.84E-01	2.73E+00	4.65E+00	
Counts	4.35E+00	4.12E+00	5.60E-01	3.16E+00	5.38E+00	
Vulture	4.11E+00	4.05E+00	5.49E-01	3.10E+00	5.28E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Hardness	August	Koala	Lake	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	Grizzly Kodiak 1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

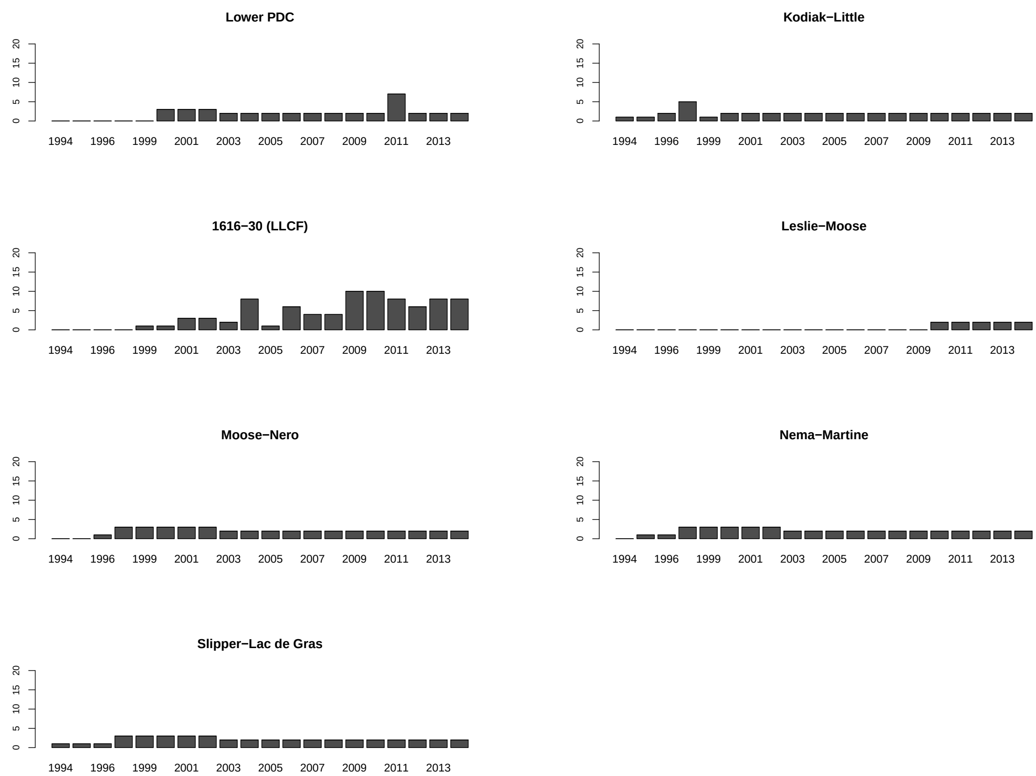
Analysis of August Water Hardness in Koala Watershed Streams

November 10, 2014

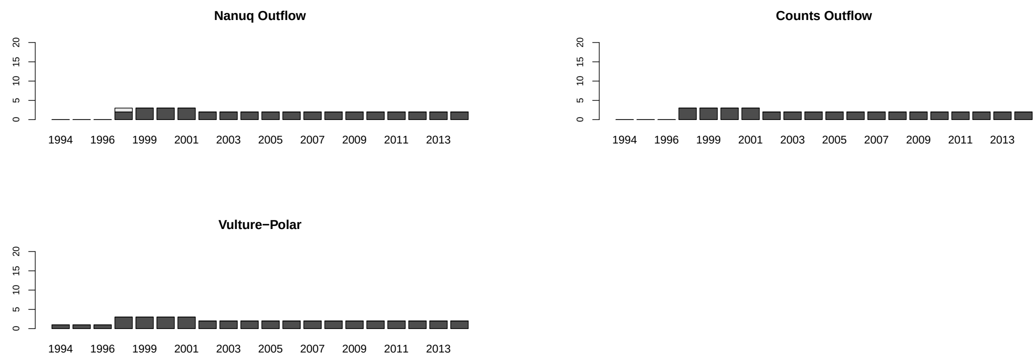
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

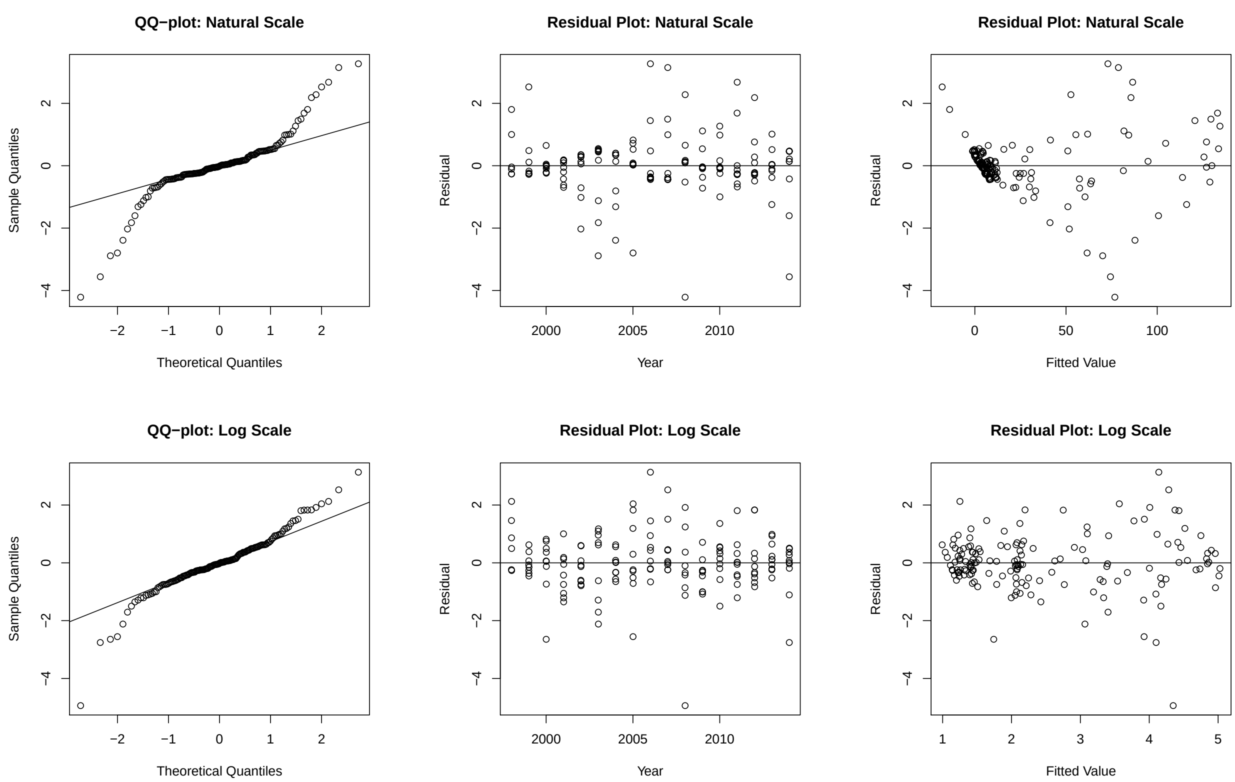


1.2 Reference



Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
118	Moose-Nero	2006	106.50	72.98	3.27
119	Moose-Nero	2007	111.00	78.73	3.15
120	Moose-Nero	2008	33.55	76.77	-4.21
126	Moose-Nero	2014	37.85	74.36	-3.56

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
118	Moose-Nero	2006	106.50	4.14	3.14
120	Moose-Nero	2008	33.55	4.35	-4.94

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log transformed model.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
117.04	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
91.85	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.998	0.000	0.002	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	1.3098	2	0.5195
Kodiak-Little	7.0330	2	0.0297
Leslie-Moose	1.7361	2	0.4198
1616-30 (LLCF)	431.1062	2	0.0000
Moose-Nero	212.5580	2	0.0000
Nema-Martine	206.2964	2	0.0000
Slipper-Lac de Gras	112.2224	2	0.0000

- Conclusions:
  All monitored streams except Lower PDC and Leslie-Moose show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Kodiak-Little-vs-Nanuq Outflow	195.0635	3	0.0000
Kodiak-Little-vs-Counts Outflow	139.2381	3	0.0000
Kodiak-Little-vs-Vulture-Polar	86.3167	3	0.0000
1616-30 (LLCF)-vs-Nanuq Outflow	85.9200	3	0.0000
1616-30 (LLCF)-vs-Counts Outflow	80.1960	3	0.0000
1616-30 (LLCF)-vs-Vulture-Polar	89.9286	3	0.0000
Moose-Nero-vs-Nanuq Outflow	1985.4884	3	0.0000
Moose-Nero-vs-Counts Outflow	1811.1712	3	0.0000
Moose-Nero-vs-Vulture-Polar	1632.9791	3	0.0000
Nema-Martine-vs-Nanuq Outflow	1604.0389	3	0.0000
Nema-Martine-vs-Counts Outflow	1447.3054	3	0.0000
Nema-Martine-vs-Vulture-Polar	1294.5592	3	0.0000
Slipper-Lac de Gras-vs-Nanuq Outflow	789.7280	3	0.0000
Slipper-Lac de Gras-vs-Counts Outflow	678.0018	3	0.0000
Slipper-Lac de Gras-vs-Vulture-Polar	576.9269	3	0.0000

- Conclusions:
  All remaining monitored streams show significant deviation from the slopes of individual reference streams.

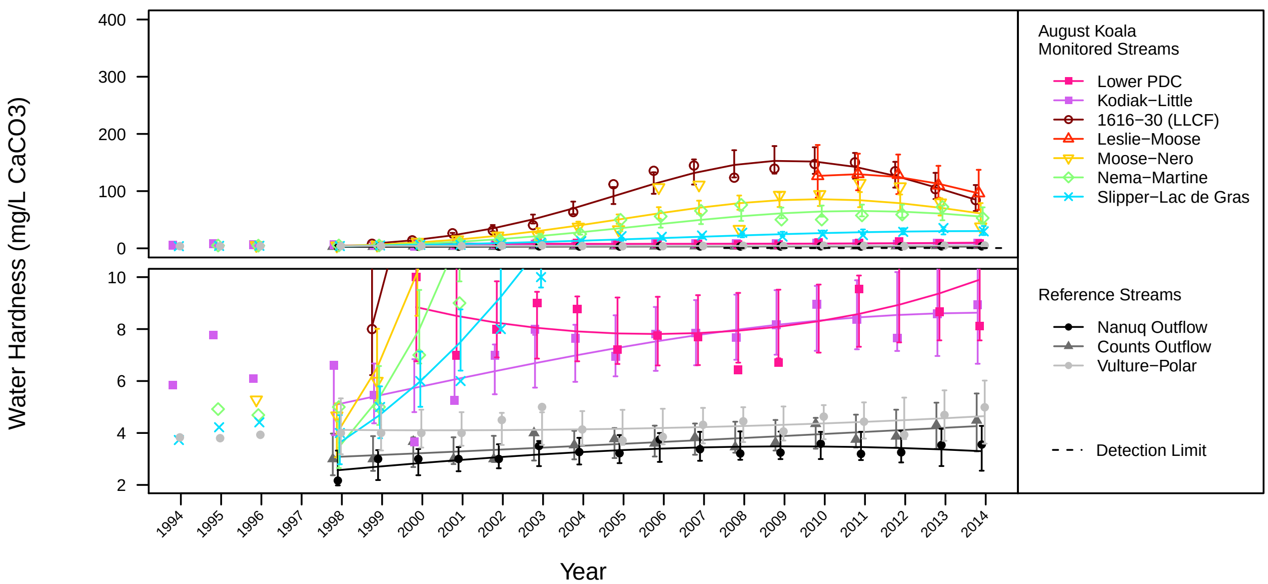
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.6240
Reference Stream	Nanuq Outflow	0.6100
Reference Stream	Vulture-Polar	0.2080
Monitored Stream	1616-30 (LLCF)	0.9820
Monitored Stream	Kodiak-Little	0.5680
Monitored Stream	Leslie-Moose	0.9740
Monitored Stream	Lower PDC	0.1600
Monitored Stream	Moose-Nero	0.8850
Monitored Stream	Nema-Martine	0.9420
Monitored Stream	Slipper-Lac de Gras	0.9540

- Conclusions:
  Model fit for Vulture-Polar is weak. Model fit for Lower PDC is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean water hardness for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	8.12E+00	9.90E+00	1.36E+00	7.56E+00	1.30E+01	3.98E+00
Kodiak-Little	8.93E+00	8.63E+00	1.14E+00	6.67E+00	1.12E+01	3.33E+00
Leslie-Moose	9.64E+01	9.62E+01	1.75E+01	6.74E+01	1.37E+02	5.11E+01
1616-30 (LLCF)	8.42E+01	8.50E+01	1.14E+01	6.53E+01	1.11E+02	3.34E+01
Moose-Nero	3.79E+01	6.10E+01	8.04E+00	4.71E+01	7.90E+01	2.35E+01
Nema-Martine	5.30E+01	5.54E+01	7.30E+00	4.27E+01	7.17E+01	2.13E+01
Slipper-Lac de Gras	2.96E+01	3.02E+01	3.98E+00	2.33E+01	3.91E+01	1.16E+01
Nanuq Outflow	3.55E+00	3.30E+00	4.35E-01	2.55E+00	4.27E+00	
Counts Outflow	4.48E+00	4.26E+00	5.62E-01	3.29E+00	5.52E+00	
Vulture-Polar	4.99E+00	4.65E+00	6.13E-01	3.59E+00	6.02E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Hardness	August	Koala	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	NA	Kodiak-Little 1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

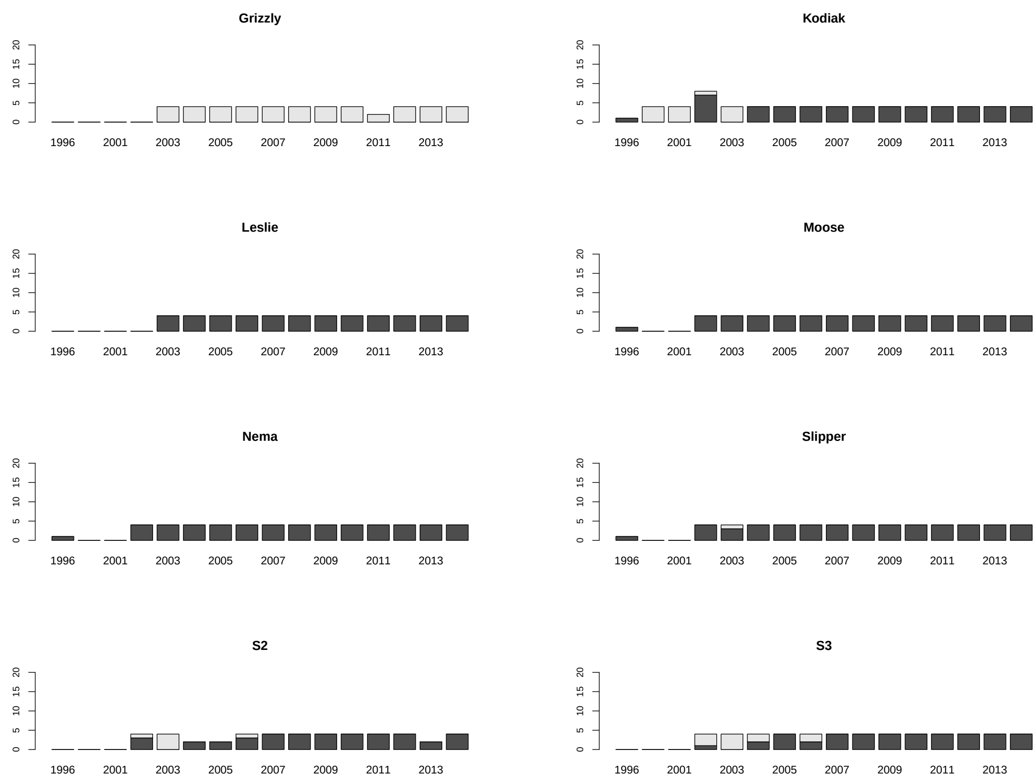
Analysis of April Chloride in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

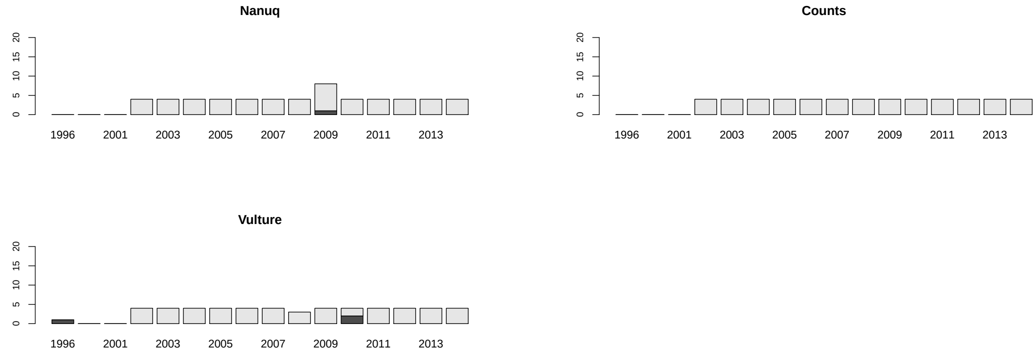
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

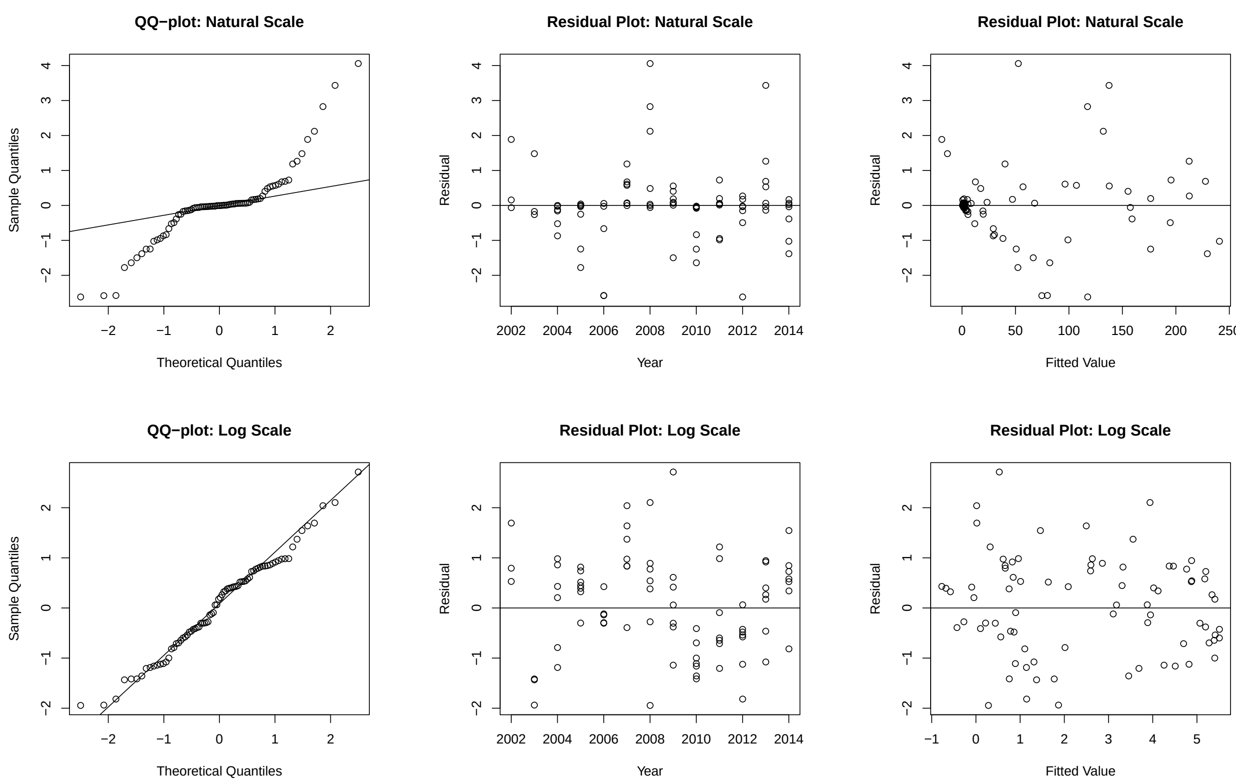


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and Grizzly lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Kodiak, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	100.22	52.69	4.06
167	Nema	2013	177.75	137.54	3.43

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
5.57E-149	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log transformed model.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	13.1418	2	0.0014
Leslie	172.7333	2	0.0000
Moose	259.7841	2	0.0000
Nema	242.2631	2	0.0000
Slipper	214.9316	2	0.0000
S2	38.5143	2	0.0000
S3	49.6020	2	0.0000

All monitored lakes show significant deviation from a slope of zero.

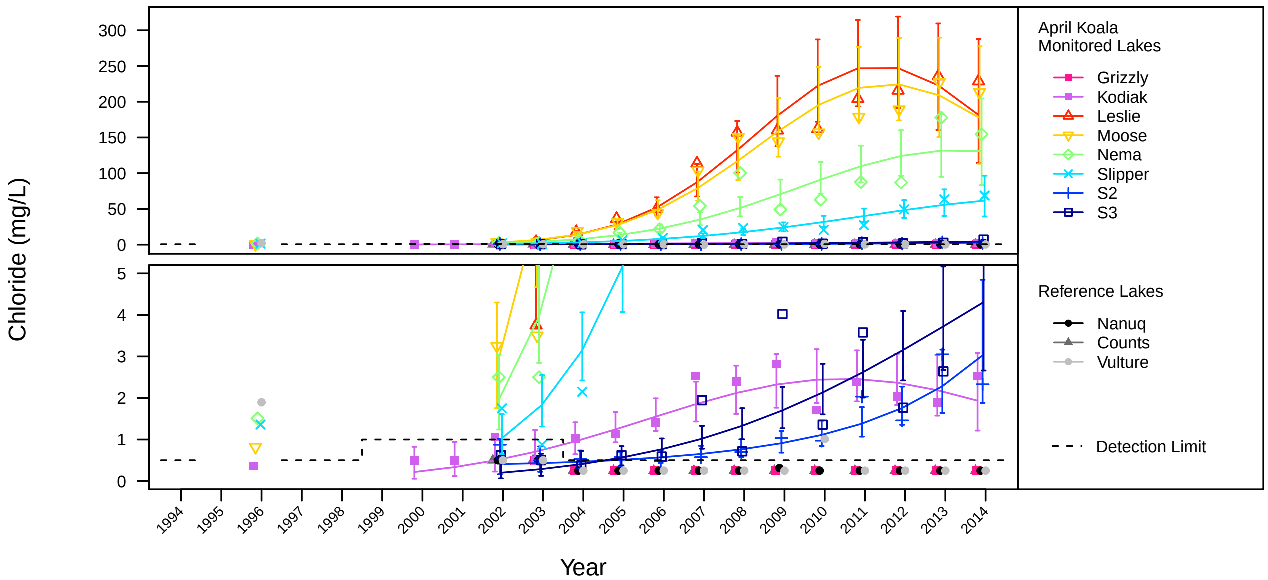
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Kodiak	0.8200
Monitored Lake	Leslie	0.9630
Monitored Lake	Moose	0.9690
Monitored Lake	Nema	0.9390
Monitored Lake	S2	0.8350
Monitored Lake	S3	0.7450
Monitored Lake	Slipper	0.9280

- Conclusions:
  Models provide a good fit for all monitored lakes.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean chloride for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	2.53E+00	1.94E+00	4.60E-01	1.22E+00	3.08E+00	1.35E+00
Leslie	2.29E+02	1.81E+02	4.27E+01	1.14E+02	2.88E+02	1.25E+02
Moose	2.13E+02	1.77E+02	4.05E+01	1.13E+02	2.78E+02	1.19E+02
Nema	1.54E+02	1.31E+02	2.99E+01	8.35E+01	2.05E+02	8.75E+01
Slipper	6.87E+01	6.16E+01	1.41E+01	3.94E+01	9.65E+01	4.12E+01
S2	2.33E+00	3.02E+00	7.29E-01	1.88E+00	4.85E+00	2.13E+00
S3	7.03E+00	4.30E+00	1.05E+00	2.66E+00	6.95E+00	3.08E+00
Nanuq	2.50E-01					
Counts	2.50E-01					
Vulture	2.50E-01					

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmakr	Significant Monitored Contrasts*
Chloride	April	Koala	Lake	Water	Counts Nanuq Vulture Grizzly	log e	Tobit regression	#1a slope of zero	hardness dependent	Kodiak Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

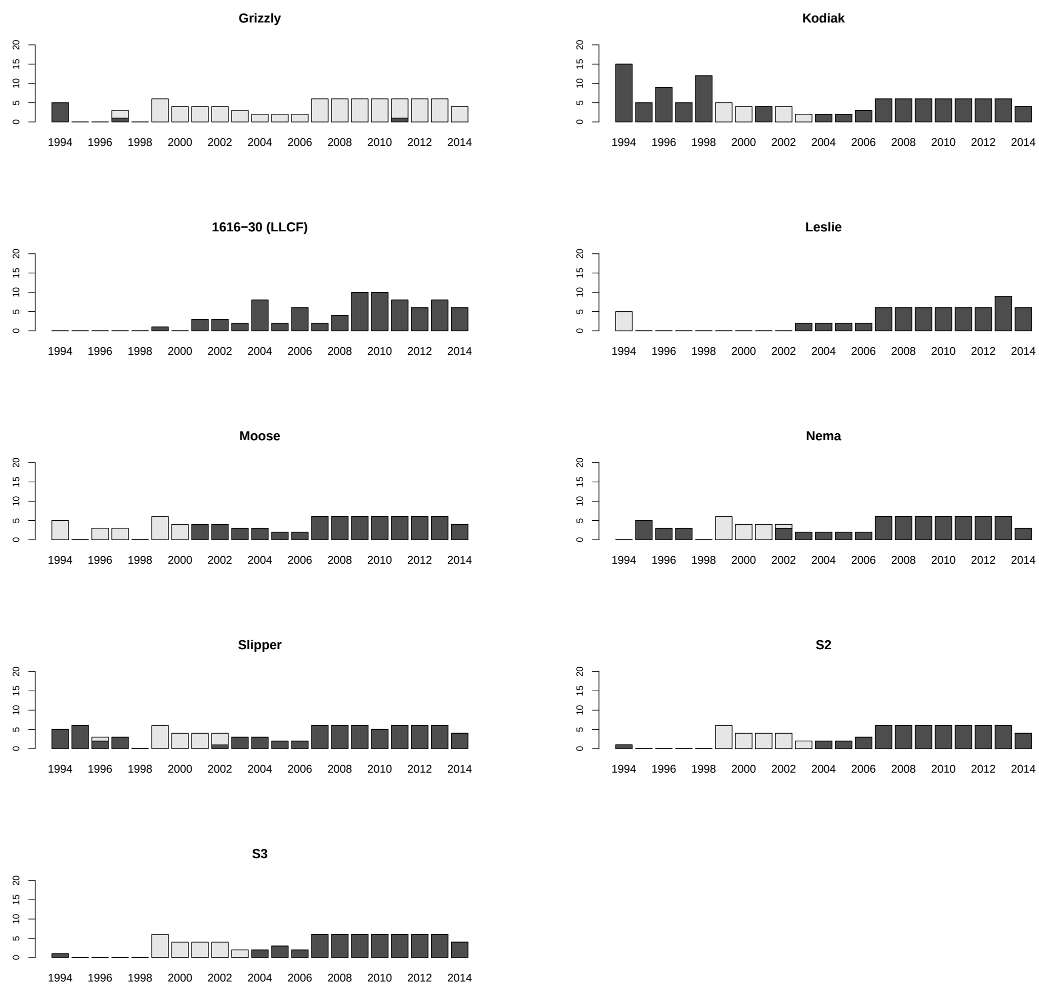
Analysis of August Chloride in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

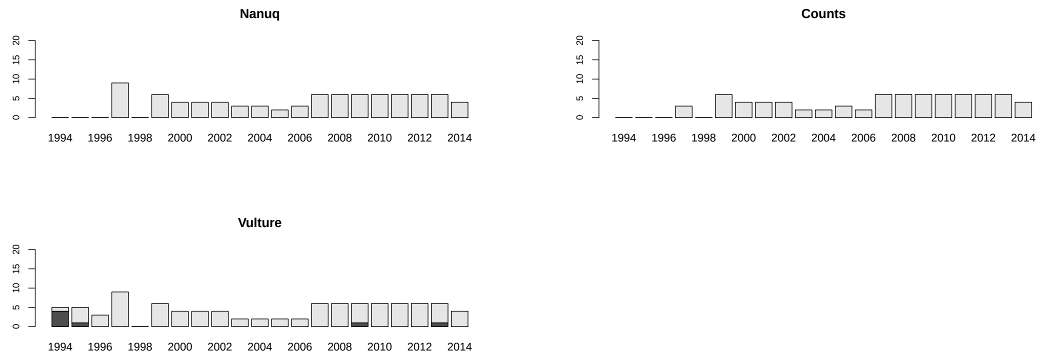
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

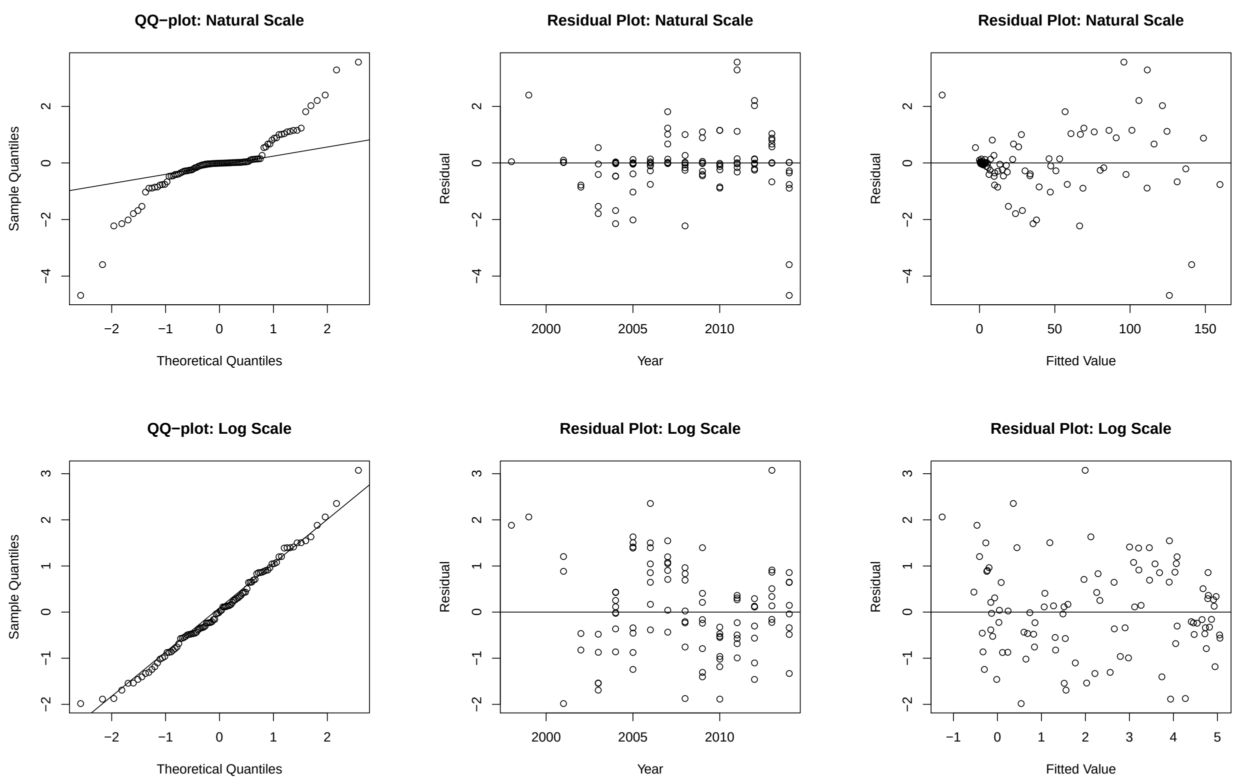


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and Grizzly lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Kodiak, Moose, Nema, Slipper, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
18	1616-30 (LLCF)	2011	146.12	111.44	3.29
21	1616-30 (LLCF)	2014	103.00	140.89	-3.59
123	Moose	2011	133.50	95.89	3.57
126	Moose	2014	76.72	126.08	-4.68

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
188	S2	2013	17.00	2.00	3.07

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	5.9541	2	0.0509
1616-30 (LLCF)	676.2914	2	0.0000
Leslie	206.8469	2	0.0000
Moose	489.9095	2	0.0000
Nema	265.2250	2	0.0000
Slipper	182.3747	2	0.0000
S2	91.4138	2	0.0000
S3	61.5306	2	0.0000

- Conclusions:
  All monitored lakes show significant deviation from a slope of zero.

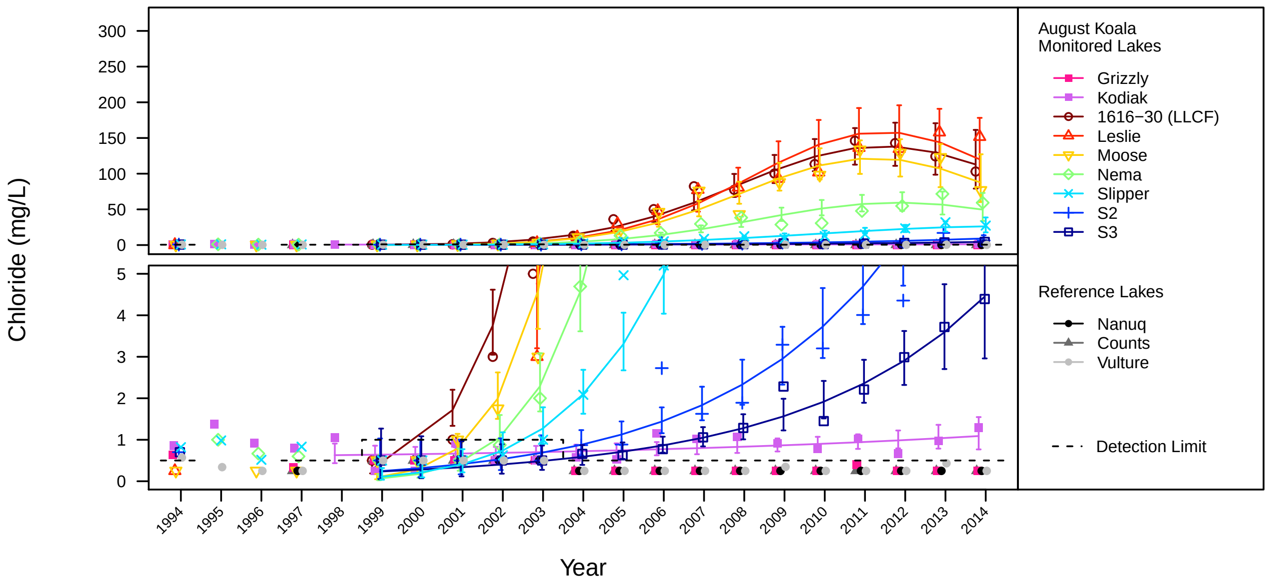
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-30 (LLCF)	0.9770
Monitored Lake	Kodiak	0.1750
Monitored Lake	Leslie	0.9510
Monitored Lake	Moose	0.9540
Monitored Lake	Nema	0.9240
Monitored Lake	S2	0.8940
Monitored Lake	S3	0.9070
Monitored Lake	Slipper	0.9290

- Conclusions:
  Model fit for Kodiak poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean chloride for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	1.30E+00	1.09E+00	1.95E-01	7.67E-01	1.55E+00	5.70E-01
Leslie	1.52E+02	1.20E+02	2.42E+01	8.09E+01	1.78E+02	7.08E+01
1616-30 (LLCF)	1.03E+02	1.13E+02	2.05E+01	7.91E+01	1.61E+02	6.01E+01
Moose	7.67E+01	8.75E+01	1.67E+01	6.03E+01	1.27E+02	4.88E+01
Nema	5.93E+01	4.97E+01	9.76E+00	3.38E+01	7.30E+01	2.86E+01
Slipper	2.73E+01	2.62E+01	5.20E+00	1.78E+01	3.87E+01	1.52E+01
S2	6.39E+00	9.19E+00	1.87E+00	6.17E+00	1.37E+01	5.46E+00
S3	4.39E+00	4.44E+00	9.18E-01	2.96E+00	6.66E+00	2.69E+00
Nanuq	2.50E-01					
Counts	2.50E-01					
Vulture	2.50E-01					

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Chloride	August	Koala	Lake	Water	Nanuq Counts Vulture Grizzly	log e	Tobit regression	#1a slope of zero	hardness-dependent	1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

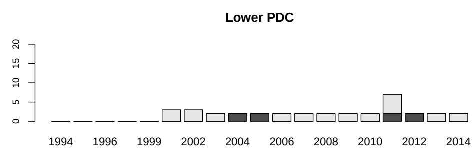
Analysis of August Chloride in Koala Watershed Streams

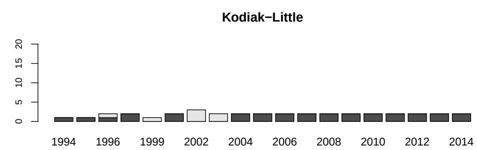
November 10, 2014

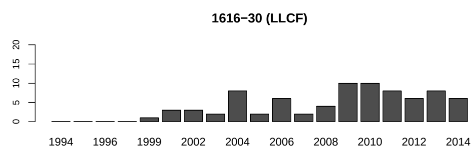
1 Censored Values:

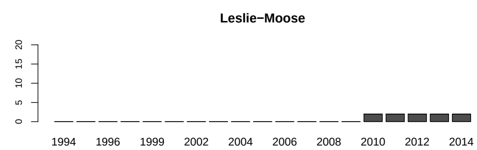
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

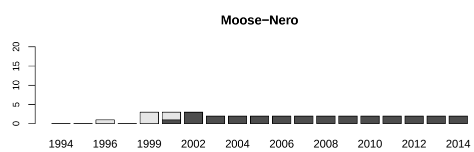
1.1 Monitored

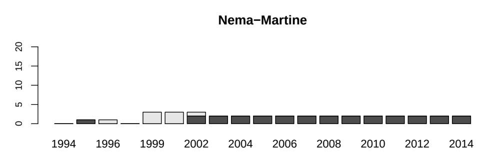


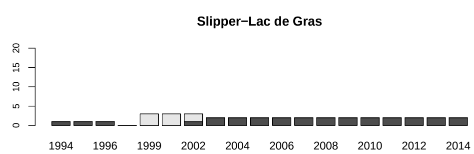




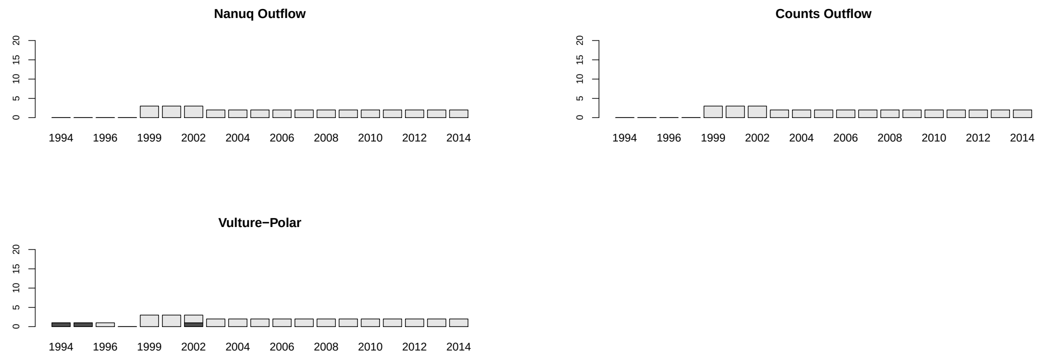






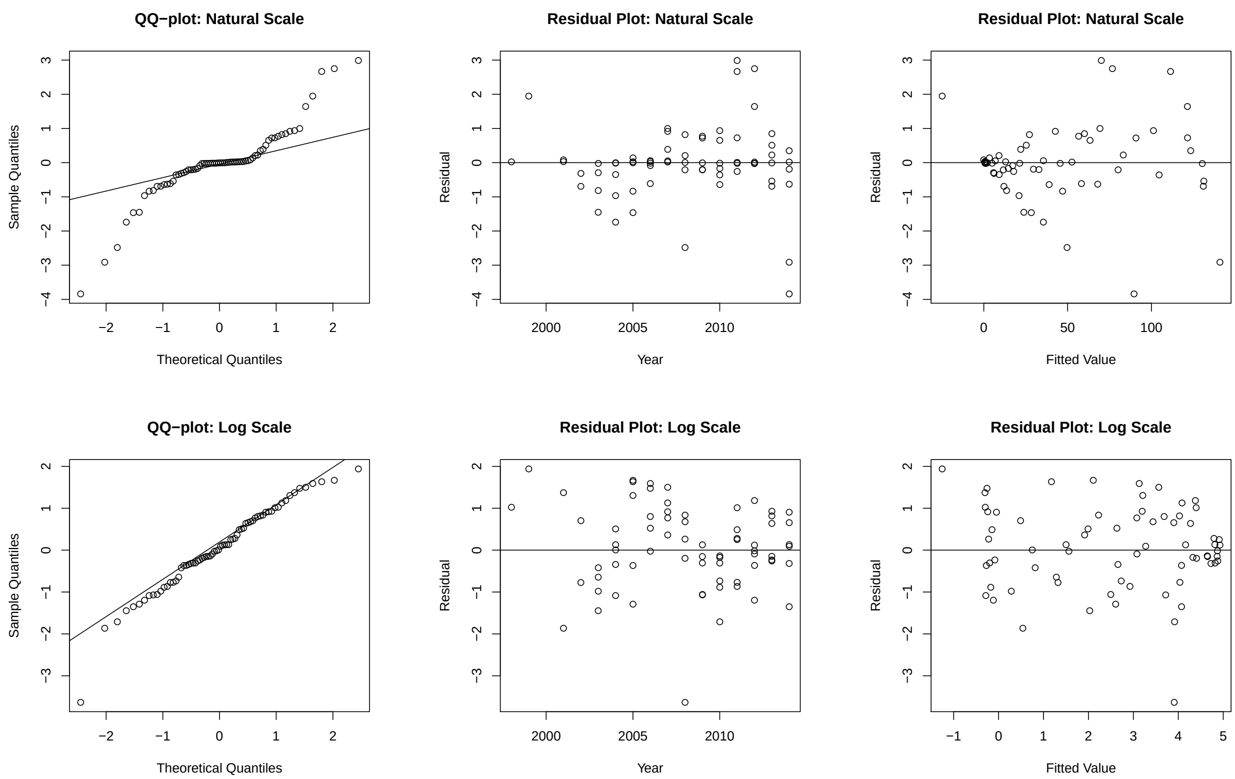


1.2 Reference



Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar, and the Lower PDC was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Kodiak-Little, Moose-Nero, Nema-Martine, and Slipper-Lac de Gras was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
126	Moose-Nero	2014	39.70	89.64	-3.84

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	17.40	3.91	-3.63

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Test Results for Monitored Streams

3.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak-Little	1.1623	2	0.5593
Leslie-Moose	0.4273	2	0.8076
1616-30 (LLCF)	597.7932	2	0.0000
Moose-Nero	283.2603	2	0.0000
Nema-Martine	234.5299	2	0.0000
Slipper-Lac de Gras	145.7380	2	0.0000

- Conclusions:
  All remaining monitored streams except Kodiak-Little and Leslie-Moose show significant deviation from a slope of zero.

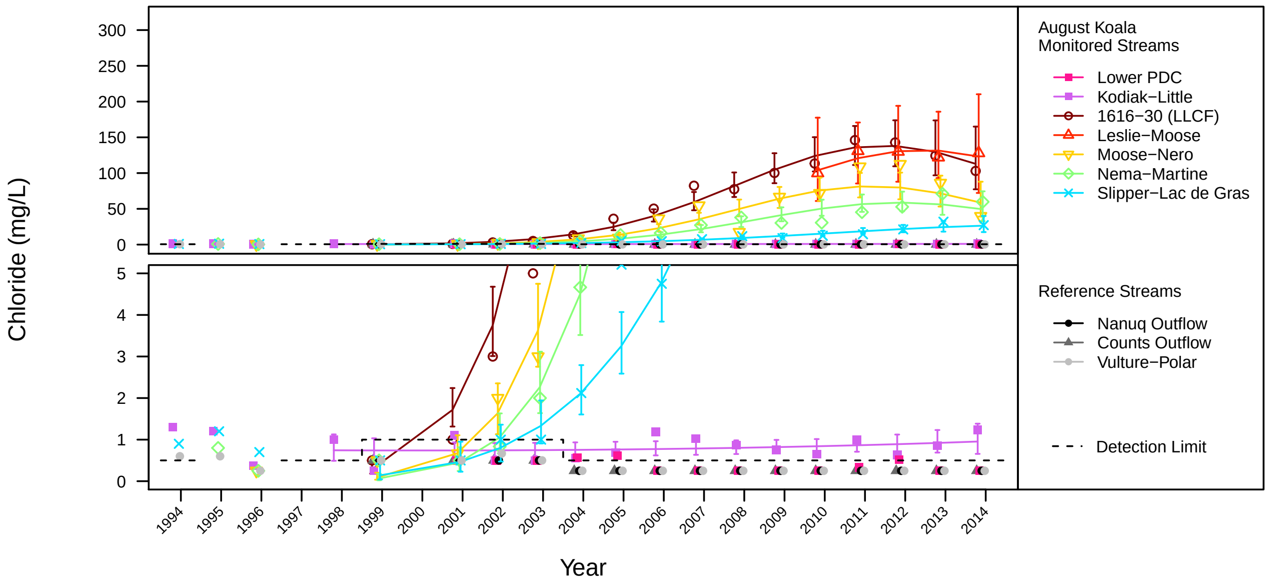
4 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-30 (LLCF)	0.9770
Monitored Stream	Kodiak-Little	0.0750
Monitored Stream	Leslie-Moose	0.7020
Monitored Stream	Moose-Nero	0.9210
Monitored Stream	Nema-Martine	0.9230
Monitored Stream	Slipper-Lac de Gras	0.9400

- Conclusions:
  Model fit for Kodiak-Little is poor. Results of statistical tests and MDD should be interpreted with caution.

5 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

6 Minimum Detectable Differences

The estimated minimum detectable difference in mean chloride for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak-Little	1.24E+00	9.54E-01	1.81E-01	6.57E-01	1.38E+00	5.30E-01
Leslie-Moose	1.28E+02	1.23E+02	3.36E+01	7.22E+01	2.10E+02	9.83E+01
1616-30 (LLCF)	1.03E+02	1.13E+02	2.18E+01	7.73E+01	1.65E+02	6.39E+01
Moose-Nero	3.97E+01	5.87E+01	1.21E+01	3.92E+01	8.79E+01	3.54E+01
Nema-Martine	5.98E+01	4.94E+01	1.03E+01	3.28E+01	7.45E+01	3.02E+01
Slipper-Lac de Gras	2.71E+01	2.64E+01	5.60E+00	1.75E+01	4.00E+01	1.64E+01
Nanuq Outflow	2.50E-01					
Counts Outflow	2.50E-01					
Vulture-Polar	2.50E-01					

7 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Chloride	August	Koala	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar Lower PDC	log e	Tobit regression	#1a slope of zero	hardness-dependent	1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

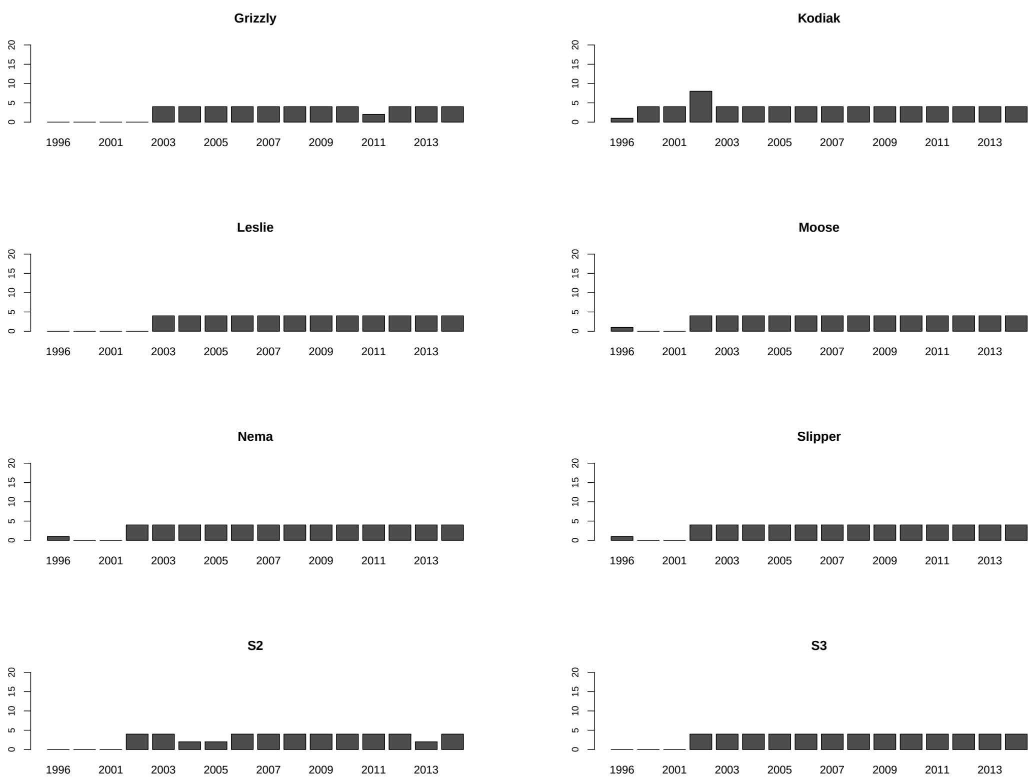
Analysis of April Sulphate in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

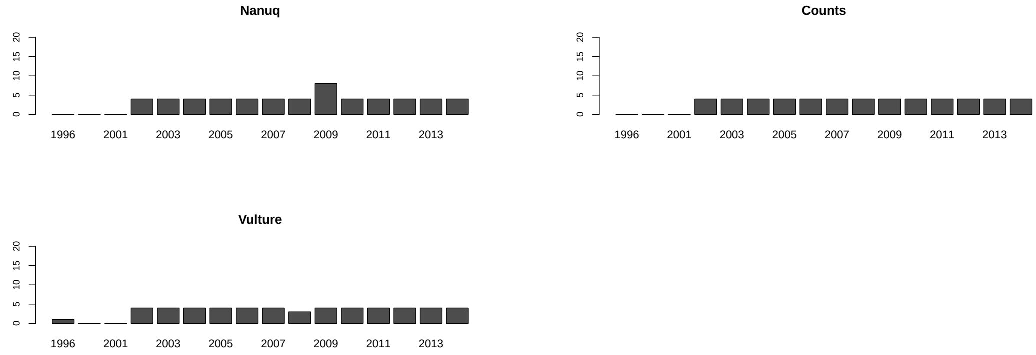
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

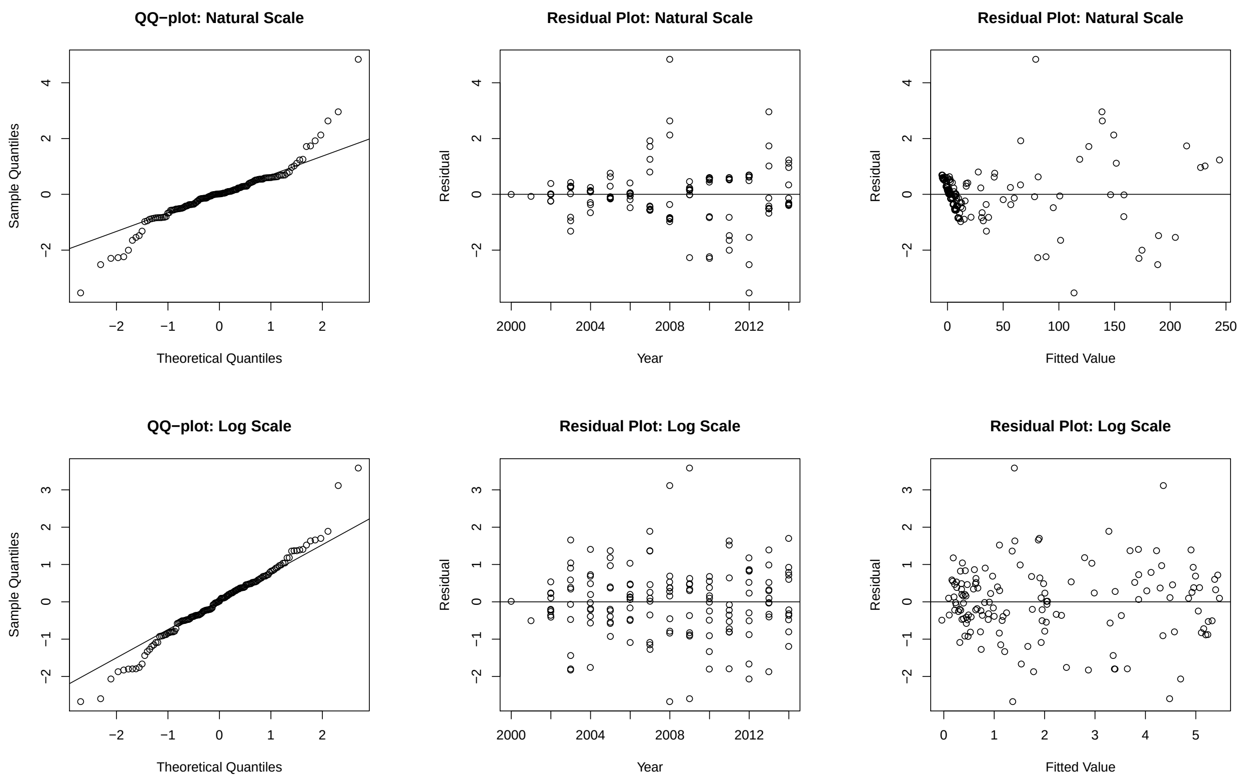


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	124.75	79.20	4.84
166	Nema	2012	80.32	113.57	-3.53

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	124.75	4.36	3.12
205	S3	2009	6.96	1.40	3.59

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.47E-255	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
227.36	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
1.30	4.00	0.86

- Conclusions:
  The slopes do not differ significantly among reference lakes.

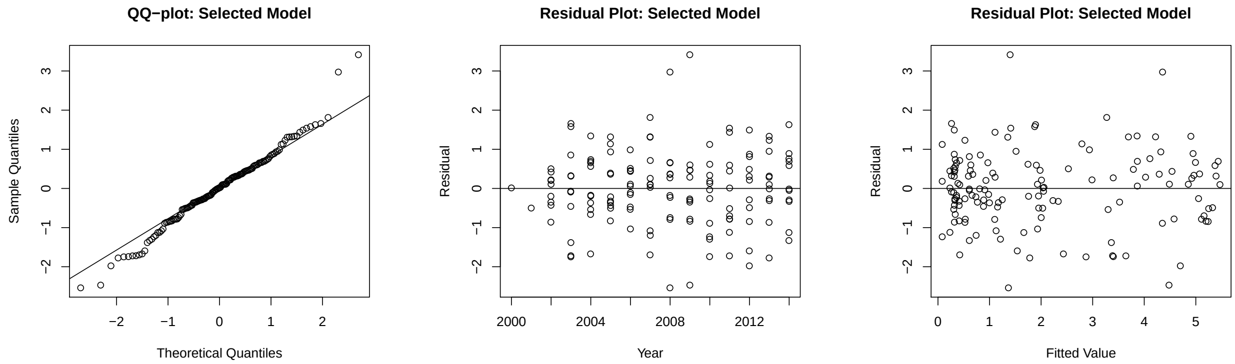
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.585	0.000	0.415	Indistinguishable support for 1 & 3; choose Model 3.

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled with a common slope and intercept, results of contrasts suggest that intercepts differ among reference lakes. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes).

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
205	S3	2009	6.96	1.40	3.42

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.04	2.00	0.98
Kodiak	0.24	2.00	0.88
Leslie	85.43	2.00	0.00
Moose	98.50	2.00	0.00
Nema	93.51	2.00	0.00
Slipper	83.95	2.00	0.00
S2	3.71	2.00	0.16
S3	13.04	2.00	0.00

- Conclusions:
  All monitored lakes except Grizzly, Kodiak, and S2 show significant deviation from the common slope of reference lakes.

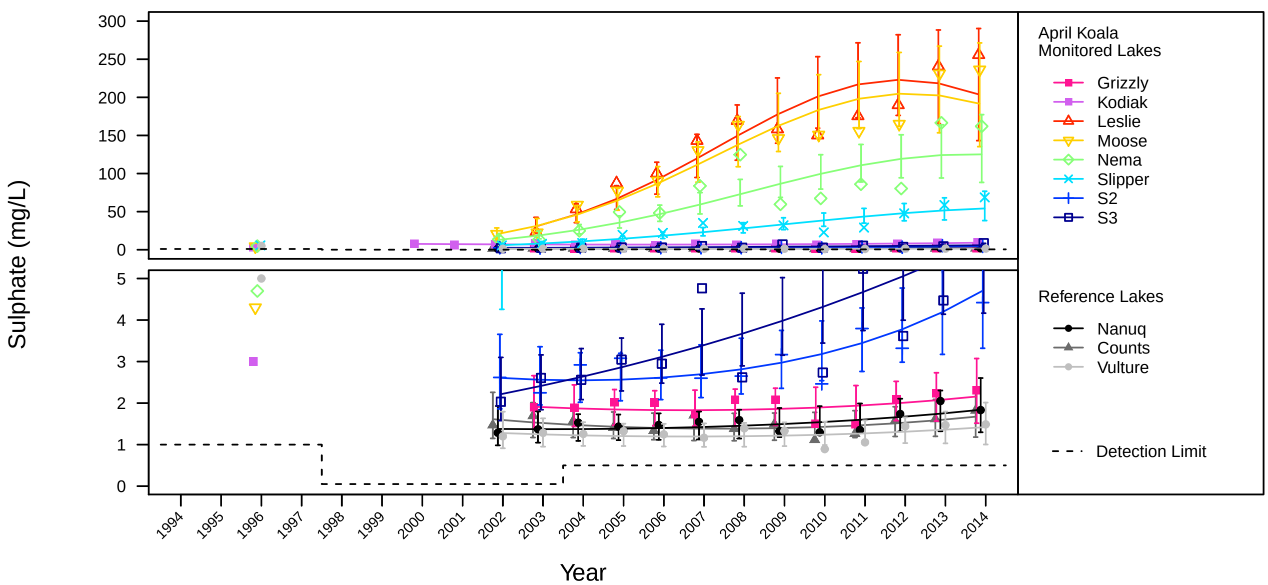
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1590
Monitored Lake	Grizzly	0.1500
Monitored Lake	Kodiak	0.4710
Monitored Lake	Leslie	0.9170
Monitored Lake	Moose	0.9390
Monitored Lake	Nema	0.8440
Monitored Lake	S2	0.6930
Monitored Lake	S3	0.5290
Monitored Lake	Slipper	0.8790

- Conclusions:
  Model fit for Kodiak Lake is weak. Model fit for pooled reference lakes and Grizzly Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean sulphate for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	2.31E+00	2.16E+00	3.89E-01	1.52E+00	3.07E+00	1.14E+00
Kodiak	9.78E+00	9.18E+00	1.57E+00	6.56E+00	1.28E+01	4.60E+00
Leslie	2.56E+02	2.04E+02	3.68E+01	1.43E+02	2.90E+02	1.08E+02
Moose	2.36E+02	1.92E+02	3.40E+01	1.35E+02	2.71E+02	9.96E+01
Nema	1.62E+02	1.25E+02	2.22E+01	8.84E+01	1.77E+02	6.50E+01
Slipper	6.87E+01	5.42E+01	9.62E+00	3.83E+01	7.67E+01	2.82E+01
S2	4.42E+00	4.70E+00	8.35E-01	3.32E+00	6.66E+00	2.44E+00
S3	8.59E+00	5.90E+00	1.05E+00	4.17E+00	8.36E+00	3.07E+00
Nanuq	1.83E+00	1.84E+00	3.26E-01	1.30E+00	2.60E+00	
Counts	1.82E+00	1.67E+00	2.97E-01	1.18E+00	2.37E+00	
Vulture	1.49E+00	1.42E+00	2.52E-01	1.00E+00	2.01E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Sulphate	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	hardness-dependent	Leslie Moose Nema Slipper S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

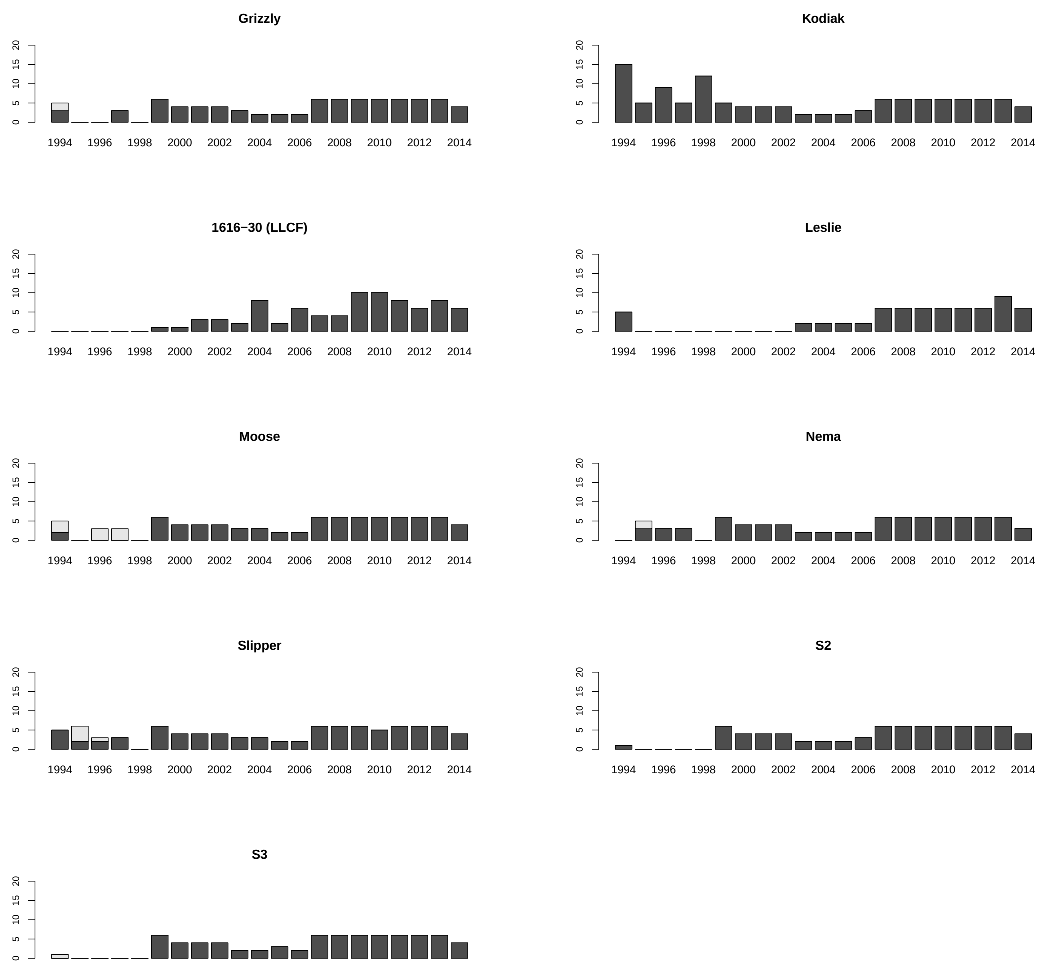
Analysis of August Sulphate in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

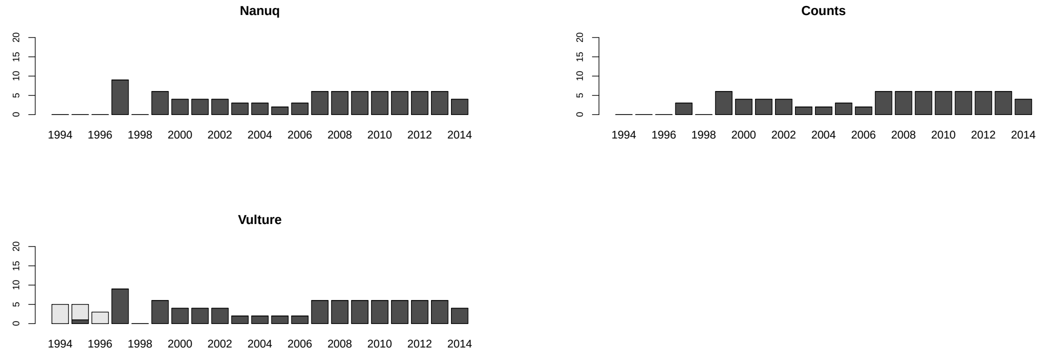
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

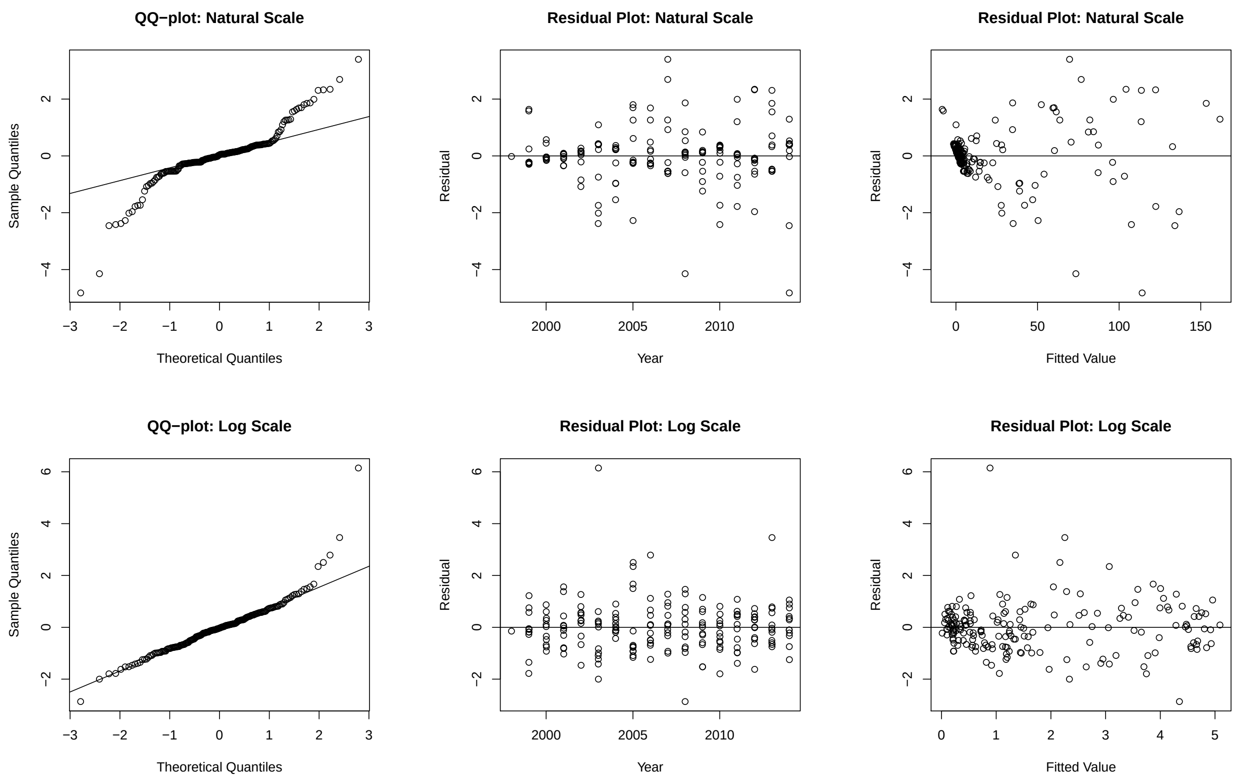


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
119	Moose	2007	90.82	69.61	3.40
120	Moose	2008	47.62	73.47	-4.15
126	Moose	2014	84.03	114.09	-4.82

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
188	S2	2013	17.13	2.25	3.46
199	S3	2003	6.88	0.89	6.15

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
6.32	6.00	0.39

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

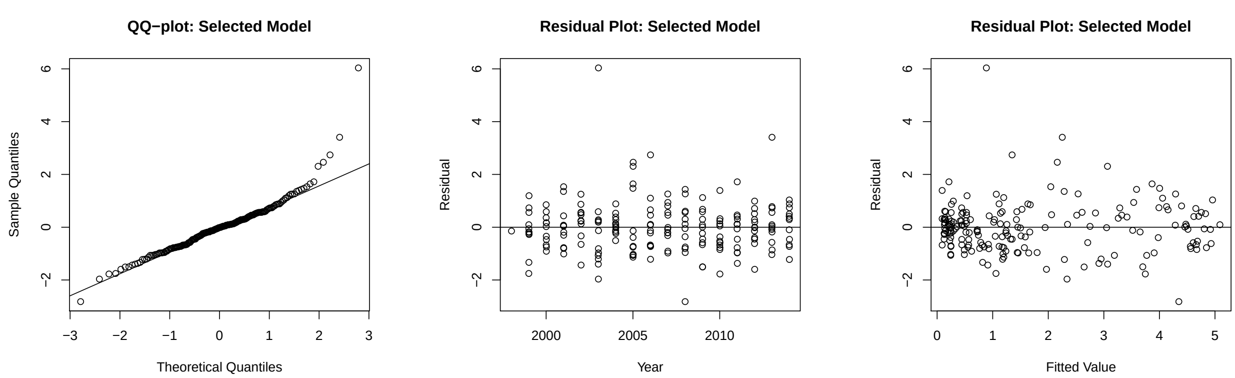
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.052	0.000	0.948	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
188	S2	2013	17.13	2.25	3.41
199	S3	2003	6.88	0.89	6.04

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
Grizzly	34.5025	3	0.0000
Kodiak	352.7213	3	0.0000
1616-30 (LLCF)	155.3459	3	0.0000
Leslie	5291.4304	3	0.0000
Moose	5076.3785	3	0.0000
Nema	3436.4152	3	0.0000
Slipper	1791.3767	3	0.0000
S2	599.0908	3	0.0000
S3	347.0041	3	0.0000

- Conclusions:
  All monitored lakes show significant deviation from the common slope of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.6021	2	0.7400
Kodiak	9.8701	2	0.0072
1616-30 (LLCF)	154.9329	2	0.0000
Leslie	105.8907	2	0.0000
Moose	552.4535	2	0.0000
Nema	444.4383	2	0.0000
Slipper	235.4190	2	0.0000
S2	90.0519	2	0.0000
S3	25.8075	2	0.0000

- Conclusions:
  When allowing for differences in intercept, all monitored lakes except Grizzly Lake show significant deviation from the common slope of reference lakes.

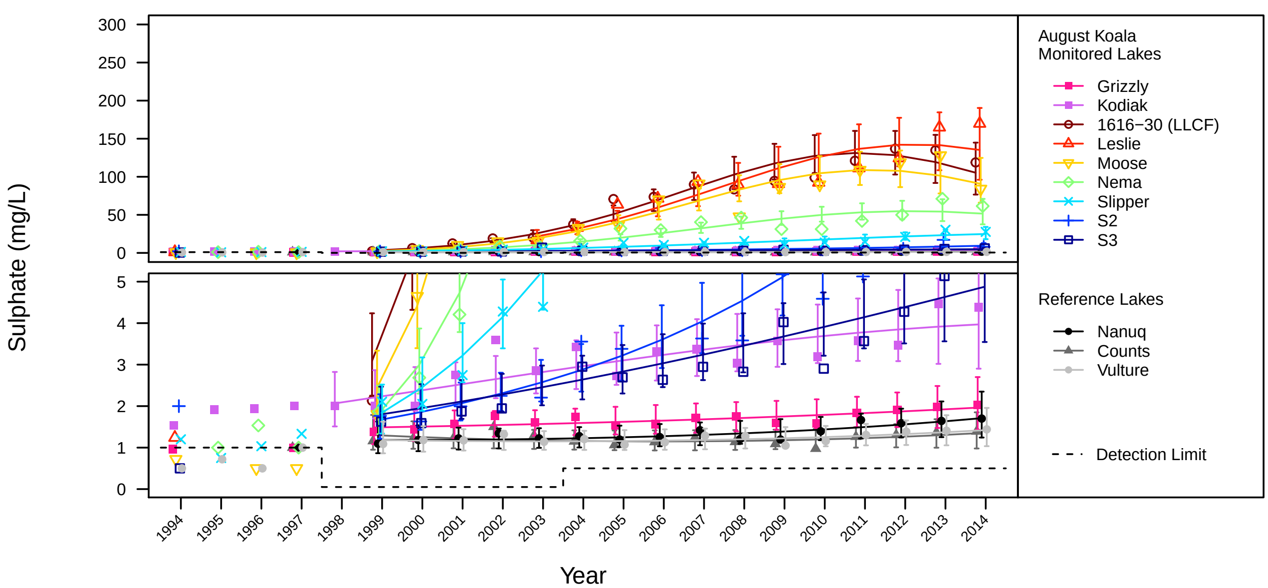
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3350
Monitored Lake	1616-30 (LLCF)	0.9740
Monitored Lake	Grizzly	0.6360
Monitored Lake	Kodiak	0.7330
Monitored Lake	Leslie	0.8930
Monitored Lake	Moose	0.9650
Monitored Lake	Nema	0.9490
Monitored Lake	S2	0.7900
Monitored Lake	S3	0.5170
Monitored Lake	Slipper	0.9310

- Conclusions:
  Model fit for pooled reference lakes is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean sulphate for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	2.03E+00	1.96E+00	3.19E-01	1.43E+00	2.70E+00	9.33E-01
Kodiak	4.38E+00	3.97E+00	6.34E-01	2.90E+00	5.43E+00	1.85E+00
Leslie	1.70E+02	1.35E+02	2.36E+01	9.61E+01	1.90E+02	6.90E+01
1616-30 (LLCF)	1.19E+02	1.05E+02	1.71E+01	7.66E+01	1.45E+02	5.01E+01
Moose	8.40E+01	9.07E+01	1.47E+01	6.60E+01	1.25E+02	4.31E+01
Nema	6.15E+01	5.16E+01	8.38E+00	3.75E+01	7.09E+01	2.45E+01
Slipper	2.76E+01	2.48E+01	4.03E+00	1.80E+01	3.41E+01	1.18E+01
S2	8.00E+00	9.41E+00	1.53E+00	6.84E+00	1.29E+01	4.47E+00
S3	5.96E+00	4.87E+00	7.92E-01	3.55E+00	6.70E+00	2.32E+00
Nanuq	1.70E+00	1.71E+00	2.78E-01	1.24E+00	2.35E+00	
Counts	1.39E+00	1.35E+00	2.19E-01	9.79E-01	1.85E+00	
Vulture	1.44E+00	1.42E+00	2.31E-01	1.03E+00	1.96E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Sulphate	August	Koala	Lake	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	hardness-dependent	Grizzly Kodiak 1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

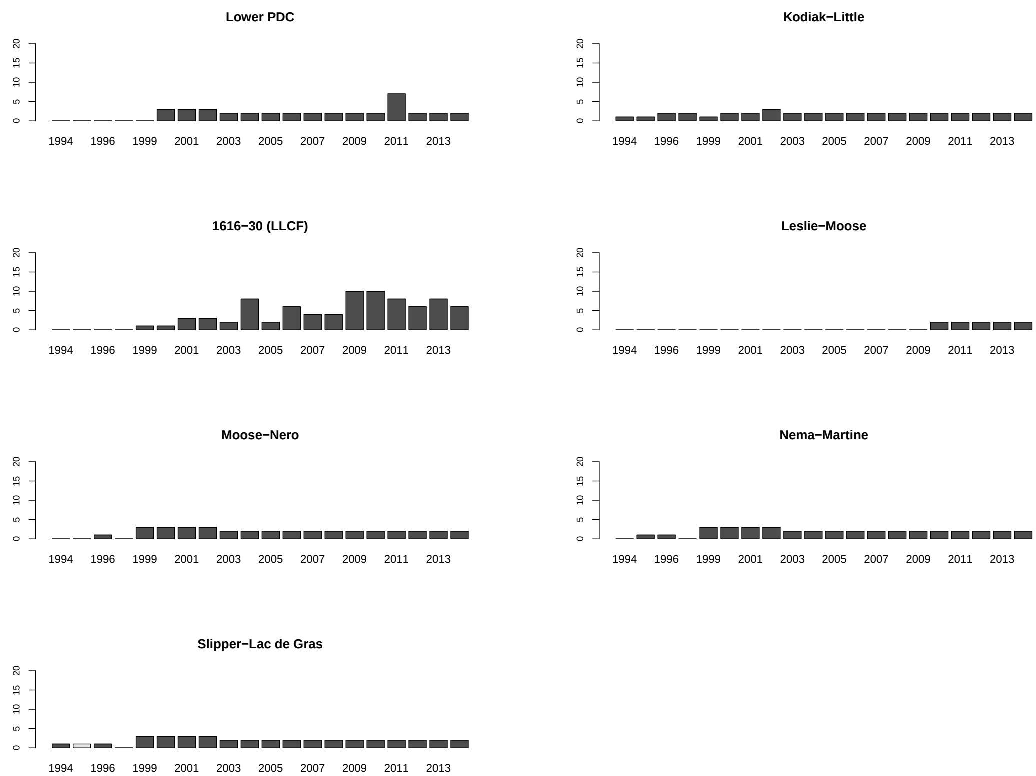
Analysis of August Sulphate in Koala Watershed Streams

November 10, 2014

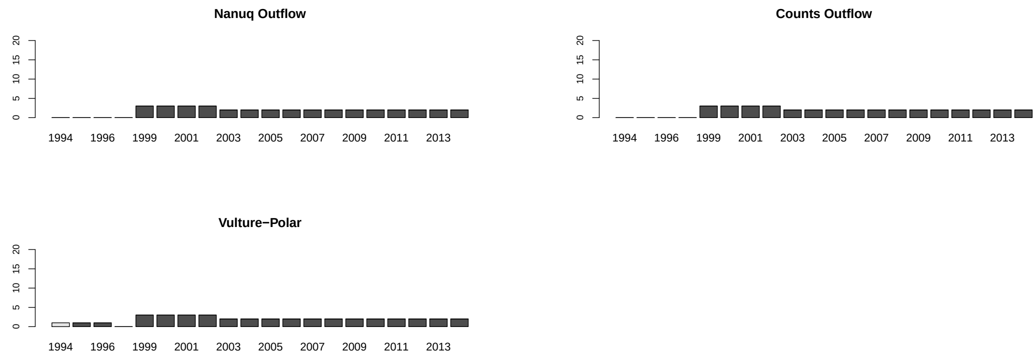
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

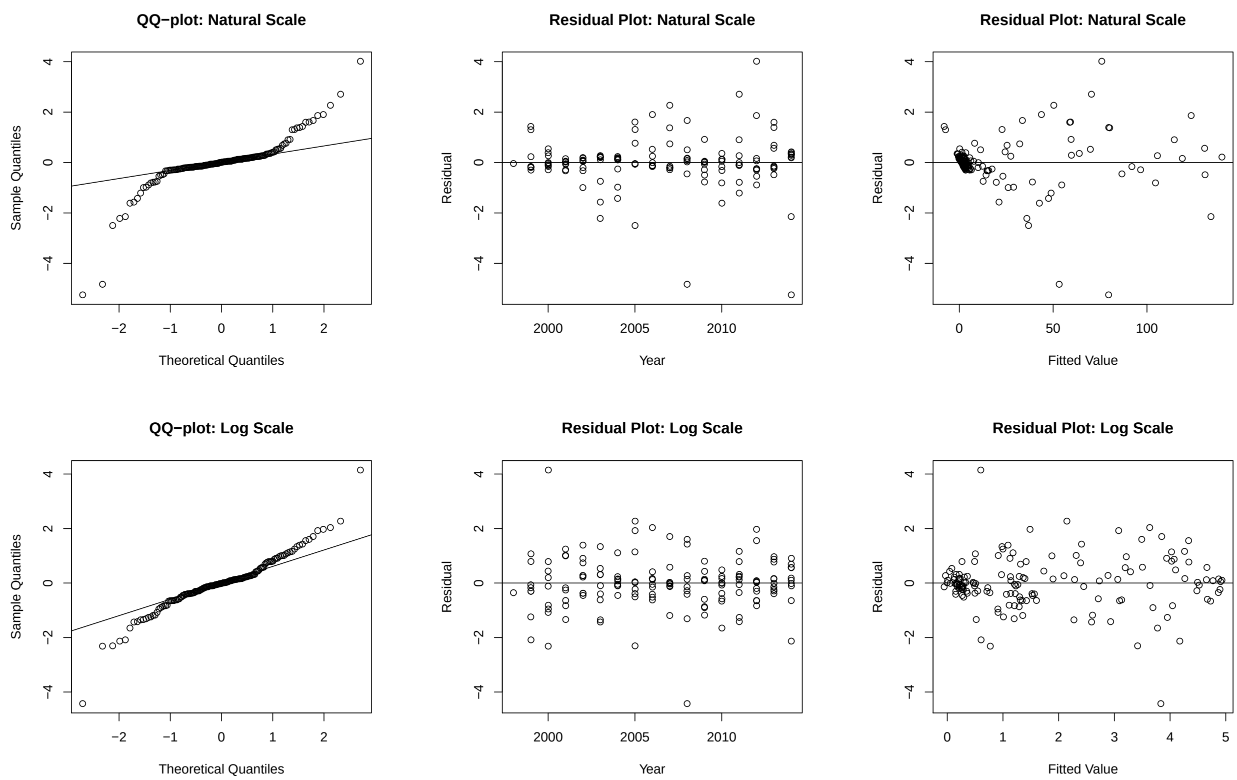


1.2 Reference



Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	18.85	53.23	-4.83
124	Moose-Nero	2012	104.50	75.92	4.02
126	Moose-Nero	2014	42.20	79.57	-5.25

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	18.85	3.83	-4.42
196	Vulture-Polar	2000	4.24	0.60	4.15

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
132.50	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
132.02	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.535	0.000	0.465	Indistinguishable support for 1 & 3; choose Model 3.

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	9.8861	2	0.0071
Kodiak-Little	4.6403	2	0.0983
Leslie-Moose	0.9965	2	0.6076
1616-30 (LLCF)	447.3653	2	0.0000
Moose-Nero	236.6976	2	0.0000
Nema-Martine	228.9081	2	0.0000
Slipper-Lac de Gras	125.0522	2	0.0000

- Conclusions:
  All monitored streams except Kodiak-Little and Leslie-Moose show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Lower PDC-vs-Nanuq Outflow	160.1824	3	0.0000
Lower PDC-vs-Counts Outflow	221.9389	3	0.0000
Lower PDC-vs-Vulture-Polar	181.8895	3	0.0000
1616-30 (LLCF)-vs-Nanuq Outflow	98.5851	3	0.0000
1616-30 (LLCF)-vs-Counts Outflow	114.0402	3	0.0000
1616-30 (LLCF)-vs-Vulture-Polar	132.2536	3	0.0000
Moose-Nero-vs-Nanuq Outflow	1897.4571	3	0.0000
Moose-Nero-vs-Counts Outflow	2103.4355	3	0.0000
Moose-Nero-vs-Vulture-Polar	1973.8387	3	0.0000
Nema-Martine-vs-Nanuq Outflow	1562.5851	3	0.0000
Nema-Martine-vs-Counts Outflow	1751.4775	3	0.0000
Nema-Martine-vs-Vulture-Polar	1637.3819	3	0.0000
Slipper-Lac de Gras-vs-Nanuq Outflow	779.6316	3	0.0000
Slipper-Lac de Gras-vs-Counts Outflow	915.7917	3	0.0000
Slipper-Lac de Gras-vs-Vulture-Polar	832.4186	3	0.0000

- Conclusions:
  All remaining monitored streams show significant deviation from the common slope of reference streams.

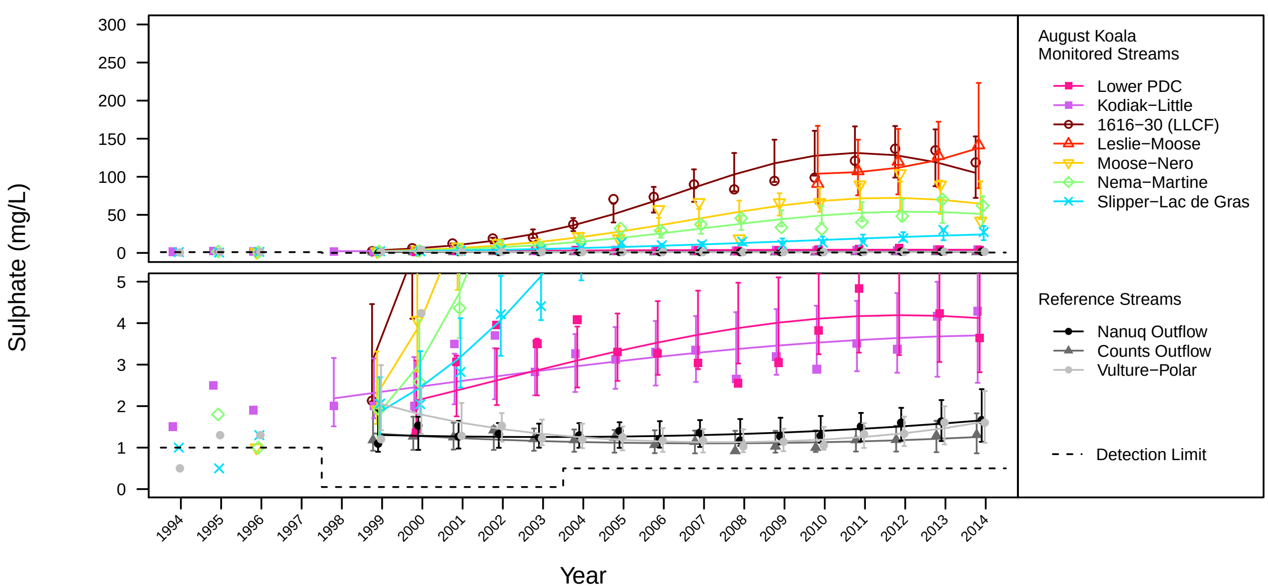
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.3040
Reference Stream	Nanuq Outflow	0.5040
Reference Stream	Vulture-Polar	0.3050
Monitored Stream	1616-30 (LLCF)	0.9740
Monitored Stream	Kodiak-Little	0.5260
Monitored Stream	Leslie-Moose	0.6690
Monitored Stream	Lower PDC	0.3910
Monitored Stream	Moose-Nero	0.8920
Monitored Stream	Nema-Martine	0.9510
Monitored Stream	Slipper-Lac de Gras	0.9290

- Conclusions:
  Model fit for Counts Outflow, Vulture-Polar, and the Lower PDC is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean sulphate for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	3.64E+00	4.12E+00	8.02E-01	2.82E+00	6.04E+00	2.35E+00
Kodiak-Little	4.29E+00	3.70E+00	6.96E-01	2.56E+00	5.35E+00	2.04E+00
Leslie-Moose	1.41E+02	1.38E+02	3.39E+01	8.49E+01	2.23E+02	9.93E+01
1616-30 (LLCF)	1.19E+02	1.05E+02	2.01E+01	7.23E+01	1.53E+02	5.89E+01
Moose-Nero	4.22E+01	6.46E+01	1.24E+01	4.44E+01	9.40E+01	3.62E+01
Nema-Martine	6.18E+01	5.11E+01	9.77E+00	3.51E+01	7.43E+01	2.86E+01
Slipper-Lac de Gras	2.74E+01	2.43E+01	4.64E+00	1.67E+01	3.53E+01	1.36E+01
Nanuq Outflow	1.66E+00	1.66E+00	3.17E-01	1.14E+00	2.41E+00	
Counts Outflow	1.31E+00	1.25E+00	2.40E-01	8.62E-01	1.83E+00	
Vulture-Polar	1.60E+00	1.62E+00	3.11E-01	1.12E+00	2.36E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Sulphate	August	Koala	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	hardness-dependent	Lower PDC 1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

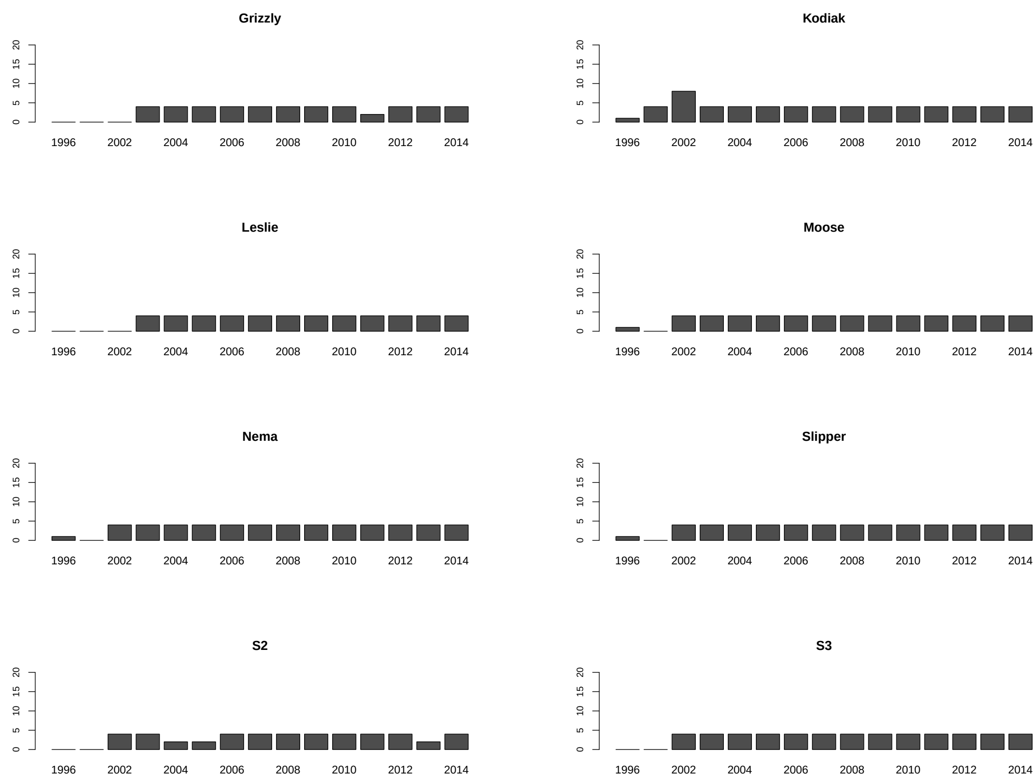
Analysis of April Potassium in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

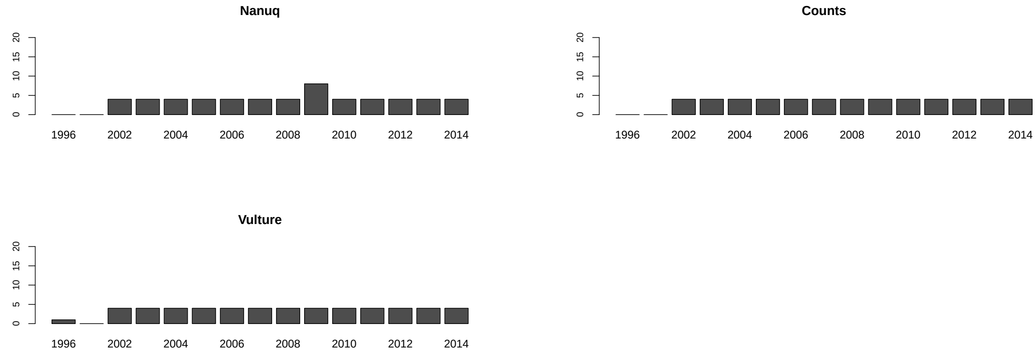
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

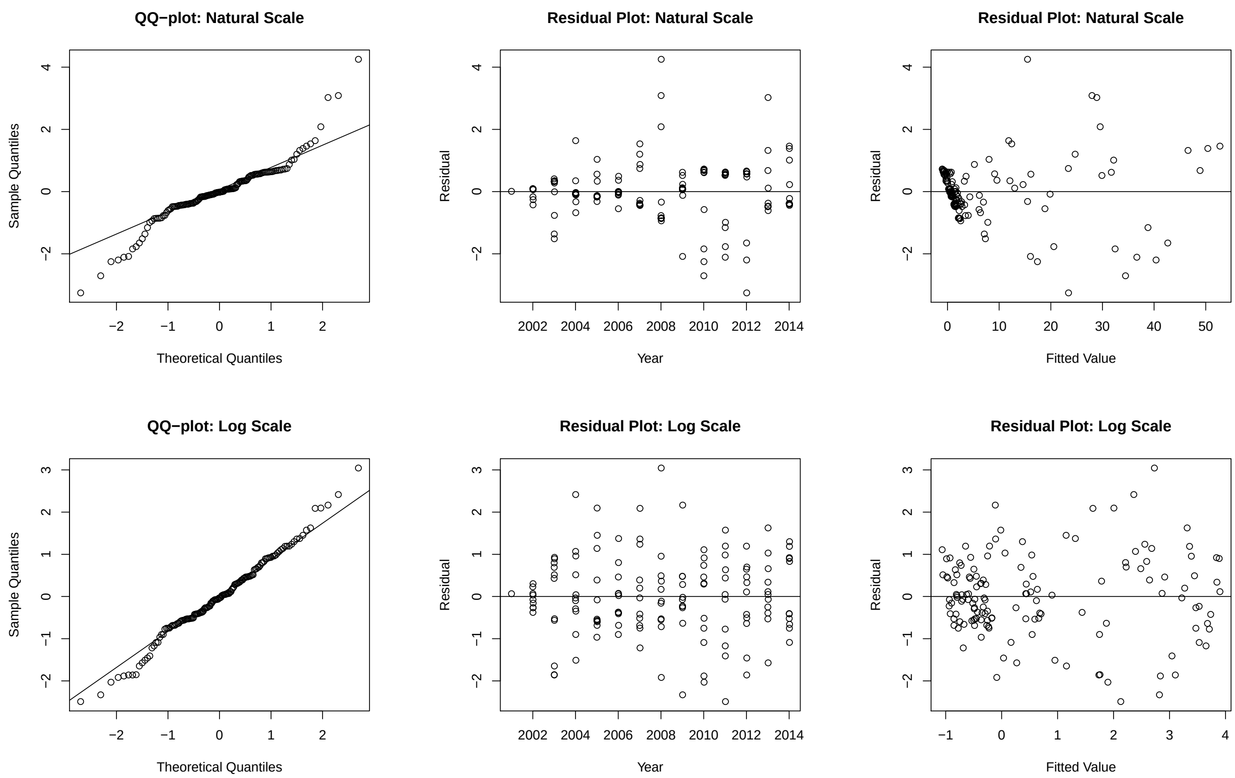


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	34.10	27.98	3.09
162	Nema	2008	23.93	15.49	4.25
166	Nema	2012	16.98	23.43	-3.26
167	Nema	2013	34.90	28.90	3.02

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	23.93	2.73	3.05

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.87E-160	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
4.06	6.00	0.67

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

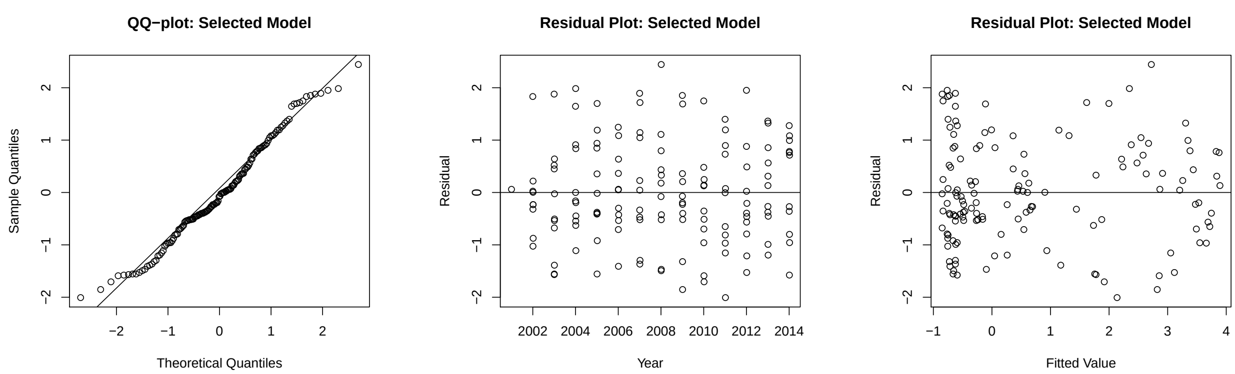
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope and intercept. Proceeding with monitored contrasts using reference model 3 (fitting a common slope and intercept for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.3 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
Kodiak	9.46	3.00	0.02
Leslie	86.28	3.00	0.00
Moose	88.87	3.00	0.00
Nema	85.42	3.00	0.00
Slipper	71.10	3.00	0.00
S2	4.31	3.00	0.23
S3	7.47	3.00	0.06

- Conclusions:
  All monitored lakes except Grizzly, S2, and S3 show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Kodiak	0.17	2.00	0.92
Leslie	65.13	2.00	0.00
Moose	80.15	2.00	0.00
Nema	80.39	2.00	0.00
Slipper	68.69	2.00	0.00
S2	2.32	2.00	0.31
S3	6.67	2.00	0.04

- Conclusions:
  When allowing for differences in intercept, Leslie, Moose, Nema, and Slipper lakes show significant deviation from the common slope of reference lakes.

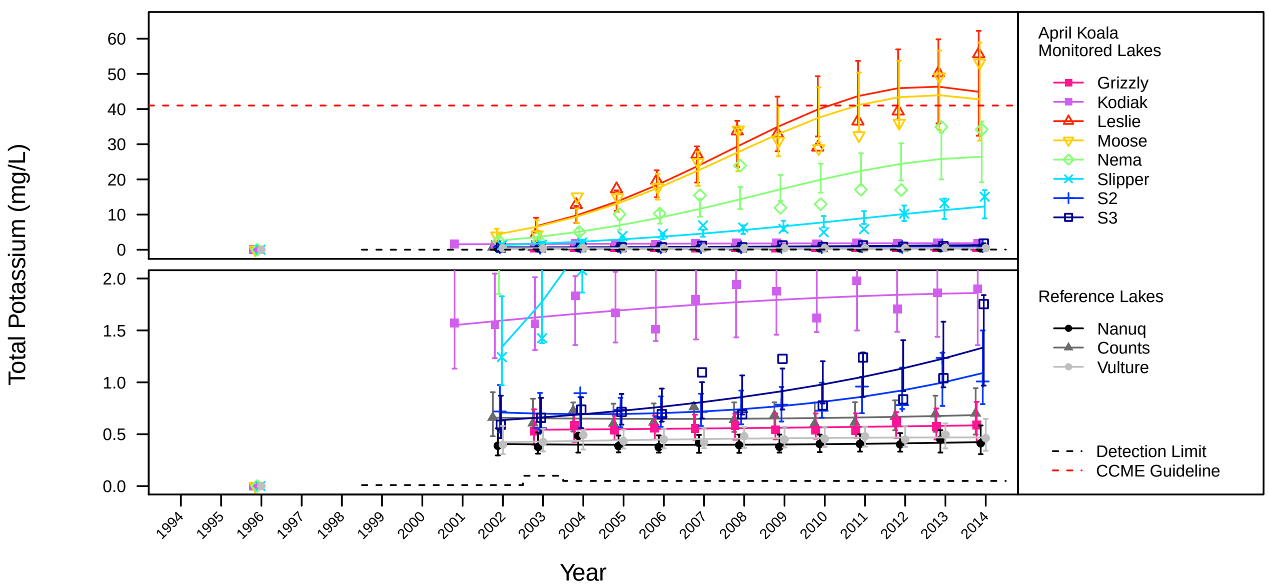
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0090
Monitored Lake	Grizzly	0.2280
Monitored Lake	Kodiak	0.4160
Monitored Lake	Leslie	0.8980
Monitored Lake	Moose	0.9150
Monitored Lake	Nema	0.8490
Monitored Lake	S2	0.5500
Monitored Lake	S3	0.5760
Monitored Lake	Slipper	0.8840

- Conclusions:
  Model fit for Grizzly and Kodiak Lake is weak. Model fit for pooled reference lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean potassium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	5.89E-01	5.85E-01	9.74E-02	4.23E-01	8.11E-01	2.85E-01
Kodiak	1.90E+00	1.86E+00	2.99E-01	1.36E+00	2.55E+00	8.74E-01
Leslie	5.56E+01	4.49E+01	7.47E+00	3.24E+01	6.22E+01	2.19E+01
Moose	5.31E+01	4.28E+01	7.00E+00	3.10E+01	5.89E+01	2.05E+01
Nema	3.42E+01	2.64E+01	4.33E+00	1.92E+01	3.64E+01	1.27E+01
Slipper	1.51E+01	1.23E+01	2.01E+00	8.92E+00	1.69E+01	5.89E+00
S2	1.01E+00	1.09E+00	1.78E-01	7.90E-01	1.50E+00	5.21E-01
S3	1.75E+00	1.33E+00	2.18E-01	9.69E-01	1.84E+00	6.39E-01
Nanuq	4.13E-01	4.24E-01	6.94E-02	3.08E-01	5.84E-01	
Counts	7.01E-01	6.85E-01	1.12E-01	4.97E-01	9.43E-01	
Vulture	4.63E-01	4.69E-01	7.68E-02	3.41E-01	6.47E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Potassium	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	41	Kodiak Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

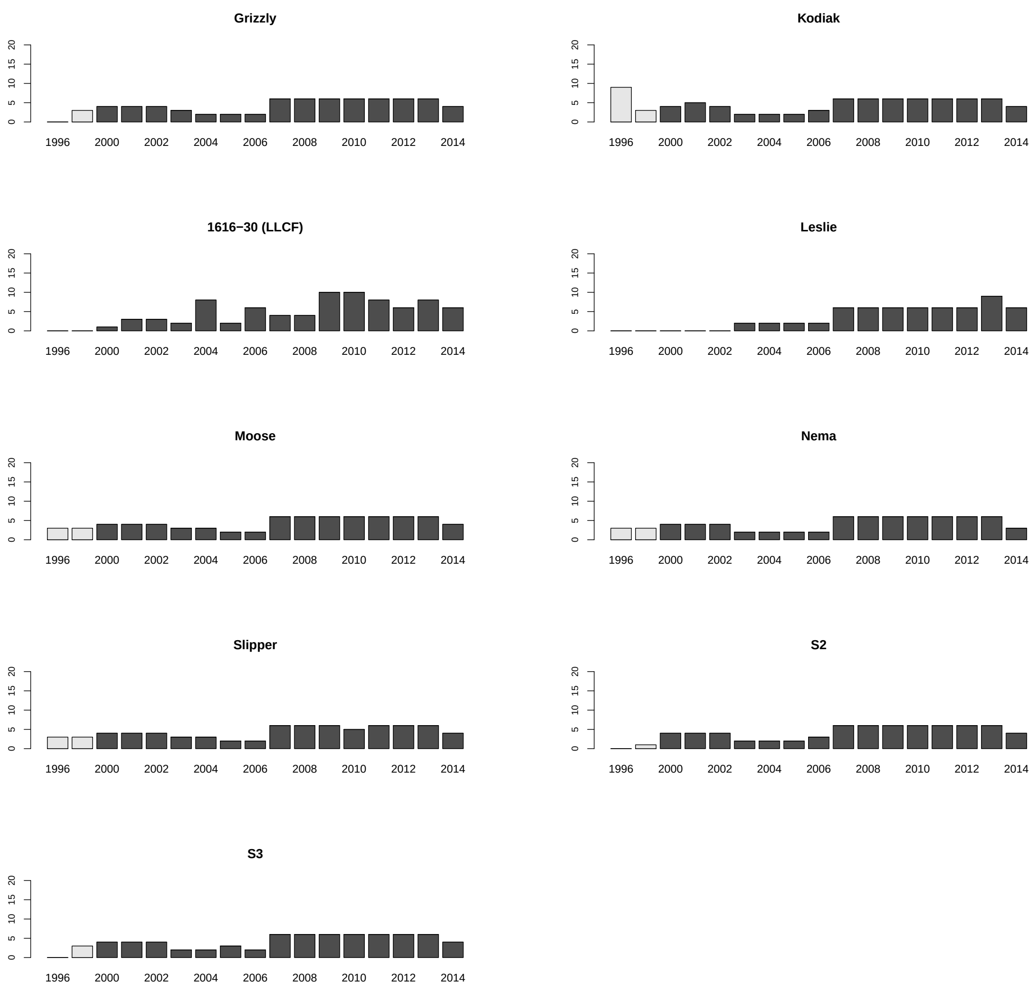
Analysis of August Potassium in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

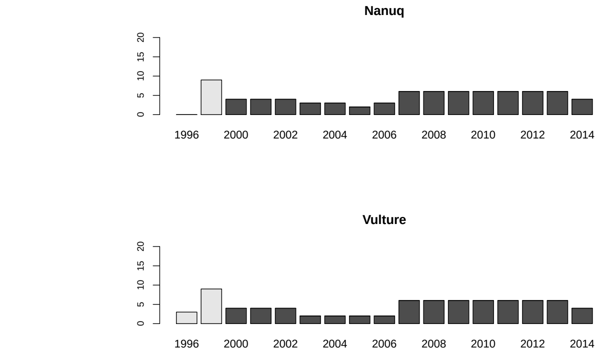
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

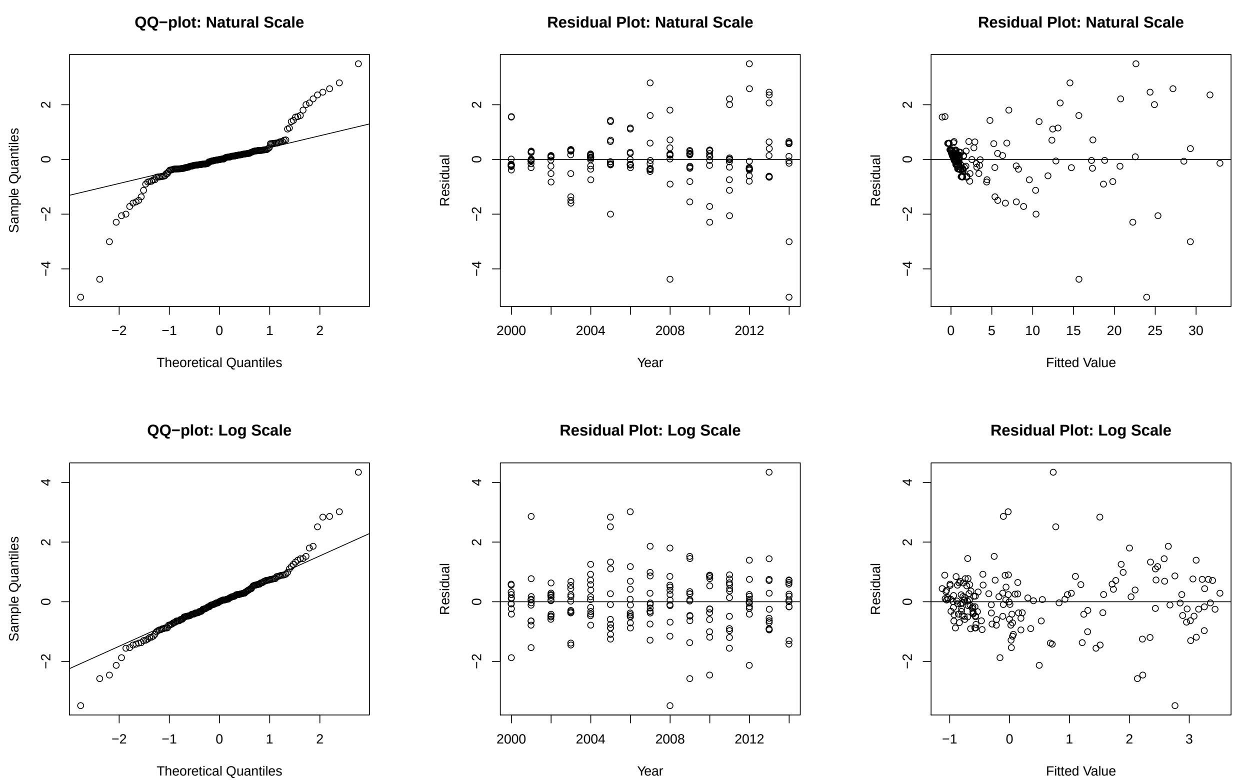


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
21	1616-30 (LLCF)	2014	25.25	29.30	-3.01
120	Moose	2008	9.77	15.67	-4.38
124	Moose	2012	27.35	22.64	3.50
126	Moose	2014	17.18	23.96	-5.04

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	9.77	2.76	-3.48
181	S2	2006	1.49	-0.02	3.02
188	S2	2013	3.79	0.73	4.34

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
46.71	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
1.12	4.00	0.89

- Conclusions:
  The slopes do not differ significantly among reference lakes.

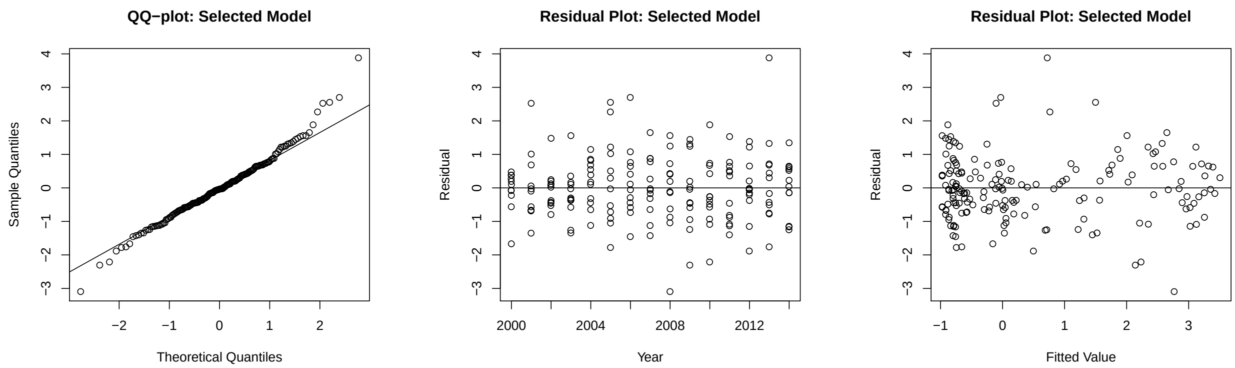
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	9.77	2.77	-3.09
188	S2	2013	3.79	0.72	3.88

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.0033	2	0.9983
Kodiak	0.0946	2	0.9538
1616-30 (LLCF)	109.1792	2	0.0000
Leslie	119.2606	2	0.0000
Moose	405.9764	2	0.0000
Nema	343.2025	2	0.0000
Slipper	183.2027	2	0.0000
S2	74.3913	2	0.0000
S3	26.8932	2	0.0000

- Conclusions:
  All monitored lakes except Grizzly and Kodiak show significant deviation from the common slope of reference lakes.

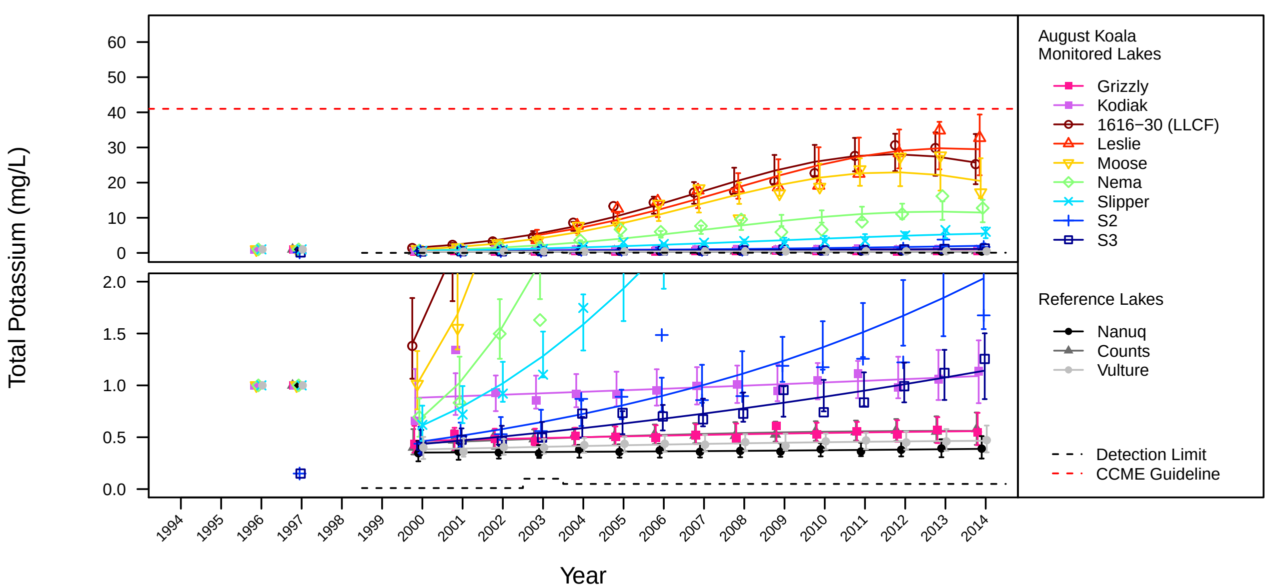
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1300
Monitored Lake	1616-30 (LLCF)	0.9860
Monitored Lake	Grizzly	0.5050
Monitored Lake	Kodiak	0.1920
Monitored Lake	Leslie	0.9080
Monitored Lake	Moose	0.9570
Monitored Lake	Nema	0.9250
Monitored Lake	S2	0.7410
Monitored Lake	S3	0.8820
Monitored Lake	Slipper	0.9300

- Conclusions:
  Model fit for pooled reference lakes and Kodiak Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean potassium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	5.49E-01	5.59E-01	7.82E-02	4.25E-01	7.35E-01	2.29E-01
Kodiak	1.14E+00	1.09E+00	1.53E-01	8.28E-01	1.43E+00	4.46E-01
Leslie	3.27E+01	2.95E+01	4.35E+00	2.21E+01	3.94E+01	1.27E+01
1616-30 (LLCF)	2.52E+01	2.57E+01	3.60E+00	1.95E+01	3.38E+01	1.05E+01
Moose	1.72E+01	2.05E+01	2.86E+00	1.56E+01	2.69E+01	8.38E+00
Nema	1.28E+01	1.15E+01	1.61E+00	8.72E+00	1.51E+01	4.70E+00
Slipper	6.02E+00	5.51E+00	7.72E-01	4.19E+00	7.25E+00	2.26E+00
S2	1.67E+00	2.03E+00	2.84E-01	1.54E+00	2.67E+00	8.31E-01
S3	1.25E+00	1.14E+00	1.60E-01	8.68E-01	1.50E+00	4.67E-01
Nanuq	3.90E-01	3.88E-01	5.43E-02	2.95E-01	5.10E-01	
Counts	5.79E-01	5.62E-01	7.86E-02	4.27E-01	7.39E-01	
Vulture	4.72E-01	4.66E-01	6.52E-02	3.54E-01	6.13E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Potassium	August	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	41	1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

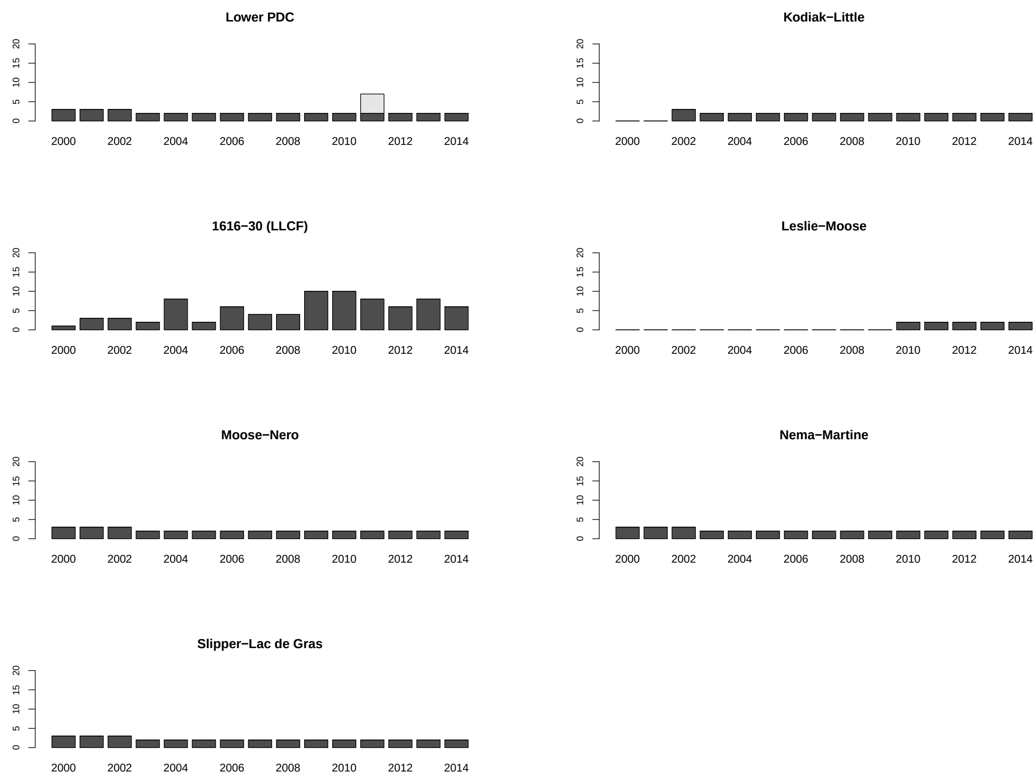
Analysis of August Potassium in Koala Watershed Streams

November 10, 2014

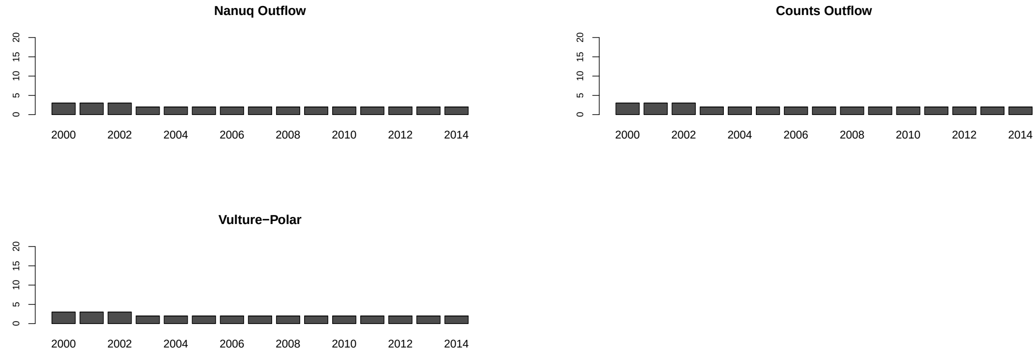
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

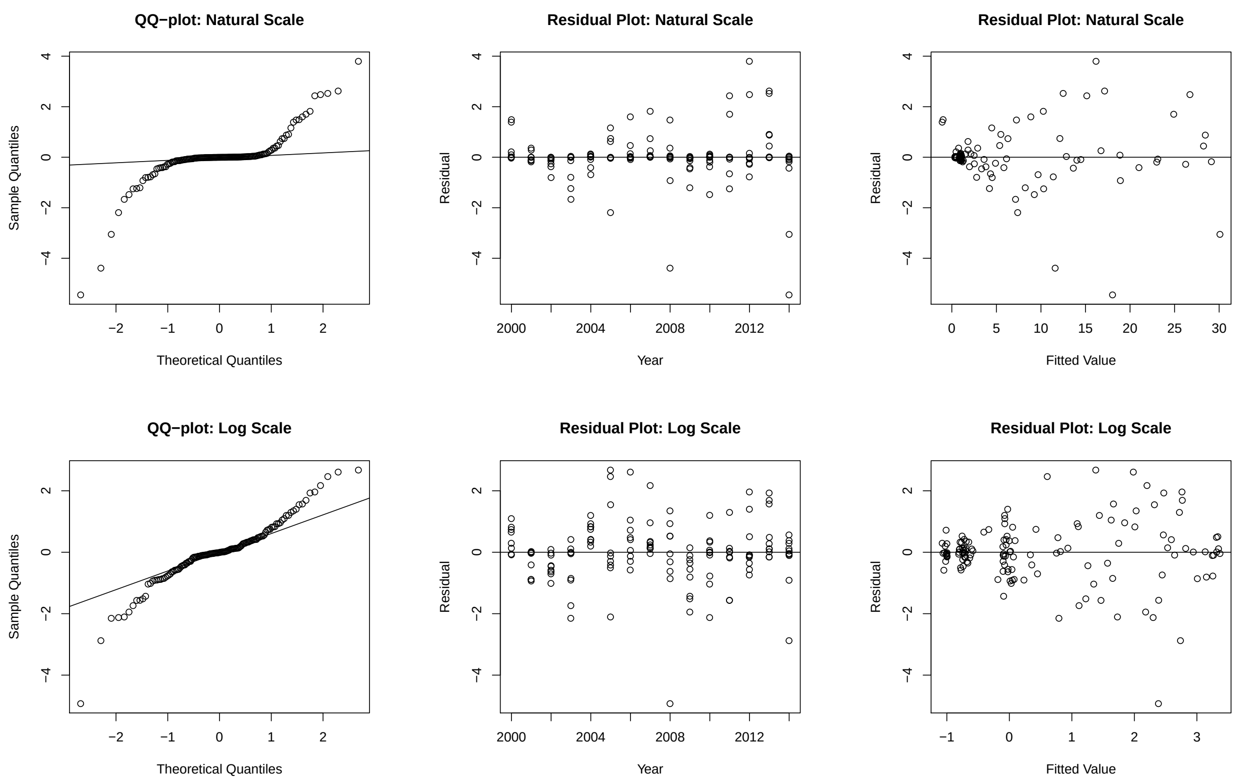


1.2 Reference



Comment:
10-60% of data in the Lower PDC was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
21	1616-30 (LLCF)	2014	25.25	30.09	-3.05
120	Moose-Nero	2008	4.64	11.60	-4.39
124	Moose-Nero	2012	22.20	16.18	3.80
126	Moose-Nero	2014	9.40	18.03	-5.45

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	4.64	2.38	-4.93

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted values. AIC reveals that the data is modeled best after log transformation. Porceeding with analysis using the log-transformed model. Results should be interpreted wtih caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
31.74	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
0.33	4.00	0.99

- Conclusions:
  The slopes do not differ significantly among reference streams.

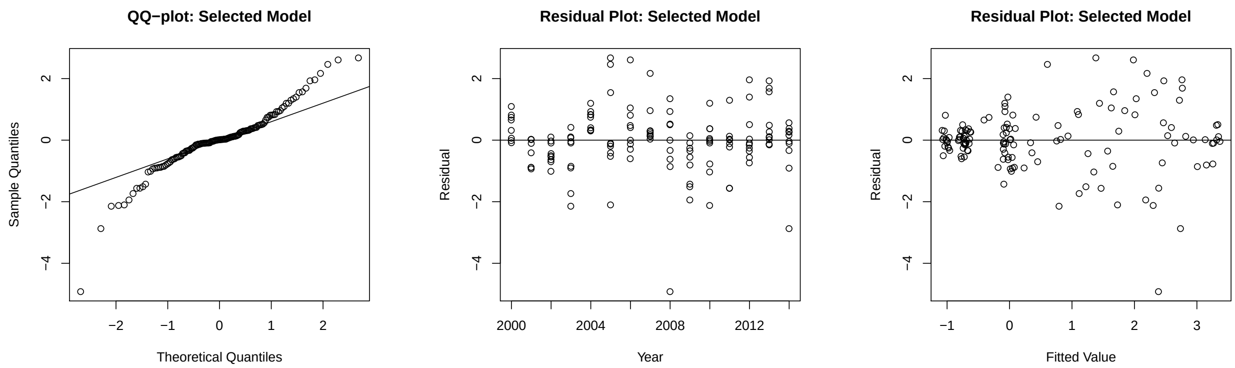
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.021	0.979	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	4.64	2.38	-4.92

Conclusion:
The reduced model shows dependence on year. Results should be interpreted wtih caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
Lower PDC	1.5273	2	0.4660
Kodiak-Little	0.2851	2	0.8672
Leslie-Moose	3.3163	2	0.1905
1616-30 (LLCF)	325.4542	2	0.0000
Moose-Nero	292.5133	2	0.0000
Nema-Martine	282.7629	2	0.0000
Slipper-Lac de Gras	152.1246	2	0.0000

- Conclusions:
  All monitored streams except the Lower PDC, Kodiak-Little, and Leslie-Moose show significant deviation from the common slope of reference streams.

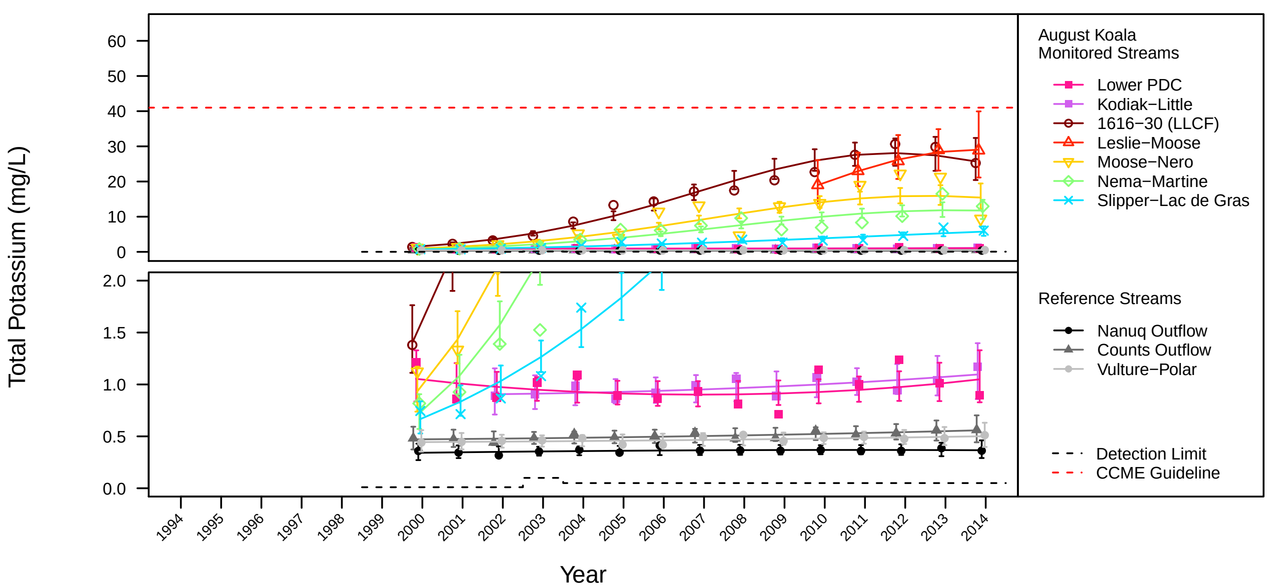
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.9000
Monitored Stream	1616-30 (LLCF)	0.9860
Monitored Stream	Kodiak-Little	0.4960
Monitored Stream	Leslie-Moose	0.9940
Monitored Stream	Lower PDC	0.1220
Monitored Stream	Moose-Nero	0.8710
Monitored Stream	Nema-Martine	0.9240
Monitored Stream	Slipper-Lac de Gras	0.9220

- Conclusions:
  Model fit for Kodiak-Little is weak. Model fit for the Lower PDC is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean potassium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	8.97E-01	1.05E+00	1.27E-01	8.28E-01	1.33E+00	3.70E-01
Kodiak-Little	1.17E+00	1.10E+00	1.36E-01	8.59E-01	1.40E+00	3.98E-01
Leslie-Moose	2.89E+01	2.91E+01	4.72E+00	2.11E+01	3.99E+01	1.38E+01
1616-30 (LLCF)	2.52E+01	2.57E+01	3.02E+00	2.04E+01	3.24E+01	8.85E+00
Moose-Nero	9.40E+00	1.54E+01	1.82E+00	1.23E+01	1.94E+01	5.31E+00
Nema-Martine	1.29E+01	1.17E+01	1.38E+00	9.33E+00	1.48E+01	4.04E+00
Slipper-Lac de Gras	6.04E+00	5.75E+00	6.76E-01	4.56E+00	7.24E+00	1.98E+00
Nanuq Outflow	3.62E-01	3.66E-01	4.31E-02	2.91E-01	4.62E-01	
Counts Outflow	5.62E-01	5.58E-01	6.56E-02	4.43E-01	7.02E-01	
Vulture-Polar	5.12E-01	5.01E-01	5.89E-02	3.98E-01	6.31E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Potassium	August	Koala	Stream	Water	none	log e	Tobit regression	#2 shared slopes	41	1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

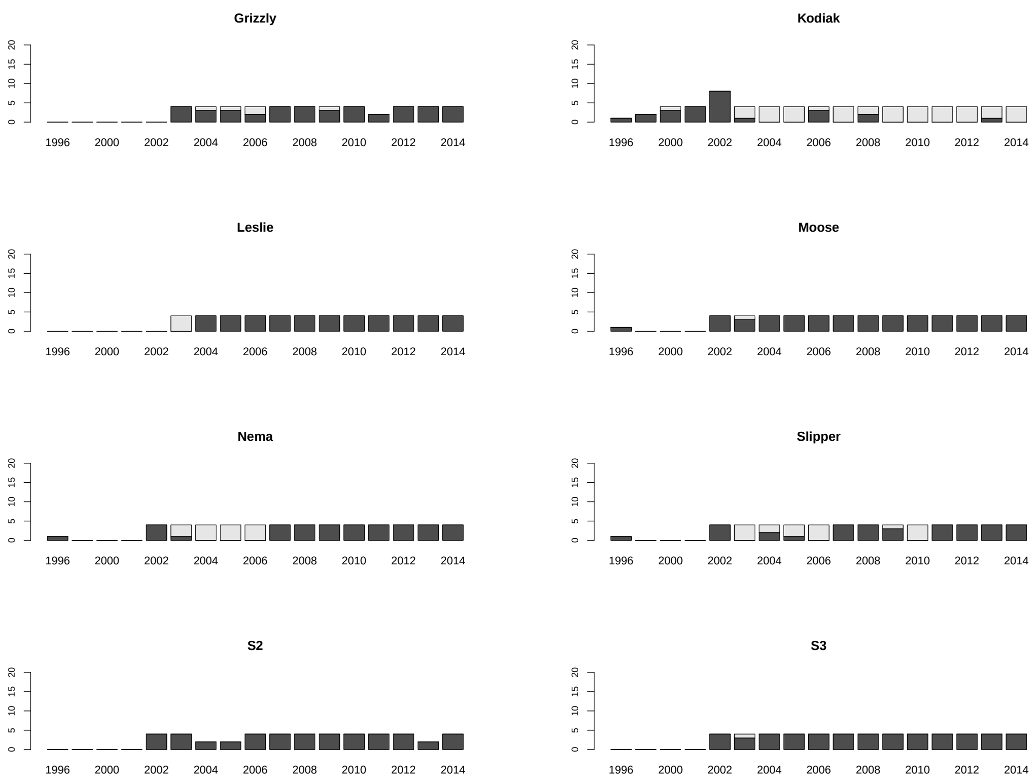
Analysis of April Total Ammonia-N in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

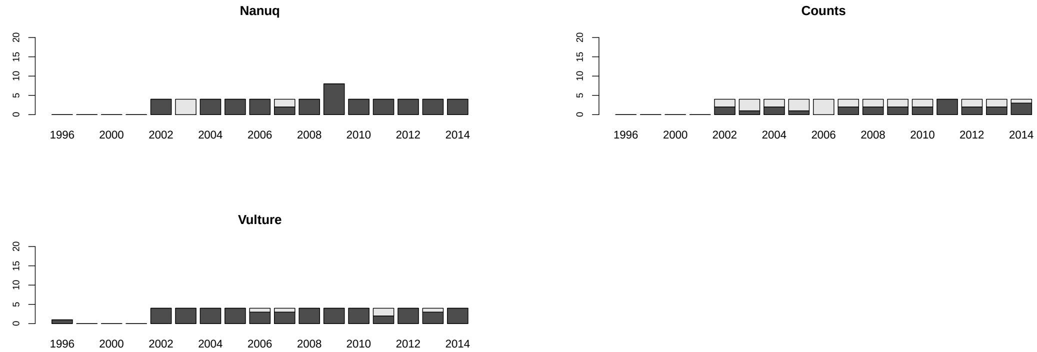
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

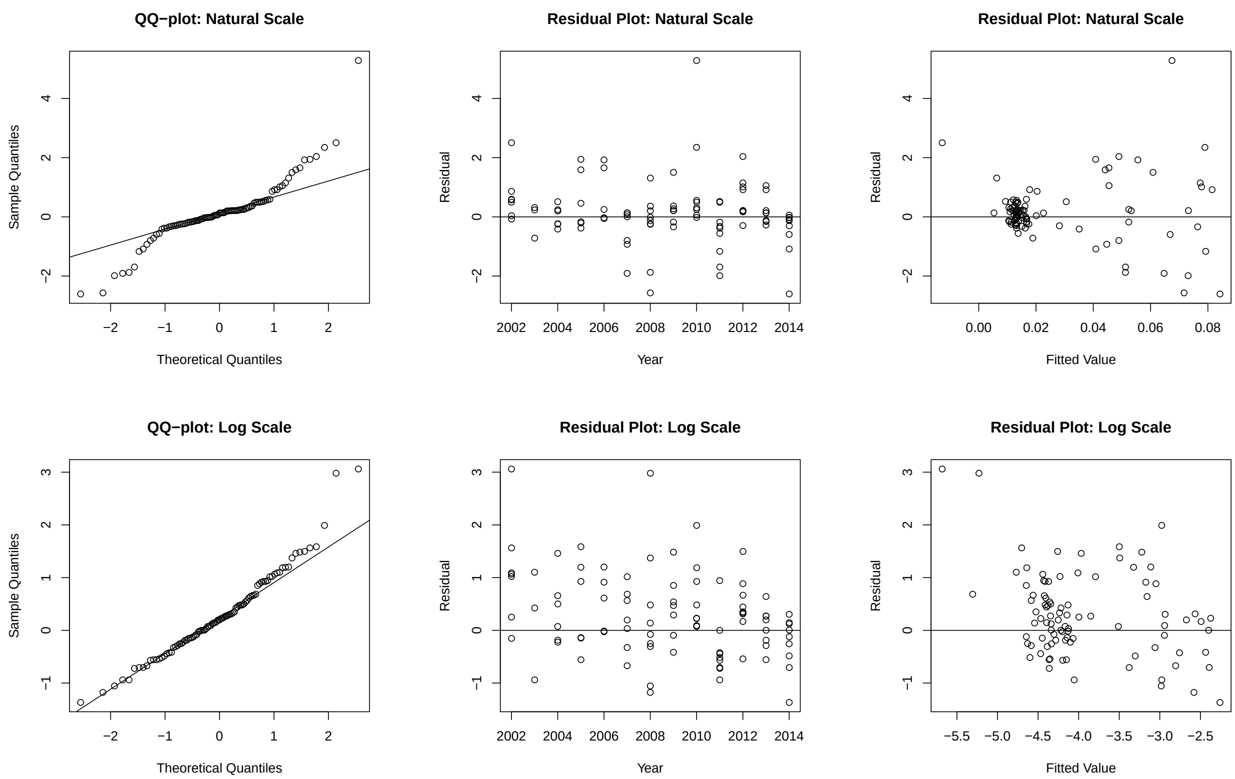


1.2 Reference



Comment:
Greater than 60% of data in Kodiak Lake was less than the detection limit. This lake was excluded from further analyses. 10-60% of data in Counts, Nanuq, Grizzly, Nema, and Slipper lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
164	Nema	2010	0.12	0.07	5.28

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
156	Nema	2002	0.01	-5.68	3.06

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	4.18E-118	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
154595.37	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
154696.01	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.918	0.082	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	1.0169	2	0.6014
Leslie	25.3867	2	0.0000
Moose	6.4361	2	0.0400
Nema	70.9795	2	0.0000
Slipper	20.9403	2	0.0000
S2	2.6749	2	0.2625
S3	0.2686	2	0.8743

- Conclusions:
  Leslie, Moose, Nema, and Slipper lakes show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Leslie-vs-Nanuq	73.7867	3	0.0000
Leslie-vs-Counts	47202.1849	3	0.0000
Leslie-vs-Vulture	85.6788	3	0.0000
Moose-vs-Nanuq	46.6923	3	0.0000
Moose-vs-Counts	78217.4867	3	0.0000
Moose-vs-Vulture	54.8650	3	0.0000
Nema-vs-Nanuq	53.6882	3	0.0000
Nema-vs-Counts	76395.8496	3	0.0000
Nema-vs-Vulture	65.6241	3	0.0000
Slipper-vs-Nanuq	13.5421	3	0.0036
Slipper-vs-Counts	76034.5405	3	0.0000
Slipper-vs-Vulture	12.2343	3	0.0066

- Conclusions:
  Leslie, Moose, Nema, and Slipper lakes show significant deviation from the slopes of individual reference lakes.

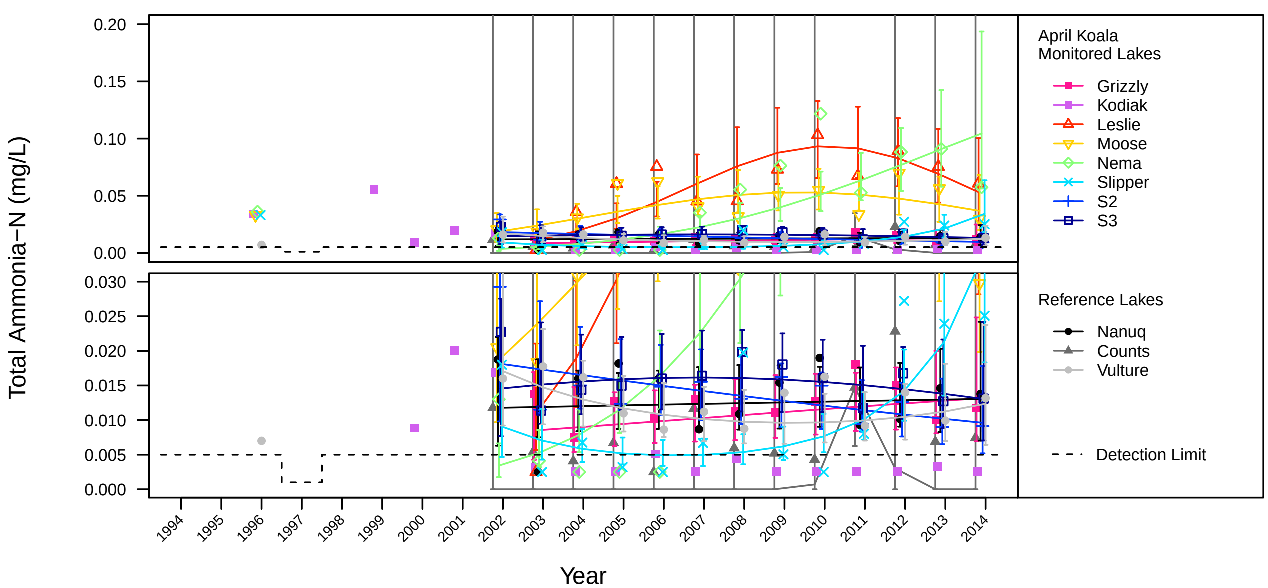
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.5000
Reference Lake	Nanuq	0.0070
Reference Lake	Vulture	0.4070
Monitored Lake	Grizzly	0.3410
Monitored Lake	Leslie	0.5740
Monitored Lake	Moose	0.5220
Monitored Lake	Nema	0.5790
Monitored Lake	S2	0.4390
Monitored Lake	S3	0.1110
Monitored Lake	Slipper	0.4290

- Conclusions:
  Model fit for Vulture Lake, Grizzly Lake, Slipper Lake and site S2 is weak. Model fit for Nanuq Lake and site S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total ammonia-N for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	1.17e-02	1.31e-02	4.27e-03	6.92e-03	2.48e-02	1.25e-02
Leslie	6.07e-02	5.32e-02	1.72e-02	2.82e-02	1.00e-01	5.04e-02
Moose	2.97e-02	3.68e-02	1.16e-02	1.99e-02	6.81e-02	3.38e-02
Nema	5.75e-02	1.04e-01	3.29e-02	5.63e-02	1.94e-01	9.63e-02
Slipper	2.51e-02	3.41e-02	1.08e-02	1.83e-02	6.35e-02	3.16e-02
S2	9.13e-03	9.61e-03	3.02e-03	5.19e-03	1.78e-02	8.84e-03
S3	1.31e-02	1.31e-02	4.11e-03	7.05e-03	2.42e-02	1.20e-02
Nanuq	1.38e-02	1.30e-02	4.11e-03	7.04e-03	2.42e-02	NA
Counts	7.45e-03	1.17e-10	2.37e-08	3.69e-182	3.74e+161	NA
Vulture	1.32e-02	1.23e-02	4.12e-03	6.42e-03	2.37e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
AmmoniaN	April	Koala	Lake	Water	Kodiak	log e	Tobit regression	#1b separate intercepts & slopes	pH- and temperature-dependent	Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

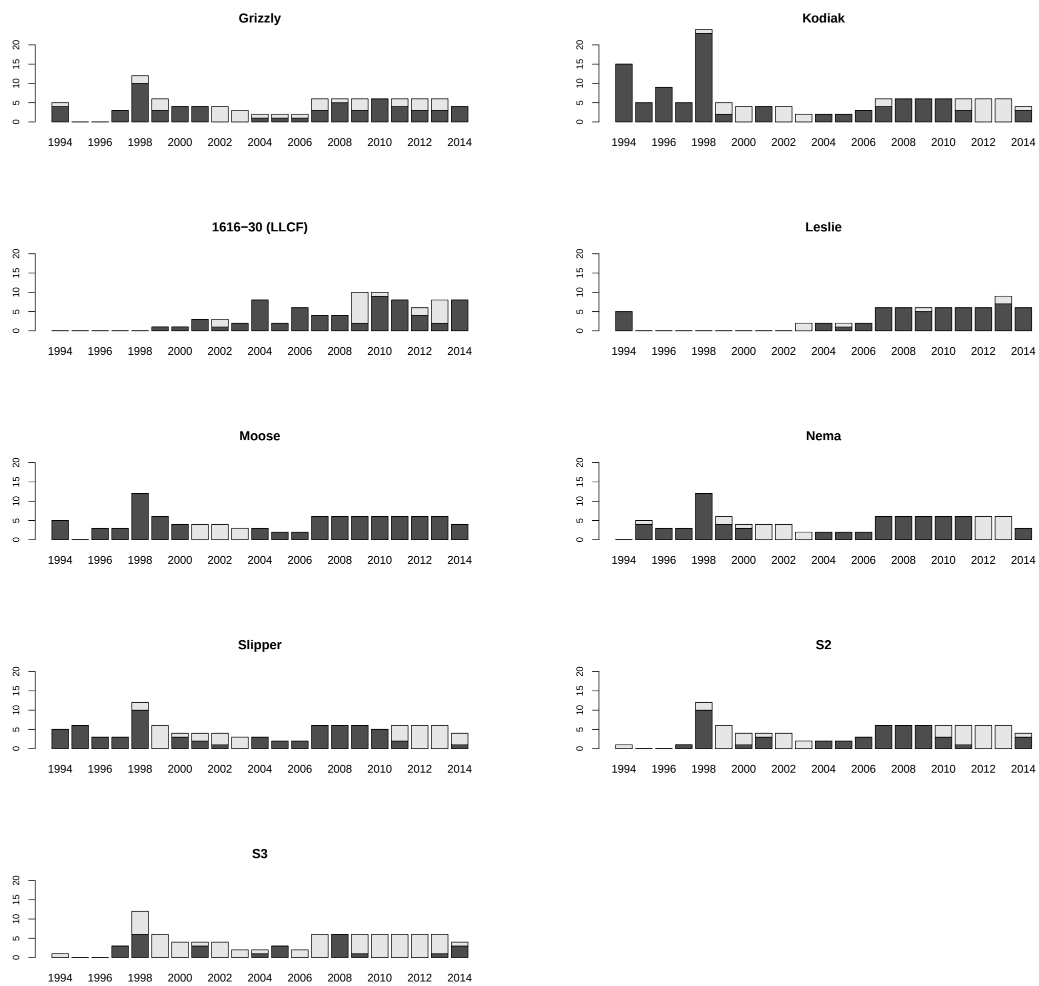
Analysis of August Total Ammonia-N in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

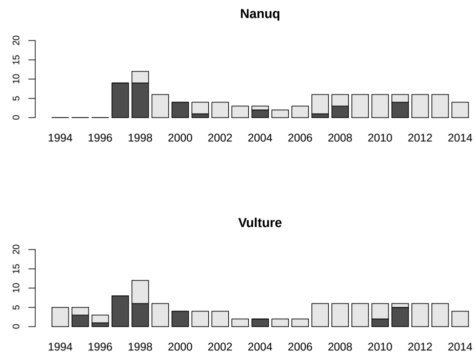
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

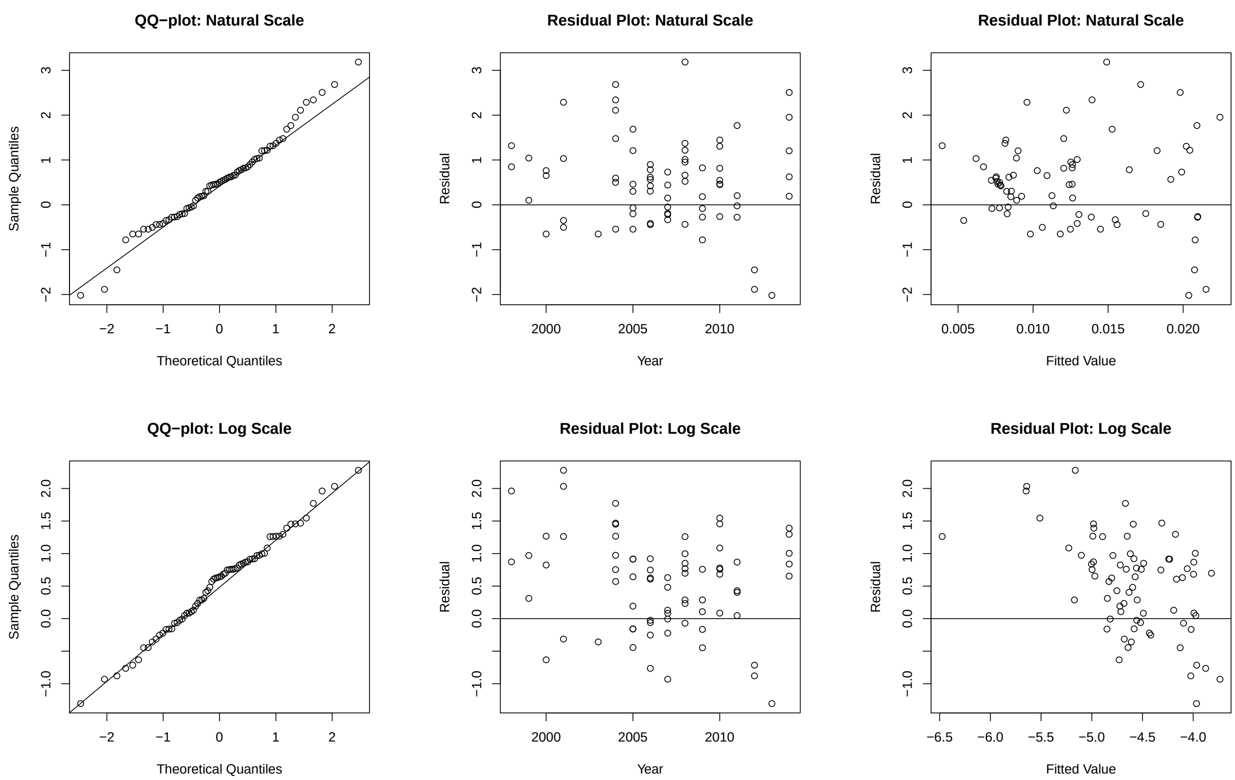


1.2 Reference



Comment:
Greater than 60% of data in Nanuq, Vulture, and S3 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Counts, 1616-30 (LLCF), Grizzly, Kodiak, Moose, Nema, Slipper, and S2 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
225	Slipper	2008	0.03	0.01	3.18

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

Two of three reference lakes were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	0.8271	2	0.6613
Kodiak	2.0997	2	0.3500
1616-30 (LLCF)	0.7173	2	0.6986
Leslie	3.4089	2	0.1819
Moose	9.8600	2	0.0072
Nema	3.4418	2	0.1789
Slipper	11.3823	2	0.0034
S2	1.2243	2	0.5422

- Conclusions:
  Moose and Slipper lakes show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Moose-vs-Counts	30.6026	3	0.0000
Slipper-vs-Counts	5.7902	3	0.1223

- Conclusions:
  Moose Lake shows significant deviation from the slope of the reference lake.

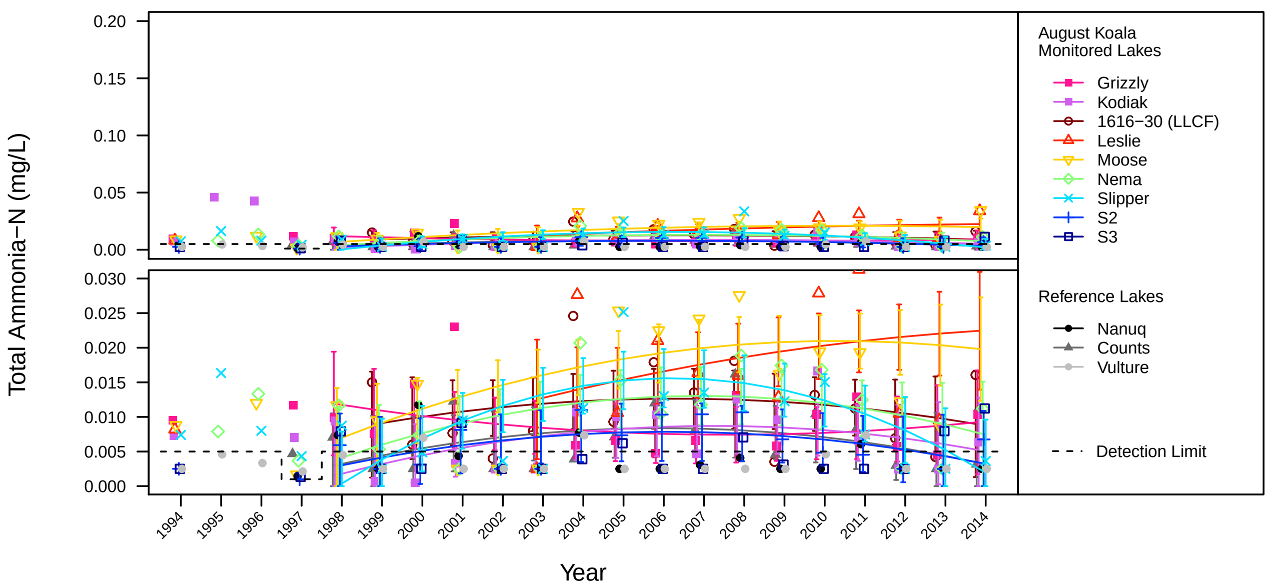
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.1770
Monitored Lake	1616-30 (LLCF)	0.0450
Monitored Lake	Grizzly	0.0670
Monitored Lake	Kodiak	0.2070
Monitored Lake	Leslie	0.1110
Monitored Lake	Moose	0.2080
Monitored Lake	Nema	0.1840
Monitored Lake	S2	0.2590
Monitored Lake	Slipper	0.3370

- Conclusions:
  Model fit for Kodiak, Moose, Slipper, and S2 is weak. Model fit for Counts, 1616-30 (LLCF), Grizzly, Leslie, and Nema is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total ammonia-N for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	1.03e-02	9.23e-03	3.83e-03	1.73e-03	1.67e-02	1.12e-02
Kodiak	6.38e-03	5.22e-03	3.86e-03	0.00e+00	1.28e-02	1.13e-02
Leslie	3.39e-02	2.24e-02	4.34e-03	1.39e-02	3.10e-02	1.27e-02
1616-30 (LLCF)	1.61e-02	9.00e-03	3.92e-03	1.32e-03	1.67e-02	1.15e-02
Moose	3.45e-02	1.98e-02	3.81e-03	1.23e-02	2.73e-02	1.12e-02
Nema	1.12e-02	7.55e-03	3.85e-03	0.00e+00	1.51e-02	1.13e-02
Slipper	3.62e-03	1.99e-03	3.89e-03	0.00e+00	9.61e-03	1.14e-02
S2	6.75e-03	3.29e-03	3.87e-03	0.00e+00	1.09e-02	1.13e-02
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	3.15e-03	3.45e-03	3.88e-03	0.00e+00	1.11e-02	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
AmmoniaN	August	Koala	Lake	Water	Nanuq Vulture S3	none	Tobit regression	#1b separate intercepts & slopes	pH- and temperature-dependent	Moose

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

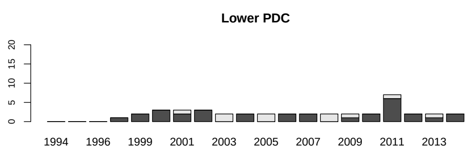
Analysis of August Total Ammonia-N in Koala Watershed Streams

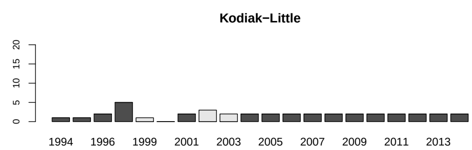
November 10, 2014

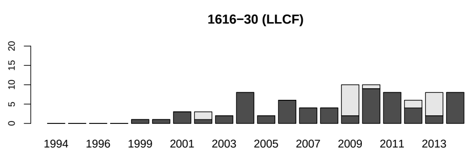
1 Censored Values:

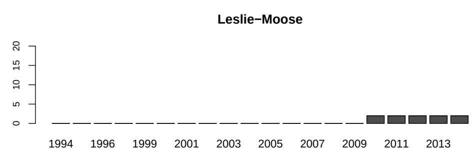
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

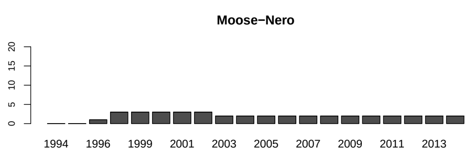
1.1 Monitored

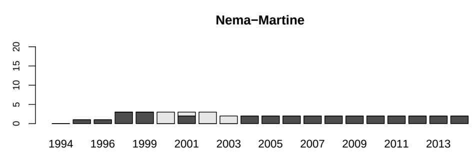


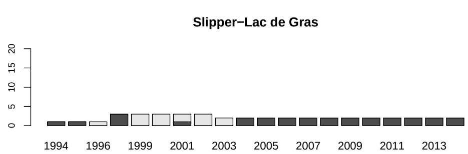




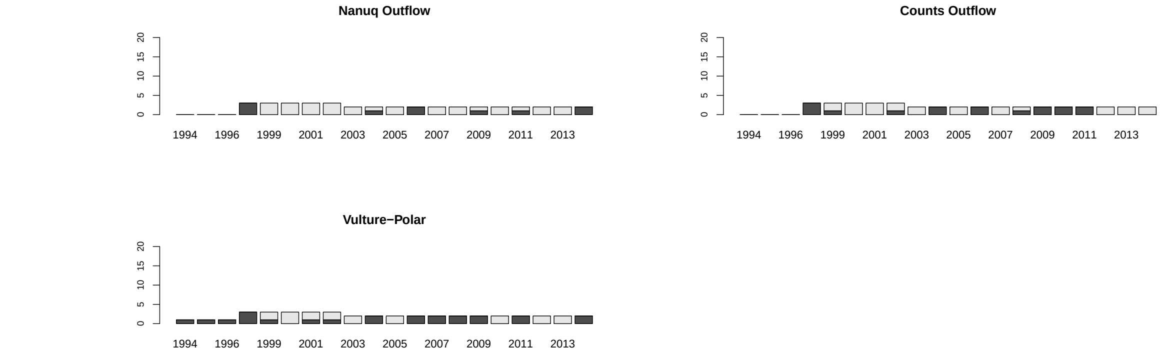






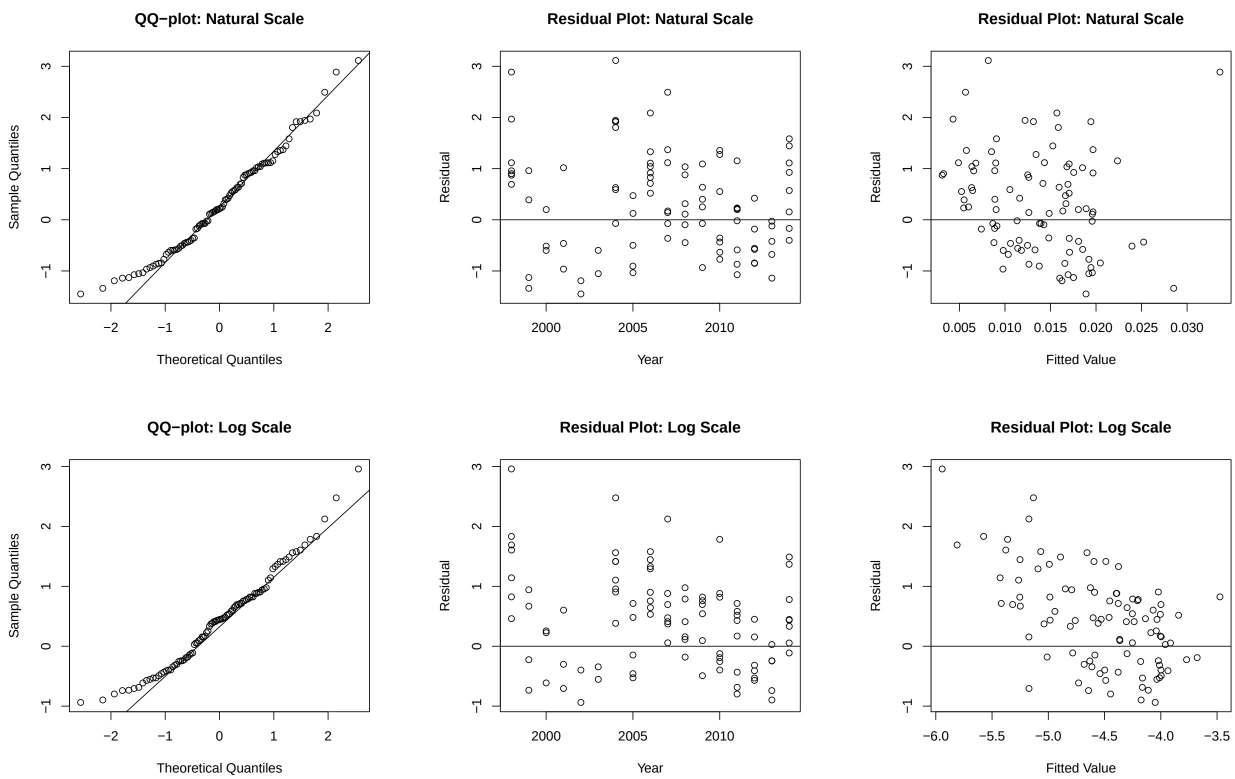


1.2 Reference



Comment:
Greater than 60% of data in Nanuq Outflow was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Counts Outflow, Vulture-Polar, 1616-30 (LLCF), Kodiak-Little, Lower PDC, Nema-Martine, and Slipper-Lac de Gras was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
200	Vulture-Polar	2004	0.03	0.01	3.11

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. AIC reveals that the data is modeled best without transformation. Proceeding with analysis using the natural, untransformed model. Results should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
1.55	3.00	0.67

- Conclusions:
  The slopes and intercepts do not differ significantly among reference streams.

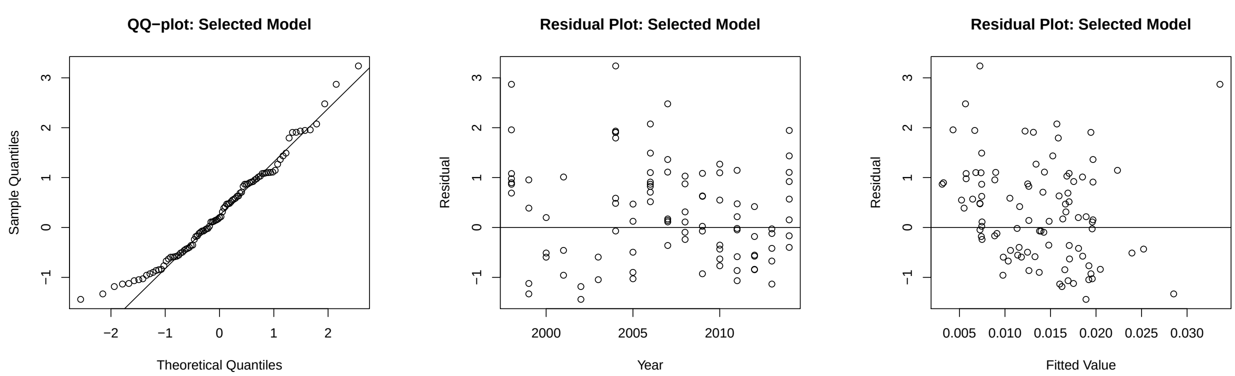
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.079	0.192	0.730	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
200	Vulture-Polar	2004	0.03	0.01	3.24

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the slope and intercept of each monitored stream compared to a common slope and intercept fitted for all reference streams together (reference model 3).

- Results:

	Chi-squared	DF	P-value
Lower PDC	31.4217	3	0.0000
Kodiak-Little	6.6820	3	0.0828
Leslie-Moose	1.7231	3	0.6318
1616-30 (LLCF)	4.7060	3	0.1946
Moose-Nero	37.9888	3	0.0000
Nema-Martine	14.8289	3	0.0020
Slipper-Lac de Gras	11.9895	3	0.0074

- Conclusions:
  The Lower PDC, Moose-Nero, Nema-Martine, and Slipper-Lac de Gras show significant deviation from the common slope and intercept of reference streams.

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
Lower PDC	22.4035	2	0.0000
Kodiak-Little	1.4942	2	0.4737
Leslie-Moose	0.4185	2	0.8112
1616-30 (LLCF)	0.2206	2	0.8956
Moose-Nero	0.0464	2	0.9771
Nema-Martine	3.9581	2	0.1382
Slipper-Lac de Gras	3.8429	2	0.1464

- Conclusions:
  When allowing for differences in intercept, the Lower PDC shows significant deviation from the common slope of reference streams.

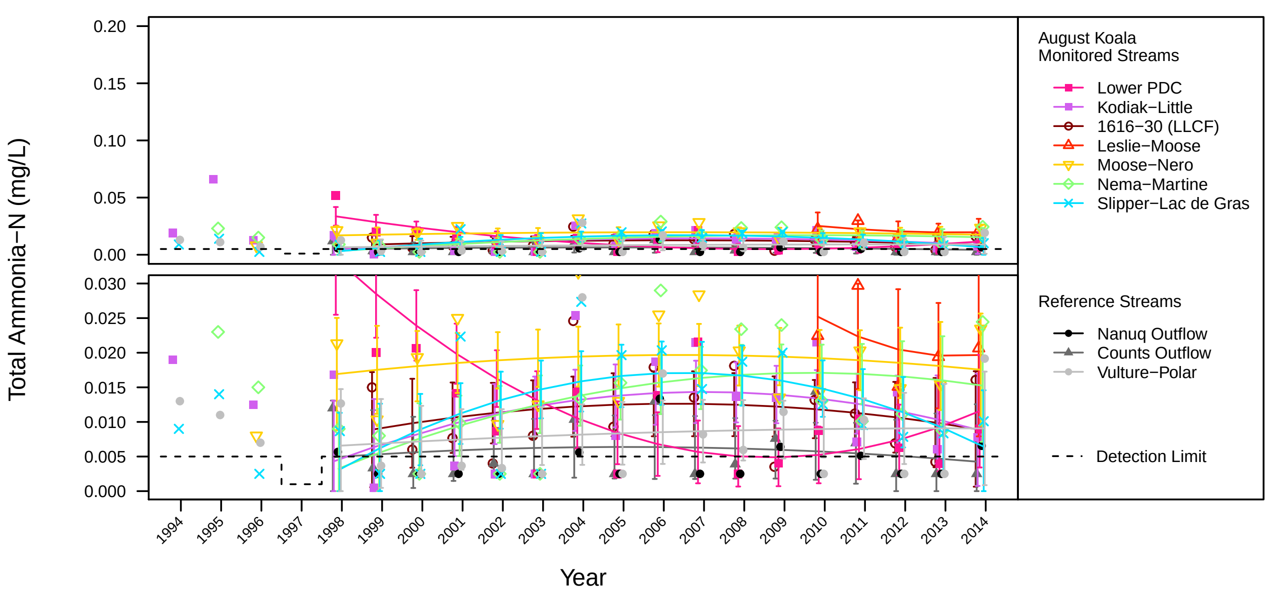
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.0070
Monitored Stream	1616-30 (LLCF)	0.0450
Monitored Stream	Kodiak-Little	0.1450
Monitored Stream	Leslie-Moose	0.1990
Monitored Stream	Lower PDC	0.5430
Monitored Stream	Moose-Nero	0.0180
Monitored Stream	Nema-Martine	0.2940
Monitored Stream	Slipper-Lac de Gras	0.3030

- Conclusions:
  Model fit for Nema-Martine and Slipper-Lac de Gras is weak. Model fit for pooled reference streams, 1616-30 (LLCF), Kodiak-Little, Leslie-Moose, and Moose-Nero is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total ammonia-N for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	9.00e-03	1.16e-02	4.15e-03	3.42e-03	1.97e-02	1.21e-02
Kodiak-Little	7.80e-03	8.87e-03	4.14e-03	7.52e-04	1.70e-02	1.21e-02
Leslie-Moose	2.07e-02	1.97e-02	6.00e-03	7.91e-03	3.14e-02	1.75e-02
1616-30 (LLCF)	1.61e-02	8.99e-03	4.25e-03	6.46e-04	1.73e-02	1.25e-02
Moose-Nero	2.34e-02	1.76e-02	4.14e-03	9.44e-03	2.57e-02	1.21e-02
Nema-Martine	2.44e-02	1.53e-02	4.14e-03	7.14e-03	2.34e-02	1.21e-02
Slipper-Lac de Gras	1.01e-02	6.45e-03	4.14e-03	0.00e+00	1.46e-02	1.21e-02
Nanuq Outflow	6.55e-03	NA	NA	NA	NA	NA
Counts Outflow	2.50e-03	4.26e-03	4.23e-03	0.00e+00	1.26e-02	NA
Vulture-Polar	1.92e-02	9.07e-03	4.18e-03	8.64e-04	1.73e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
AmmoniaN	August	Koala	Stream	Water	Nanuq Outflow	none	Tobit regression	#3 shared intercept & slope	pH- and temperature-dependent	Lower PDC Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

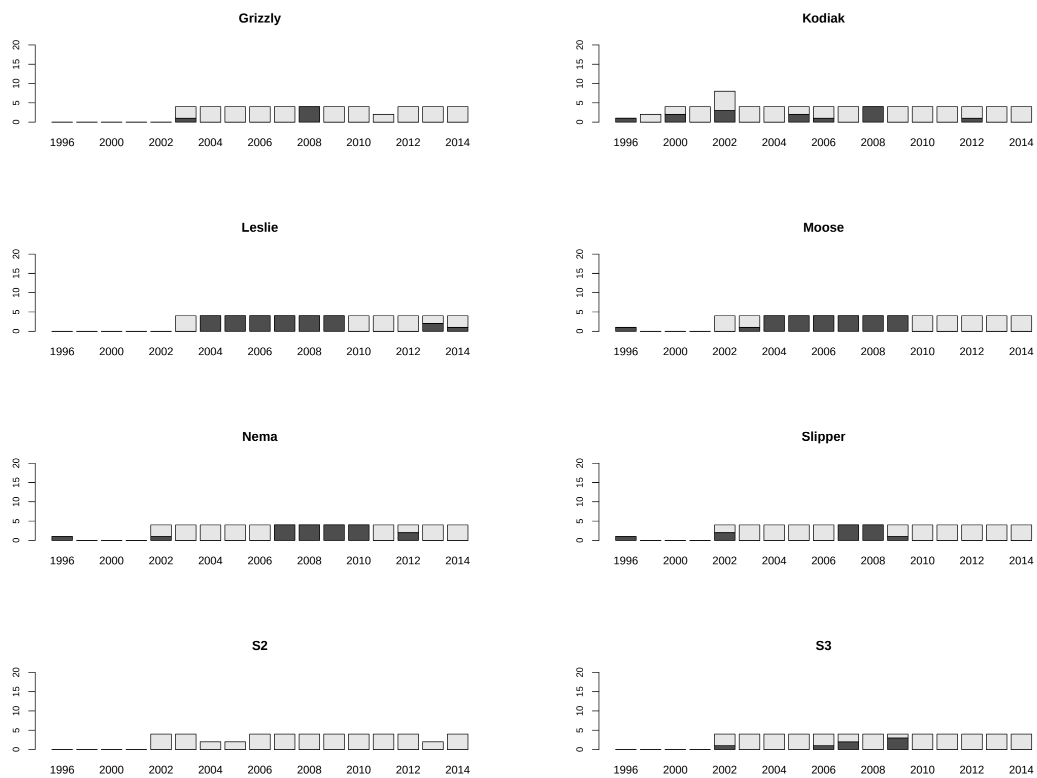
Analysis of April Nitrite-N in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

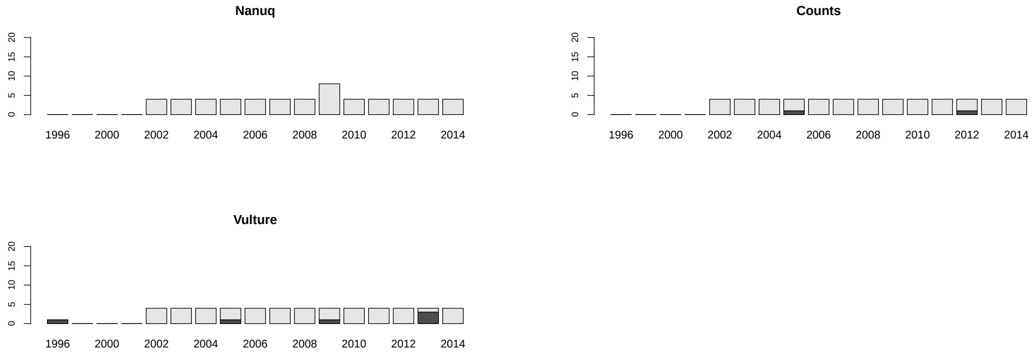
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

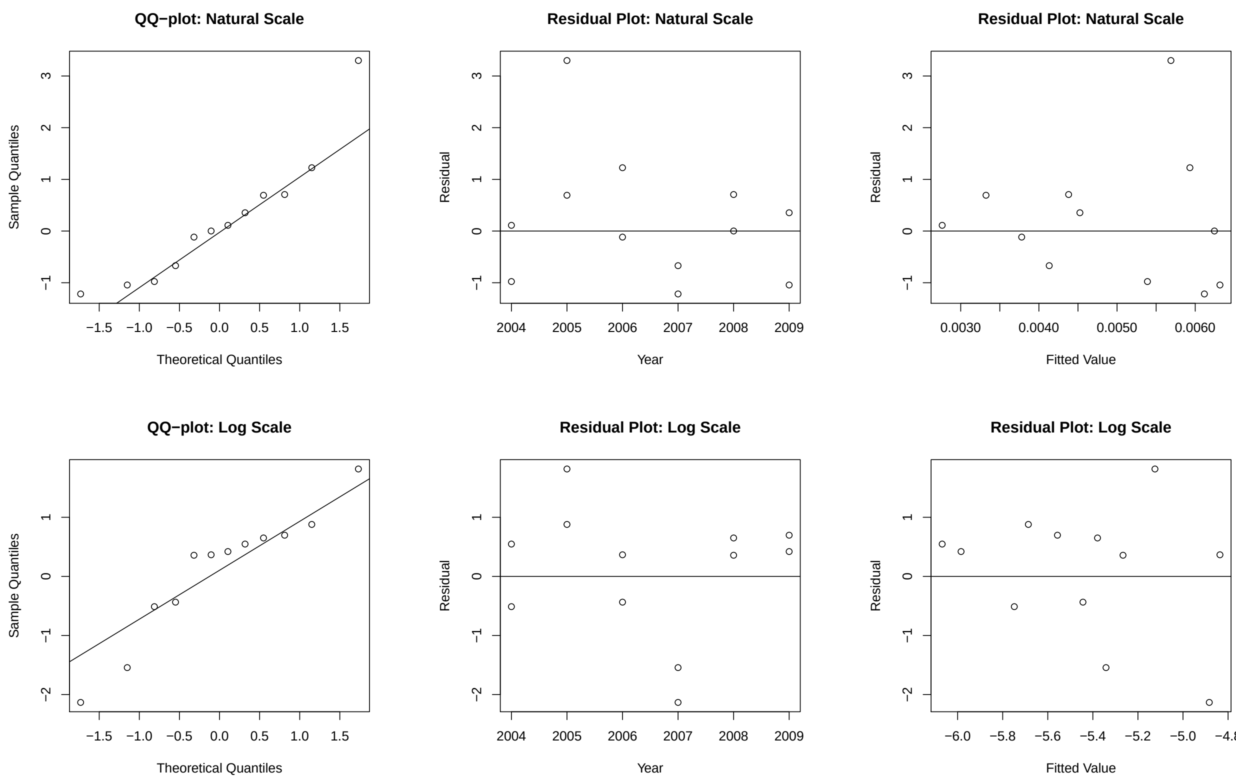


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Grizzly, Kodiak, Nema, Slipper, S2, and S3 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Leslie and Moose was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
96	Leslie	2005	0.02	0.01	3.30

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	3.38E-23	natural model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Leslie	0.1730	2	0.9171
Moose	1.2395	2	0.5381

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

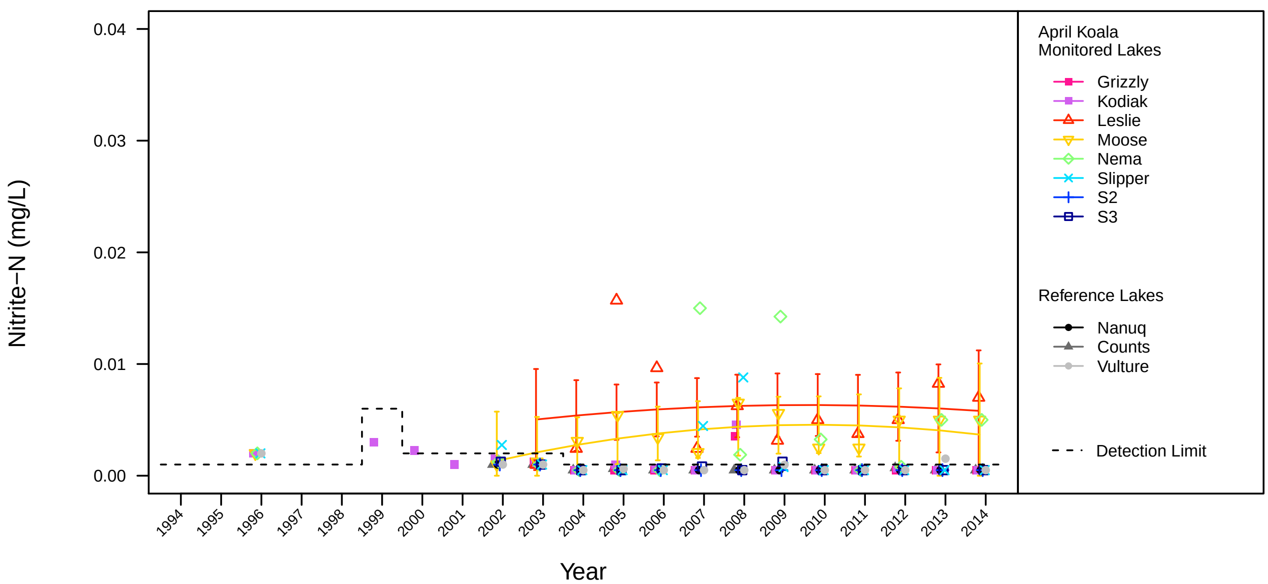
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Leslie	0.0110
Monitored Lake	Moose	0.3190

- Conclusions:
  Model fit for Moose Lake is weak. Model fit for Leslie Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrite-N for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie	7e-03	5.81e-03	2.76e-03	3.99e-04	1.12e-02	8.08e-03
Moose	5e-03	3.68e-03	3.25e-03	0.00e+00	1.00e-02	9.50e-03
Nanuq	5e-04	NA	NA	NA	NA	NA
Counts	5e-04	NA	NA	NA	NA	NA
Vulture	5e-04	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
NitriteN	April	Koala	Lake	Water	Counts Nanuq Vulture Grizzly Kodiak Nema Slipper S2 S3	none	Tobit regression	#1a slope of zero	0.06	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

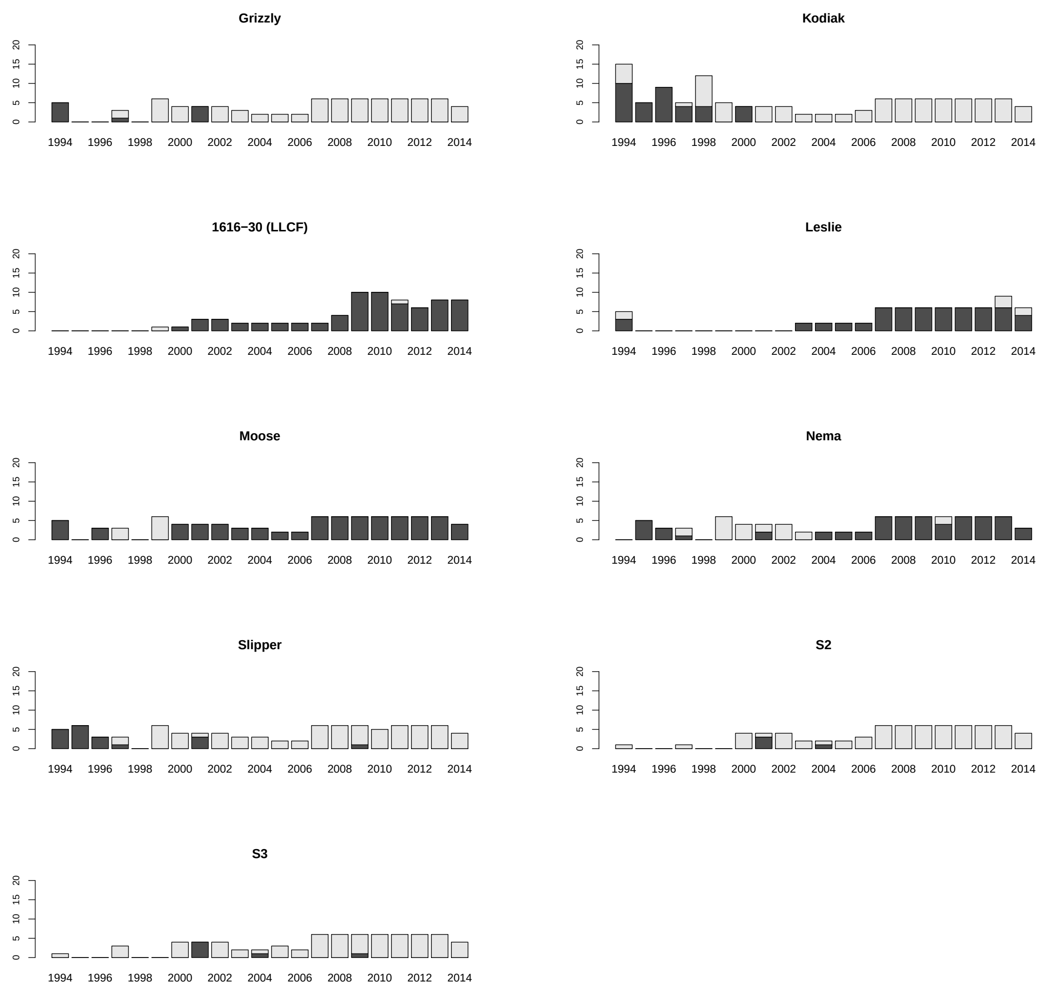
Analysis of August Nitrite-N in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

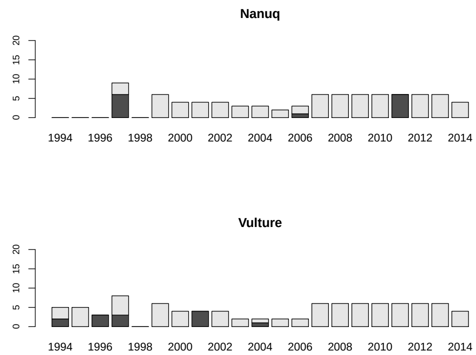
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

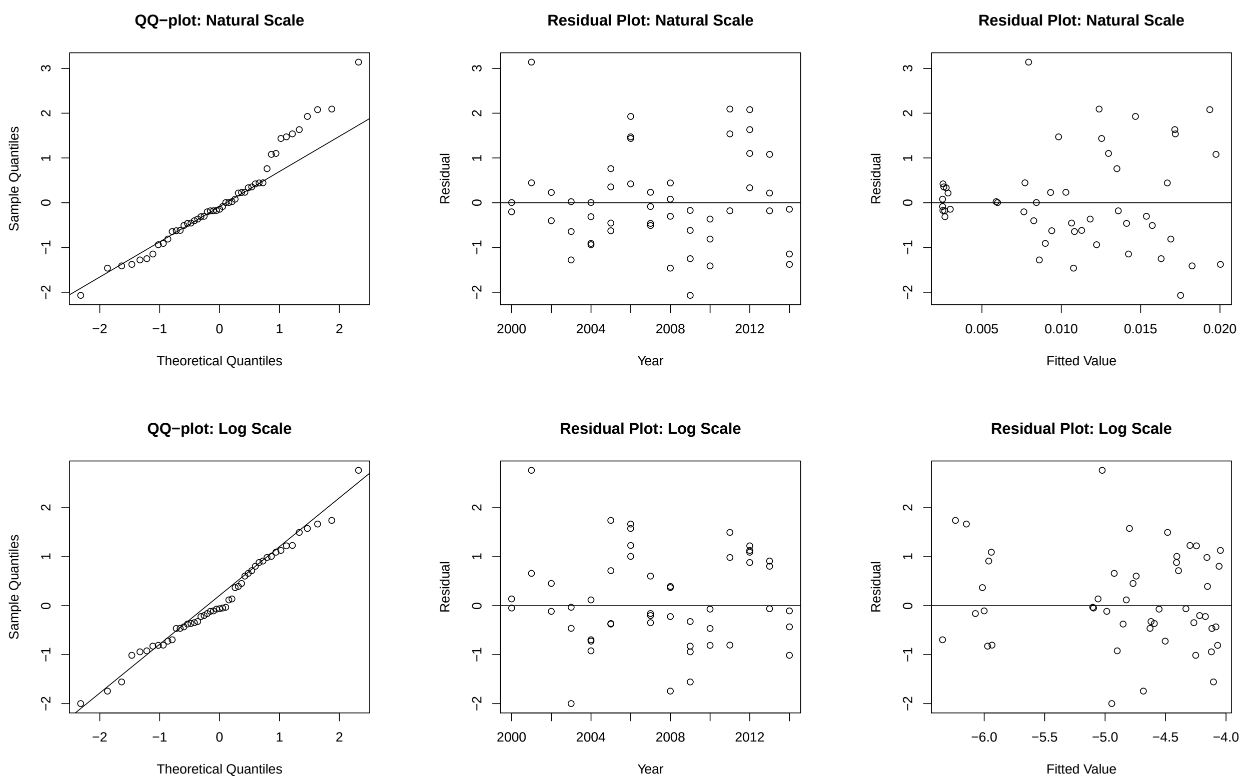


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Grizzly, Kodiak, Slipper, S2, and S3 lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Nema was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
113	Moose	2001	0.02	0.01	3.14

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model". Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-30 (LLCF)	19.8964	2	0.0000
Leslie	8.1483	2	0.0170
Moose	3.6775	2	0.1590
Nema	0.0505	2	0.9751

- Conclusions:
  Leslie Lake shows significant deviation from a slope of zero.

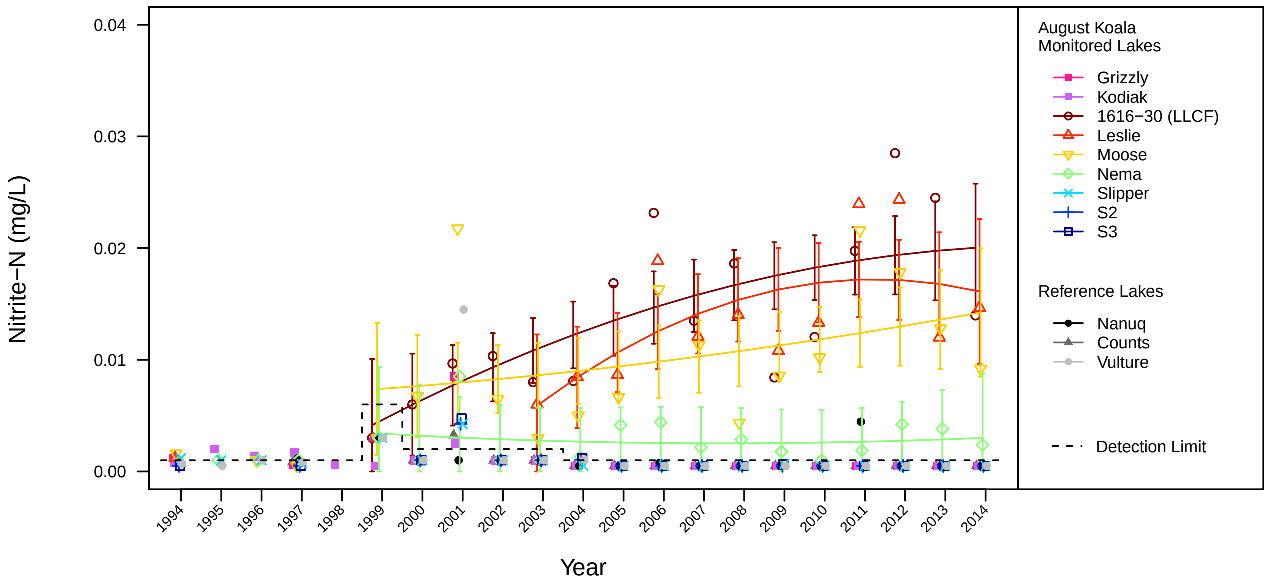
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-30 (LLCF)	0.5070
Monitored Lake	Leslie	0.4240
Monitored Lake	Moose	0.1270
Monitored Lake	Nema	0.0180

- Conclusions:
  Model fit for Leslie Lake is weak. Model fit for Moose and Nema lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrite-N for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie	1.47e-02	1.61e-02	3.31e-03	9.63e-03	2.26e-02	9.69e-03
1616-30 (LLCF)	1.40e-02	2.00e-02	2.93e-03	1.43e-02	2.58e-02	8.58e-03
Moose	9.20e-03	1.42e-02	2.93e-03	8.50e-03	2.00e-02	8.57e-03
Nema	2.37e-03	3.01e-03	2.93e-03	0.00e+00	8.75e-03	8.58e-03
Nanuq	5.00e-04	NA	NA	NA	NA	NA
Counts	5.00e-04	NA	NA	NA	NA	NA
Vulture	5.00e-04	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
NitriteN	August	Koala	Lake	Water	Counts Nanuq Vulture Grizzly Kodiak Slipper S2 S3	none	Tobit regression	#1a slope of zero	0.06	1616-30 (LLCF) Leslie

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

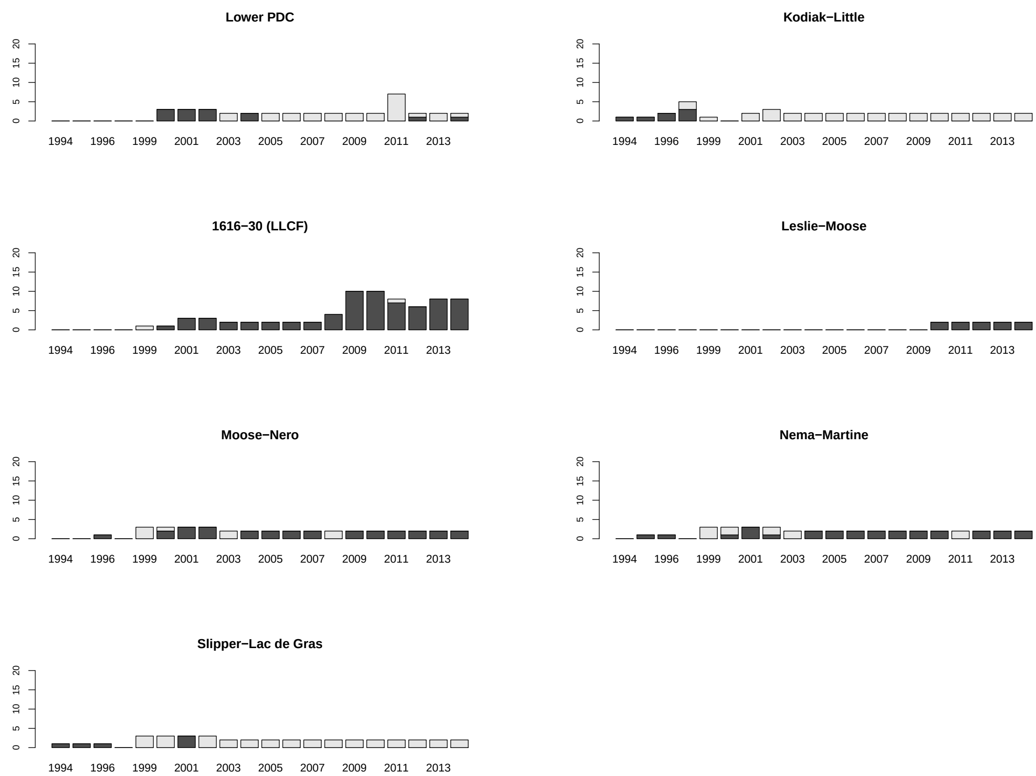
Analysis of August Nitrite-N in Koala Watershed Streams

November 10, 2014

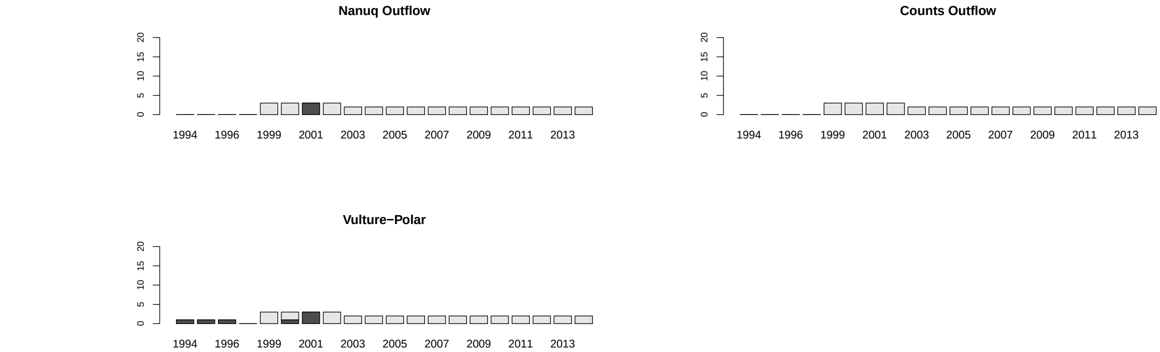
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

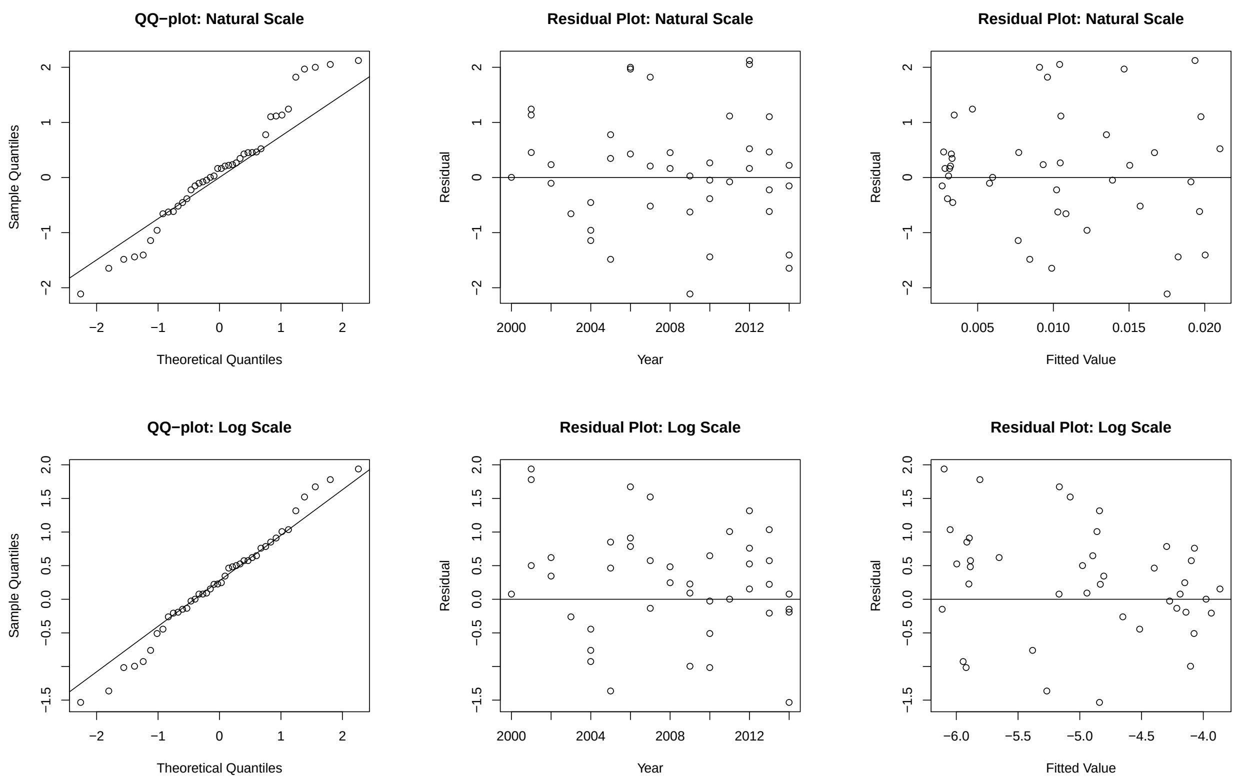


1.2 Reference



Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar, Lower PDC, Kodiak-Little, Slipper-Lac de Gras was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Moose-Nero and Nema-Martine was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the un-transformed "natural model".

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Leslie-Moose	2.0549	2	0.3579
1616-30 (LLCF)	20.6941	2	0.0000
Moose-Nero	5.8508	2	0.0536
Nema-Martine	0.0579	2	0.9715

- Conclusions:
  1616-30 (LLCF) and Moose-Nero show significant deviation from a slope of zero.

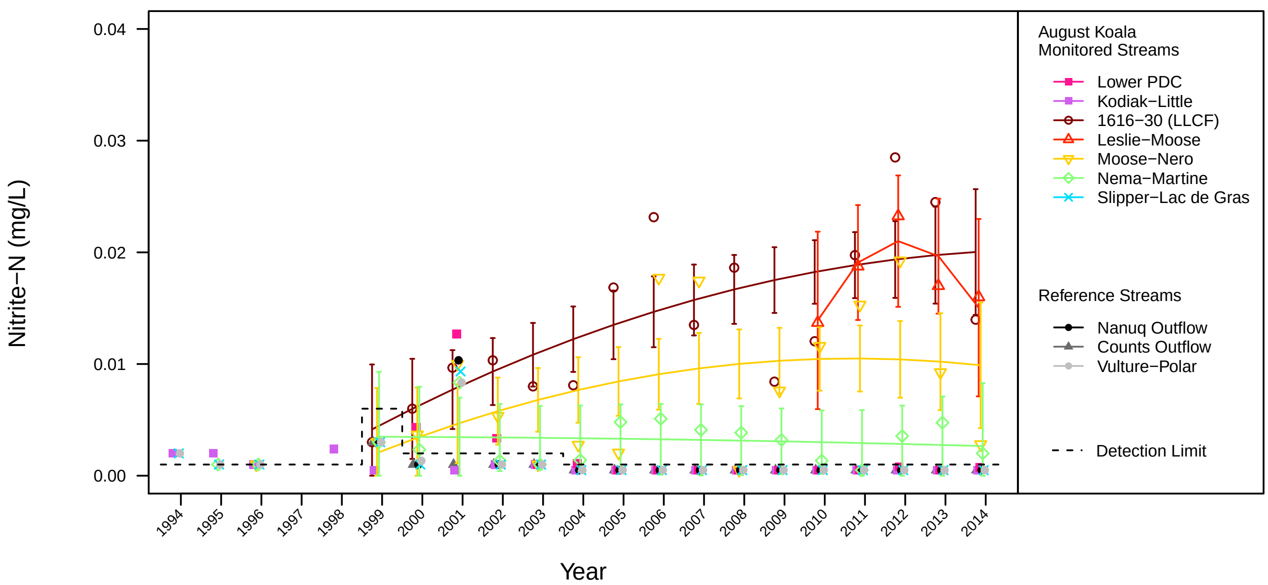
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-30 (LLCF)	0.5070
Monitored Stream	Leslie-Moose	0.7430
Monitored Stream	Moose-Nero	0.1810
Monitored Stream	Nema-Martine	0.0180

- Conclusions:
  Model fit for Moose-Nero and Nema-Martine is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrite-N for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie-Moose	1.6e-02	1.50e-02	4.05e-03	7.10e-03	2.30e-02	1.19e-02
1616-30 (LLCF)	1.4e-02	2.00e-02	2.87e-03	1.44e-02	2.57e-02	8.40e-03
Moose-Nero	2.8e-03	9.89e-03	2.87e-03	4.26e-03	1.55e-02	8.40e-03
Nema-Martine	2.0e-03	2.66e-03	2.87e-03	0.00e+00	8.28e-03	8.40e-03
Nanuq Outflow	5.0e-04	NA	NA	NA	NA	NA
Counts Outflow	5.0e-04	NA	NA	NA	NA	NA
Vulture-Polar	5.0e-04	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
NitriteN	August	Koala	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar Lower PDC Kodiak-Little Slipper-Lac de Gras	none	Tobit regression	#1a slope of zero	0.06	1616-30 (LLCF) Moose-Nero

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

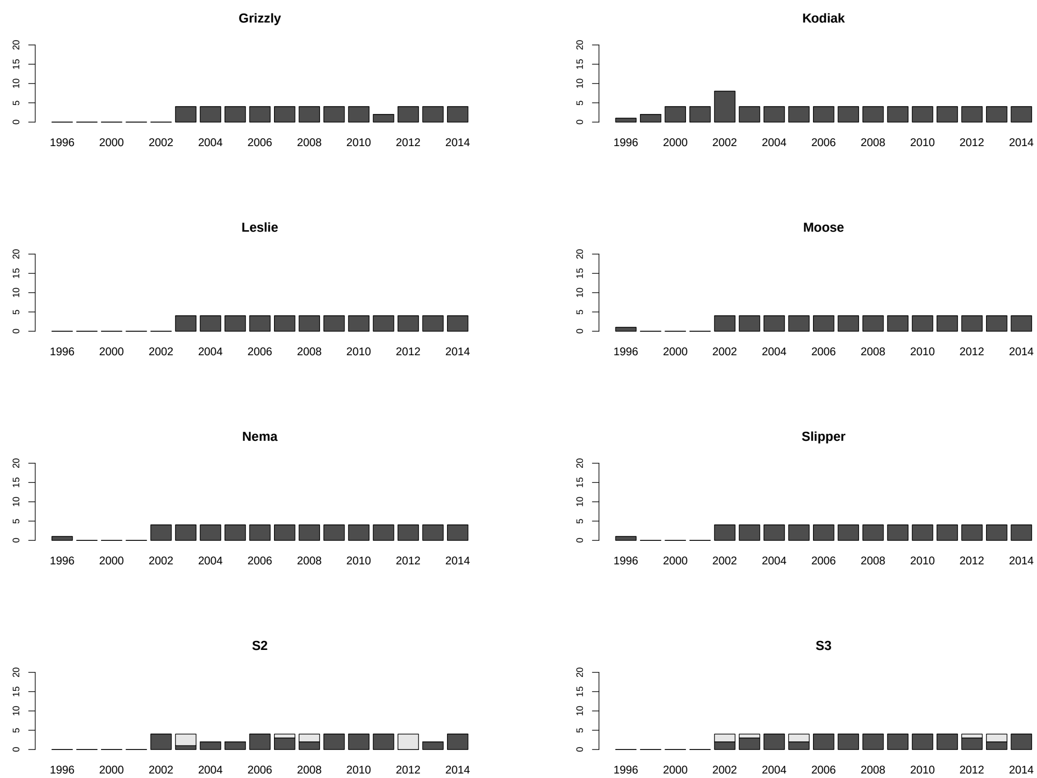
Analysis of April Nitrate-N in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

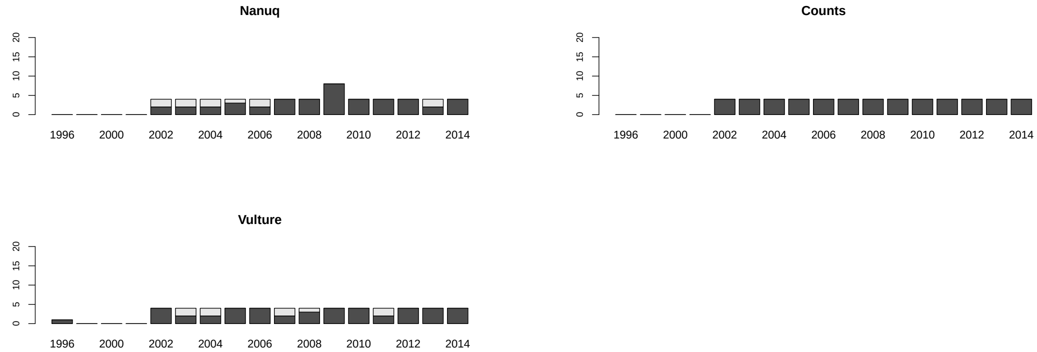
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

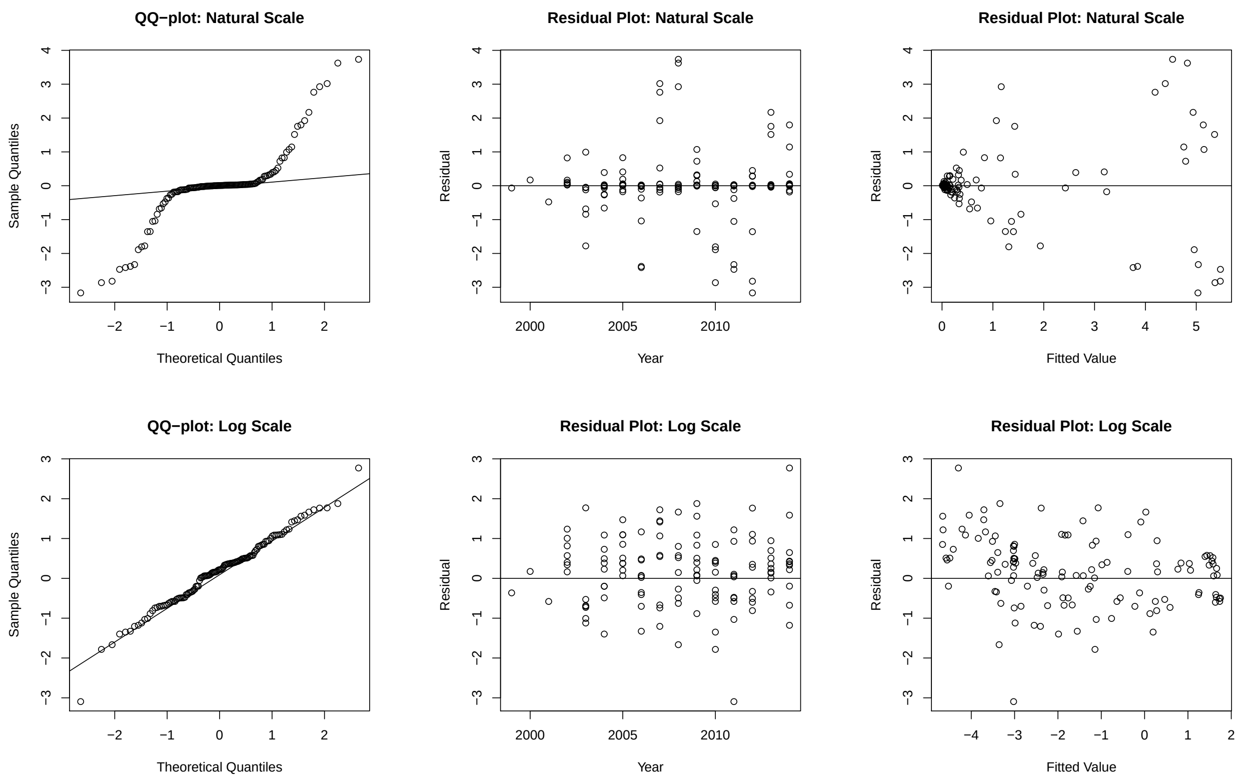


1.2 Reference



Comment:
10-60% of data in Nanuq, Vulture, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
98	Leslie	2007	5.51	4.39	3.02
99	Leslie	2008	6.17	4.83	3.62
120	Moose	2008	5.92	4.53	3.74
124	Moose	2012	3.86	5.03	-3.16

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
60	Grizzly	2011	0.01	-3.02	-3.09

AIC weights and model comparison:

Natural Model	Log Model	Best Model
6.51E-38	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
49.44	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
9.04	4.00	0.06

- Conclusions:
  The slopes do not differ significantly among reference lakes.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.993	0.007	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. AIC suggests that reference lakes are best modeled using separate slopes and intercepts. Contrasts suggest that reference lakes share a common slope; however, these results are marginally significant, suggesting that there may be important differences in reference lake slopes. Proceeding with monitored contrasts using reference model 1b (fitting separate slopes and intercepts for reference lakes).

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	0.0090	2	0.9955
Kodiak	23.9433	2	0.0000
Leslie	8.9026	2	0.0117
Moose	10.7507	2	0.0046
Nema	10.1107	2	0.0064
Slipper	11.9552	2	0.0025
S2	1.0245	2	0.5992
S3	6.7764	2	0.0338

- Conclusions:
  All monitored lakes except Grizzly and S2 show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Kodiak-vs-Nanuq	29.1108	3	0.0000
Kodiak-vs-Counts	42.0833	3	0.0000
Kodiak-vs-Vulture	124.2308	3	0.0000
Leslie-vs-Nanuq	62.0076	3	0.0000
Leslie-vs-Counts	414.1416	3	0.0000
Leslie-vs-Vulture	615.3283	3	0.0000
Moose-vs-Nanuq	63.1657	3	0.0000
Moose-vs-Counts	423.9038	3	0.0000
Moose-vs-Vulture	633.0019	3	0.0000
Nema-vs-Nanuq	34.3178	3	0.0000
Nema-vs-Counts	171.0256	3	0.0000
Nema-vs-Vulture	324.6506	3	0.0000
Slipper-vs-Nanuq	17.7041	3	0.0005
Slipper-vs-Counts	31.3586	3	0.0000
Slipper-vs-Vulture	117.5909	3	0.0000
S3-vs-Nanuq	5.1058	3	0.1642
S3-vs-Counts	44.9790	3	0.0000
S3-vs-Vulture	4.8710	3	0.1815

- Conclusions:
  All monitored lakes except S3 show significant deviation from the common slope of reference lakes. However, the trend at site S3 differs from the slope in only one reference lake (i.e., Coutns Lake).

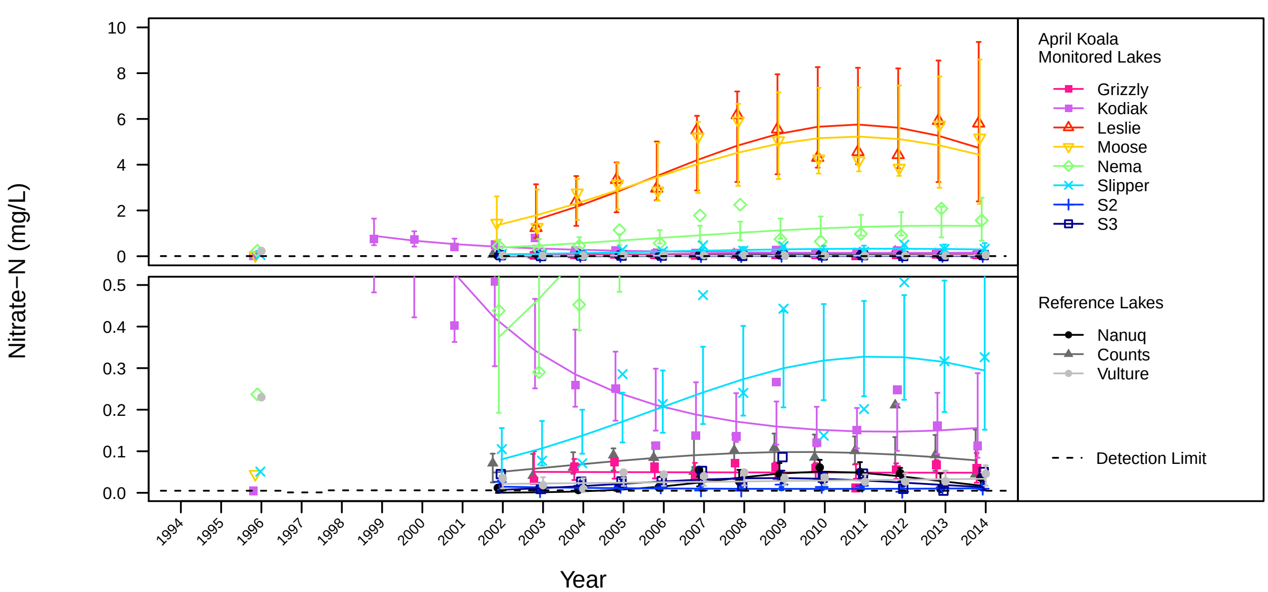
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.2600
Reference Lake	Nanuq	0.6340
Reference Lake	Vulture	0.1680
Monitored Lake	Grizzly	0.0010
Monitored Lake	Kodiak	0.7180
Monitored Lake	Leslie	0.7950
Monitored Lake	Moose	0.8090
Monitored Lake	Nema	0.4480
Monitored Lake	S2	0.0430
Monitored Lake	S3	0.2640
Monitored Lake	Slipper	0.5000

- Conclusions:
  Model fit for Counts, Nema, and S3 is weak. Model fit for Vulture, Grizzly, and S2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrate-N for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	5.89e-02	4.84e-02	1.68e-02	2.45e-02	9.57e-02	4.93e-02
Kodiak	1.13e-01	1.56e-01	4.88e-02	8.44e-02	2.88e-01	1.43e-01
Leslie	5.80e+00	4.74e+00	1.65e+00	2.40e+00	9.36e+00	4.82e+00
Moose	5.18e+00	4.43e+00	1.50e+00	2.29e+00	8.60e+00	4.38e+00
Nema	1.56e+00	1.32e+00	4.46e-01	6.80e-01	2.56e+00	1.30e+00
Slipper	3.26e-01	2.95e-01	9.96e-02	1.52e-01	5.71e-01	2.91e-01
S2	9.88e-03	1.08e-02	3.70e-03	5.54e-03	2.12e-02	1.08e-02
S3	5.01e-02	1.36e-02	4.86e-03	6.77e-03	2.74e-02	1.42e-02
Nanuq	3.68e-02	1.75e-02	6.58e-03	8.34e-03	3.65e-02	NA
Counts	4.49e-02	7.83e-02	2.65e-02	4.03e-02	1.52e-01	NA
Vulture	4.58e-02	3.38e-02	1.16e-02	1.72e-02	6.62e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
NitrateN	April	Koala	Lake	Water	none	log e	Tobit regression	#1b separate intercepts & slopes	hardness-dependent	Kodiak Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

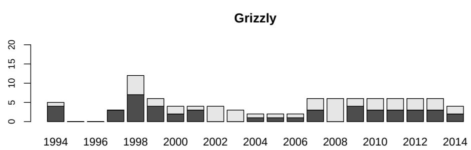
Analysis of August Nitrate-N in Lakes of the Koala Watershed and Lac de Gras

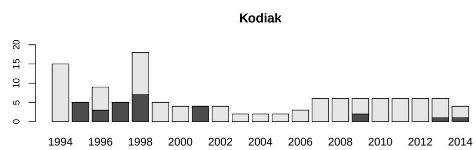
November 10, 2014

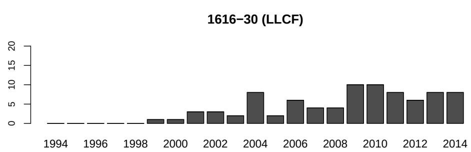
1 Censored Values:

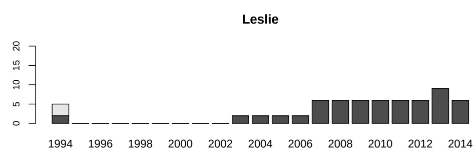
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

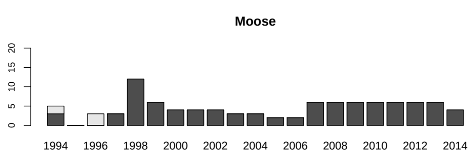
1.1 Monitored

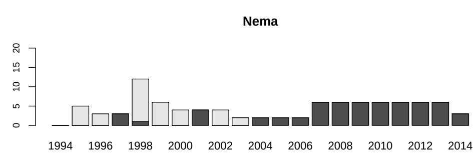


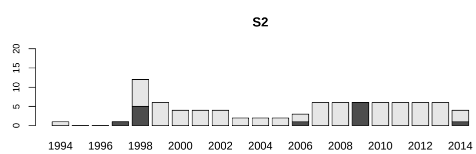


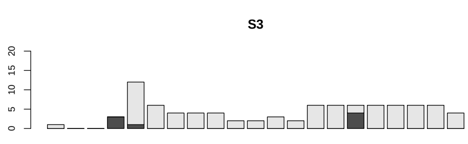




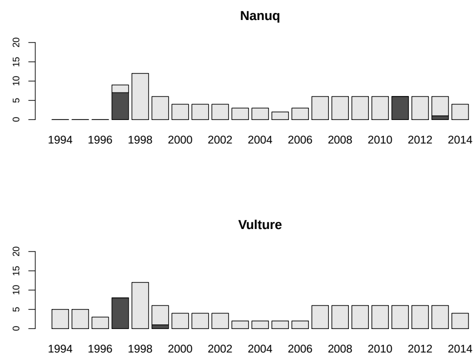






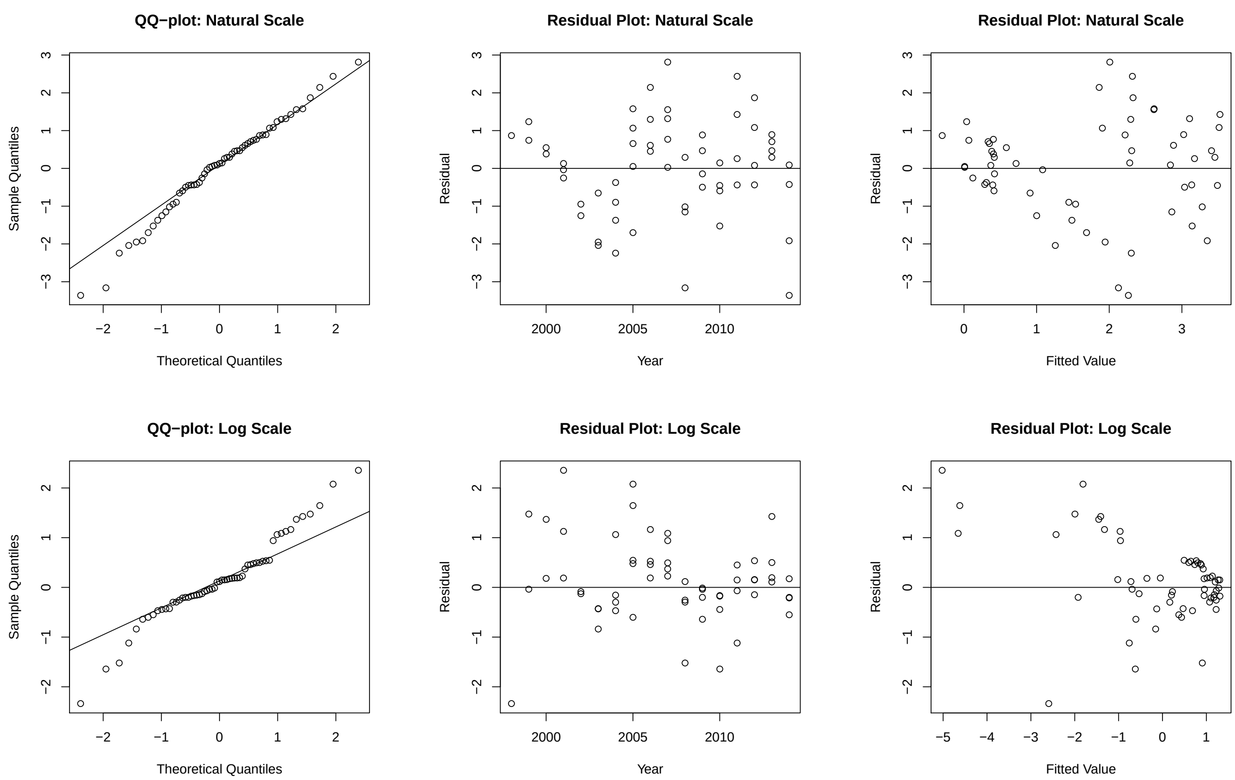


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Kodiak, S2, and S3 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Grizzly and Nema was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	0.97	2.13	-3.16
126	Moose	2014	1.03	2.26	-3.36

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value We are proceeding with the remaining analyses using the untransformed model despite the contradictory AIC resuts, because AIC is less relaible when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	0.0014	2	0.9993
1616-30 (LLCF)	146.9893	2	0.0000
Leslie	45.7281	2	0.0000
Moose	89.1579	2	0.0000
Nema	3.7055	2	0.1568
Slipper	0.0010	2	0.9995

- Conclusions:
  Leslie and Moose lakes show significant deviation from a slope of zero.

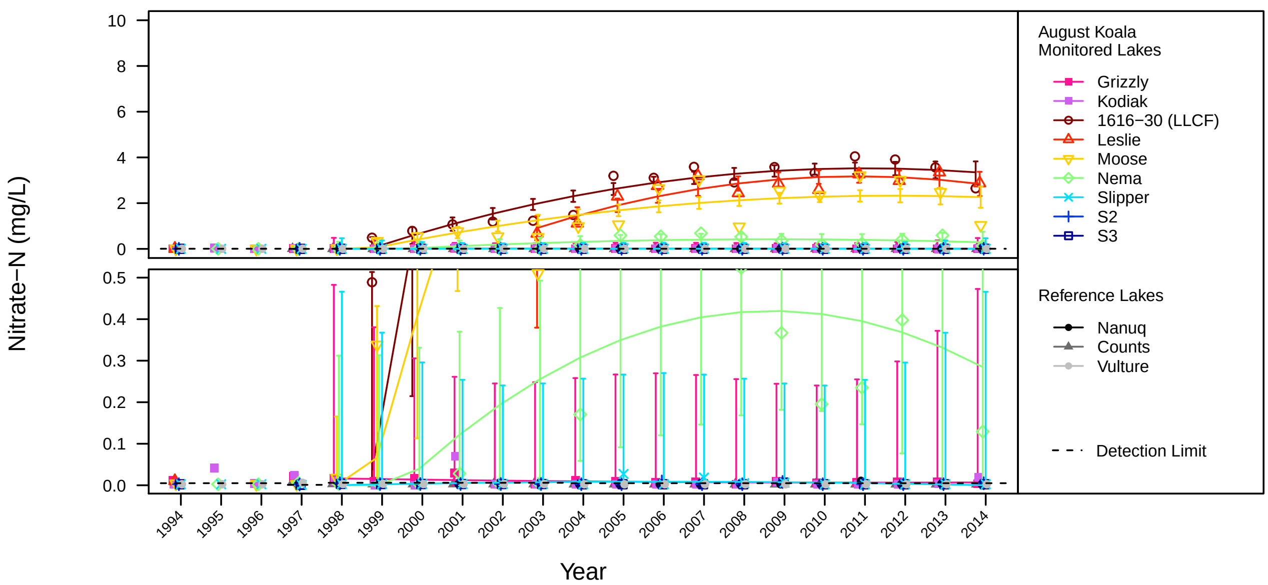
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-30 (LLCF)	0.8570
Monitored Lake	Grizzly	0.2520
Monitored Lake	Leslie	0.8000
Monitored Lake	Moose	0.6130
Monitored Lake	Nema	0.4980
Monitored Lake	Slipper	0.1810

- Conclusions:
  Model fit for Grizzly and Nema lakes is weak. Model fit for Slipper Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrate-N for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.92e-03	6.89e-03	2.38e-01	0.00e+00	4.73e-01	6.96e-01
Kodiak	1.94e-02	NA	NA	NA	NA	NA
Leslie	2.88e+00	2.84e+00	2.71e-01	2.31e+00	3.37e+00	7.92e-01
1616-30 (LLCF)	2.65e+00	3.35e+00	2.43e-01	2.87e+00	3.83e+00	7.12e-01
Moose	1.03e+00	2.26e+00	2.38e-01	1.80e+00	2.73e+00	6.96e-01
Nema	1.29e-01	2.85e-01	2.38e-01	0.00e+00	7.51e-01	6.96e-01
Slipper	2.50e-03	2.17e-05	2.38e-01	0.00e+00	4.66e-01	6.96e-01
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	2.50e-03	NA	NA	NA	NA	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
NitrateN	August	Koala	Lake	Water	Counts Nanuq Vulture Kodiak S2 S3	none	Tobit regression	#1a slope of zero	hardness-dependent	1616-30 (LLCF) Leslie Moose

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

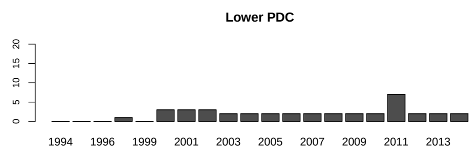
Analysis of August Nitrate-N in Koala Watershed Streams

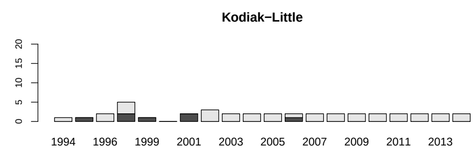
November 10, 2014

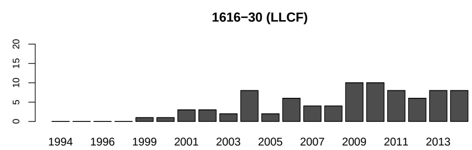
1 Censored Values:

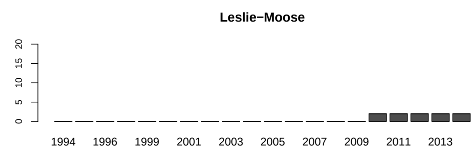
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

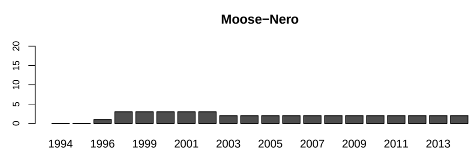
1.1 Monitored

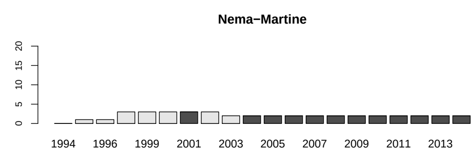


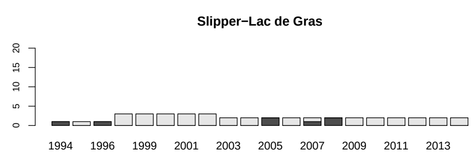




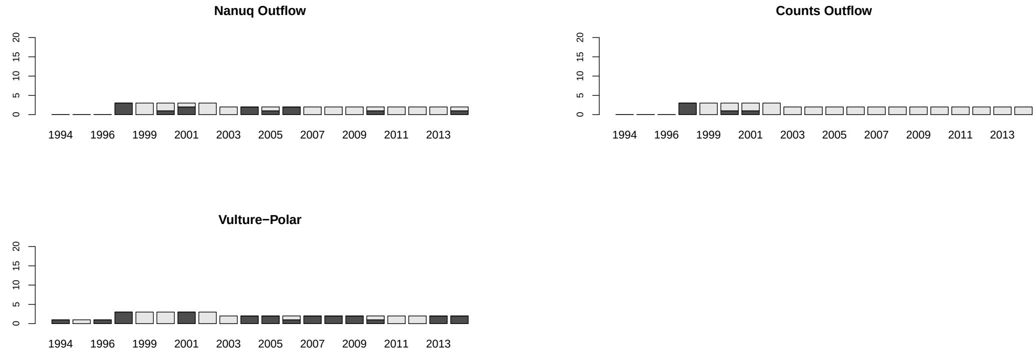






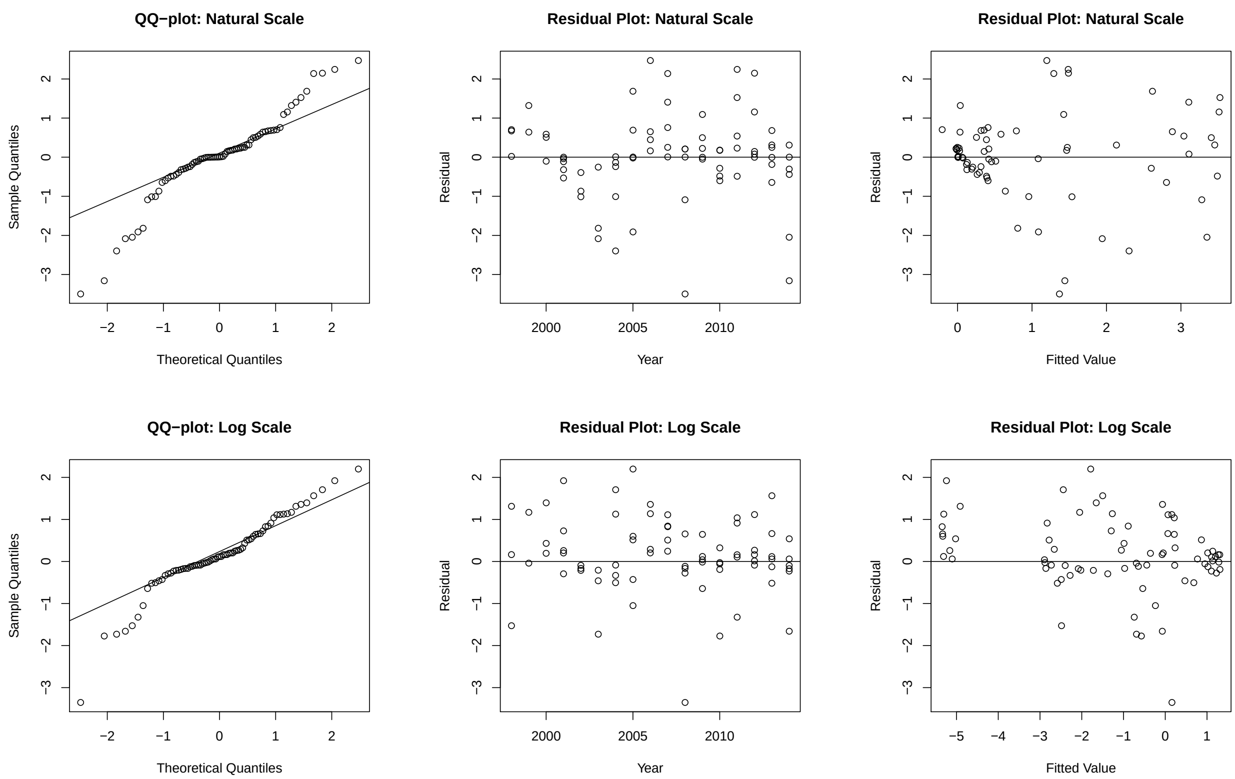


1.2 Reference



Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Kodiak-Little, and Slipper-Lac de Gras was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Vulture-Polar and Nema-Martine was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.17	1.37	-3.50
126	Moose-Nero	2014	0.36	1.44	-3.16

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.17	0.16	-3.35

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using the log-transformed model. Results should be interpreted with caution.

3 Comparisons within Reference Streams

Two of three reference streams were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	29.6476	2	0.0000
Leslie-Moose	0.2576	2	0.8792
1616-30 (LLCF)	18.9561	2	0.0001
Moose-Nero	36.5131	2	0.0000
Nema-Martine	83.8529	2	0.0000

- Conclusions:
  All monitored streams except Leslie-Moose show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Lower PDC-vs-Vulture-Polar	213.2837	3	0.0000
1616-30 (LLCF)-vs-Vulture-Polar	770.7861	3	0.0000
Moose-Nero-vs-Vulture-Polar	511.1987	3	0.0000
Nema-Martine-vs-Vulture-Polar	256.6374	3	0.0000

- Conclusions:
  All remaining monitored streams show significant deviation from the slopes of the individual reference stream.

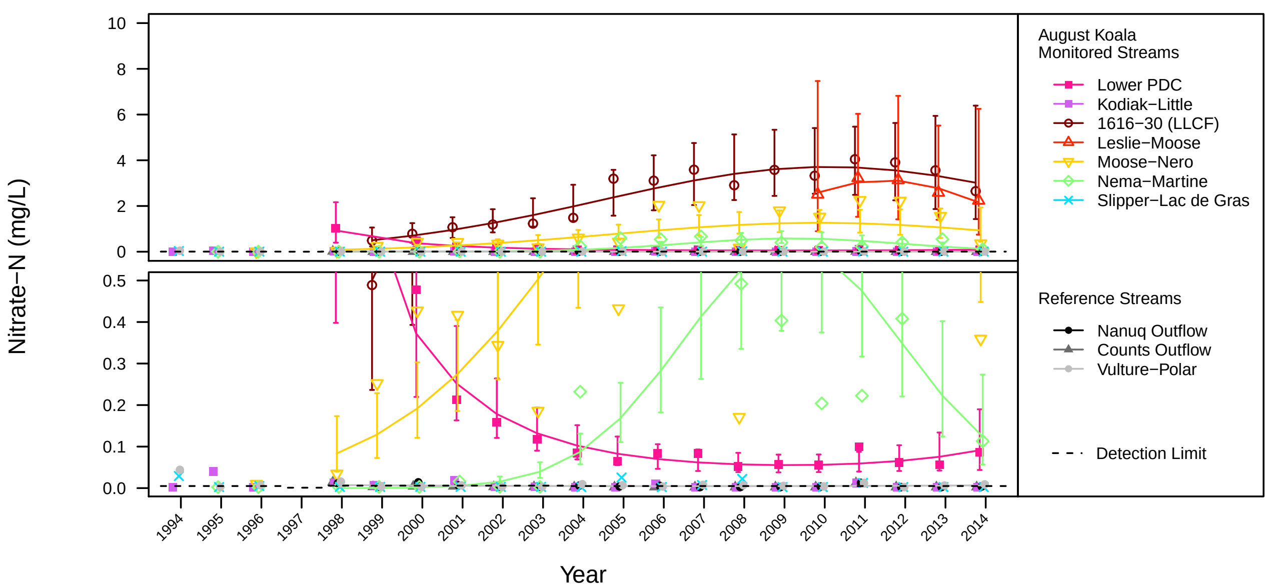
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Vulture-Polar	0.0550
Monitored Stream	1616-30 (LLCF)	0.9430
Monitored Stream	Leslie-Moose	0.8850
Monitored Stream	Lower PDC	0.9320
Monitored Stream	Moose-Nero	0.5440
Monitored Stream	Nema-Martine	0.7870

- Conclusions:
  Model fit for Vulture-Polar is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrate-N for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	8.62e-02	9.10e-02	3.41e-02	4.36e-02	1.90e-01	9.99e-02
Leslie-Moose	2.24e+00	2.16e+00	1.17e+00	7.49e-01	6.25e+00	3.43e+00
1616-30 (LLCF)	2.65e+00	3.02e+00	1.15e+00	1.43e+00	6.39e+00	3.38e+00
Moose-Nero	3.59e-01	9.32e-01	3.48e-01	4.48e-01	1.94e+00	1.02e+00
Nema-Martine	1.13e-01	1.25e-01	5.00e-02	5.68e-02	2.73e-01	1.46e-01
Nanuq Outflow	3.90e-03	NA	NA	NA	NA	NA
Counts Outflow	2.50e-03	NA	NA	NA	NA	NA
Vulture-Polar	9.00e-03	6.60e-03	2.65e-03	3.01e-03	1.45e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
NitrateN	August	Koala	Stream	Water	Counts Outflow Nanuq Outflow Kodiak-Little Slipper-Lac de Gras	log e	Tobit regression	#1b separate intercepts & slopes	hardness-dependent	Lower PDC 1616-30 (LLCF) Moose Nema-Martine

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

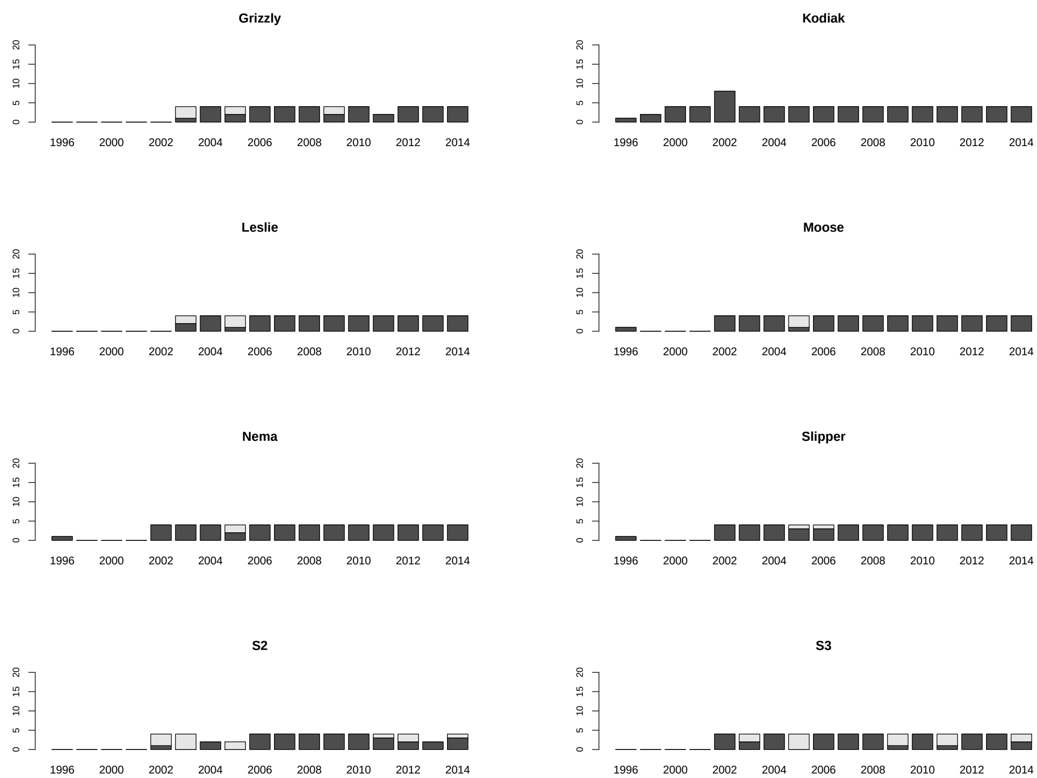
Analysis of April Total Phosphate-P in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

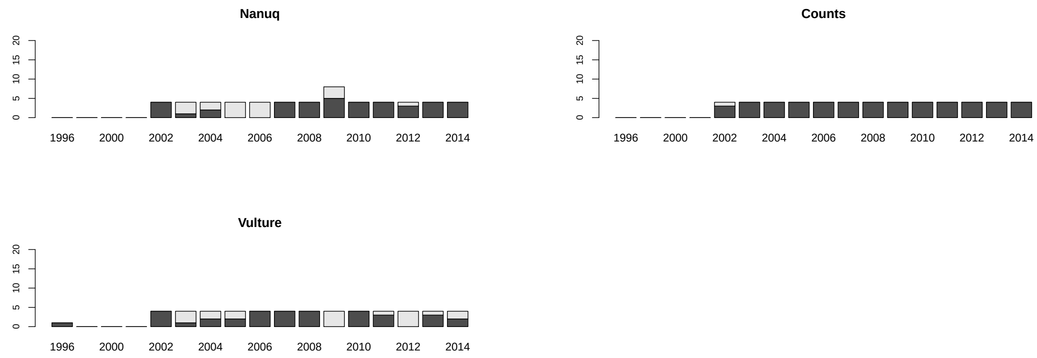
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

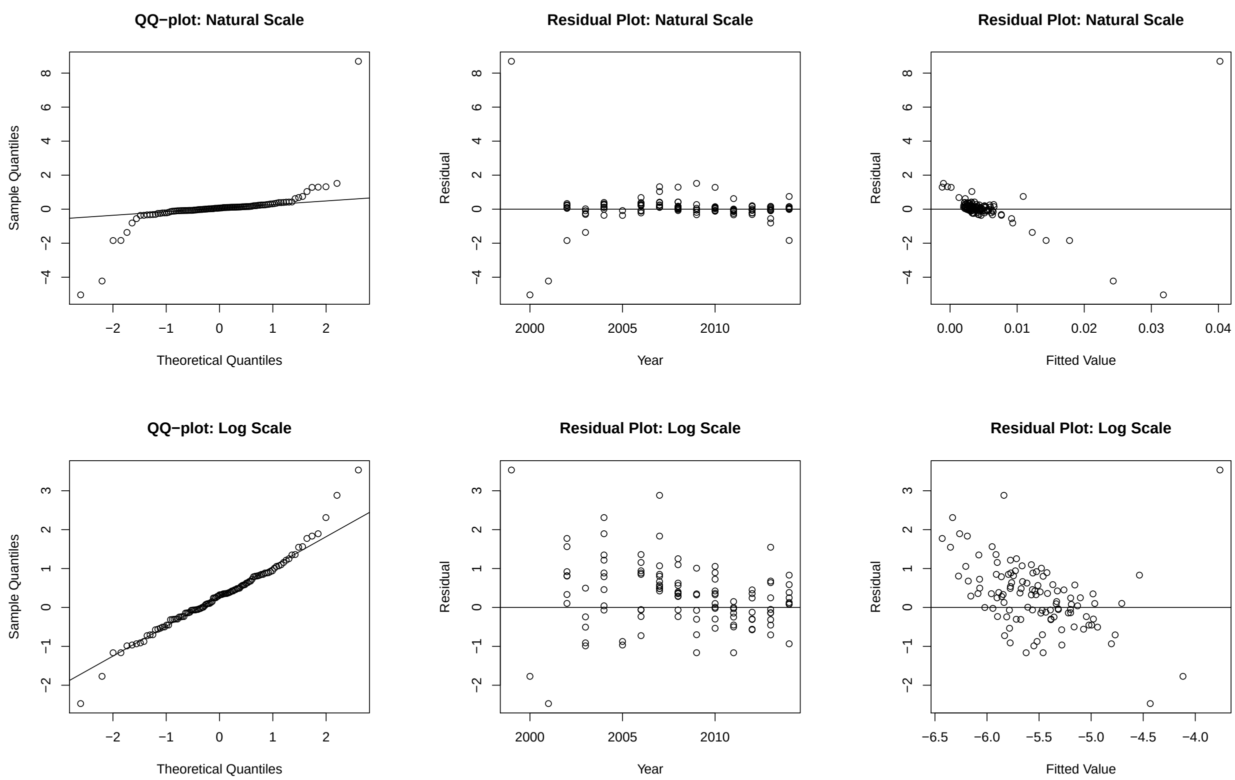


1.2 Reference



Comment:
10-60% of data in Nanuq, Vulture, Grizzly, S2 and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
69	Kodiak	1999	0.08	0.04	8.70
70	Kodiak	2000	0.01	0.03	-5.04
71	Kodiak	2001	0.00	0.02	-4.22

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
69	Kodiak	1999	0.08	-3.76	3.53

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	7.77E-171	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
45.42	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
11.42	4.00	0.02

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.956	0.044	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	6.2123	2	0.0448
Kodiak	32.7460	2	0.0000
Leslie	9.4768	2	0.0088
Moose	17.2220	2	0.0002
Nema	2.2939	2	0.3176
Slipper	2.6360	2	0.2677
S2	8.3366	2	0.0155
S3	1.4581	2	0.4824

- Conclusions:
  All monitored lakes except Nema, Slipper, and S3 show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Grizzly-vs-Nanuq	4.9867	3	0.1728
Grizzly-vs-Counts	15.9586	3	0.0012
Grizzly-vs-Vulture	6.9202	3	0.0745
Kodiak-vs-Nanuq	47.3914	3	0.0000
Kodiak-vs-Counts	33.9578	3	0.0000
Kodiak-vs-Vulture	44.9395	3	0.0000
Leslie-vs-Nanuq	13.9869	3	0.0029
Leslie-vs-Counts	6.5653	3	0.0871
Leslie-vs-Vulture	13.5608	3	0.0036
Moose-vs-Nanuq	28.3458	3	0.0000
Moose-vs-Counts	10.0308	3	0.0183
Moose-vs-Vulture	21.4577	3	0.0001
S2-vs-Nanuq	6.1159	3	0.1061
S2-vs-Counts	28.1771	3	0.0000
S2-vs-Vulture	3.9618	3	0.2656

- Conclusions:
  Of the remaining monitored lakes, Kodiak, Leslie and Moose show deviation from the slopes of individual reference lakes. However, Grizzly and S2 differ from the slope in only one reference lake (i.e., Counts Lake)

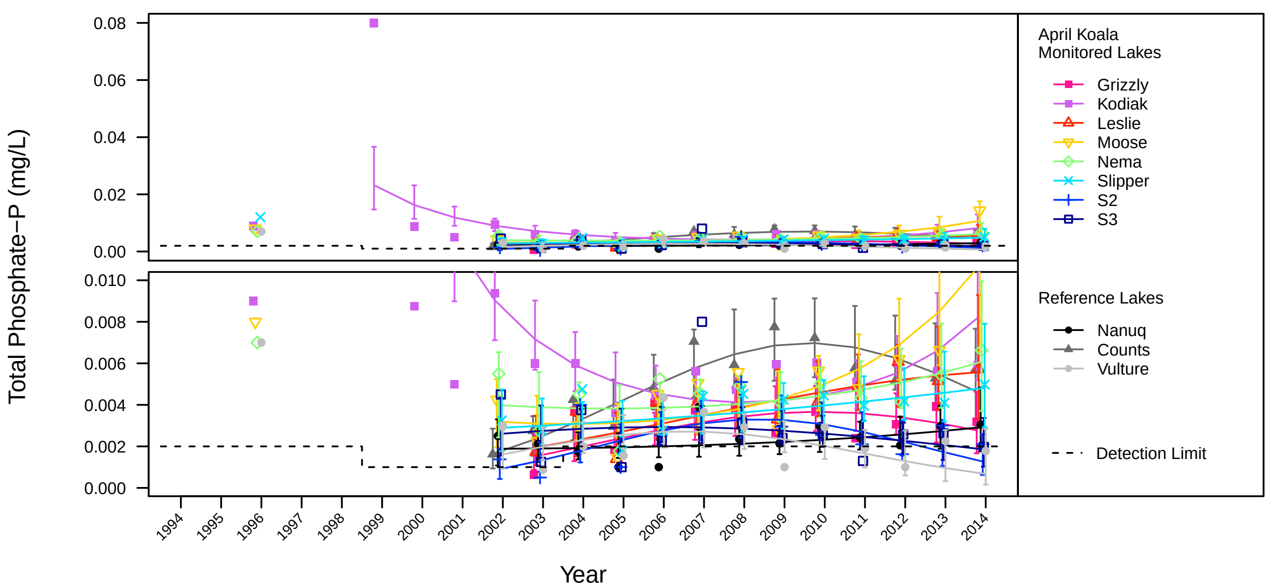
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.8640
Reference Lake	Nanuq	0.1410
Reference Lake	Vulture	0.3560
Monitored Lake	Grizzly	0.3220
Monitored Lake	Kodiak	0.5510
Monitored Lake	Leslie	0.6120
Monitored Lake	Moose	0.5810
Monitored Lake	Nema	0.2110
Monitored Lake	S2	0.3800
Monitored Lake	S3	0.0680
Monitored Lake	Slipper	0.3150

- Conclusions:
  Model fit for Vulture, Grizzly, Nema, Slipper, and S2 is weak. Model fit for Nanuq and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total phosphate-P for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.17e-03	2.78e-03	7.22e-04	1.67e-03	4.62e-03	2.11e-03
Kodiak	5.90e-03	8.19e-03	1.91e-03	5.18e-03	1.29e-02	5.58e-03
Leslie	5.72e-03	5.57e-03	1.45e-03	3.34e-03	9.29e-03	4.25e-03
Moose	1.43e-02	1.07e-02	2.70e-03	6.54e-03	1.76e-02	7.90e-03
Nema	6.62e-03	6.07e-03	1.53e-03	3.71e-03	9.95e-03	4.48e-03
Slipper	4.98e-03	4.82e-03	1.22e-03	2.93e-03	7.90e-03	3.56e-03
S2	2.10e-03	1.28e-03	4.62e-04	6.27e-04	2.60e-03	1.35e-03
S3	1.97e-03	1.86e-03	5.63e-04	1.03e-03	3.37e-03	1.65e-03
Nanuq	3.05e-03	2.92e-03	7.52e-04	1.76e-03	4.84e-03	NA
Counts	5.72e-03	4.66e-03	1.18e-03	2.84e-03	7.66e-03	NA
Vulture	1.78e-03	6.75e-04	4.96e-04	1.60e-04	2.85e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Phosphorus	April	Koala	Lake	Water	none	log e	Tobit regression	#1b separate intercepts & slopes	lake specific	Kodiak Leslie Moose

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

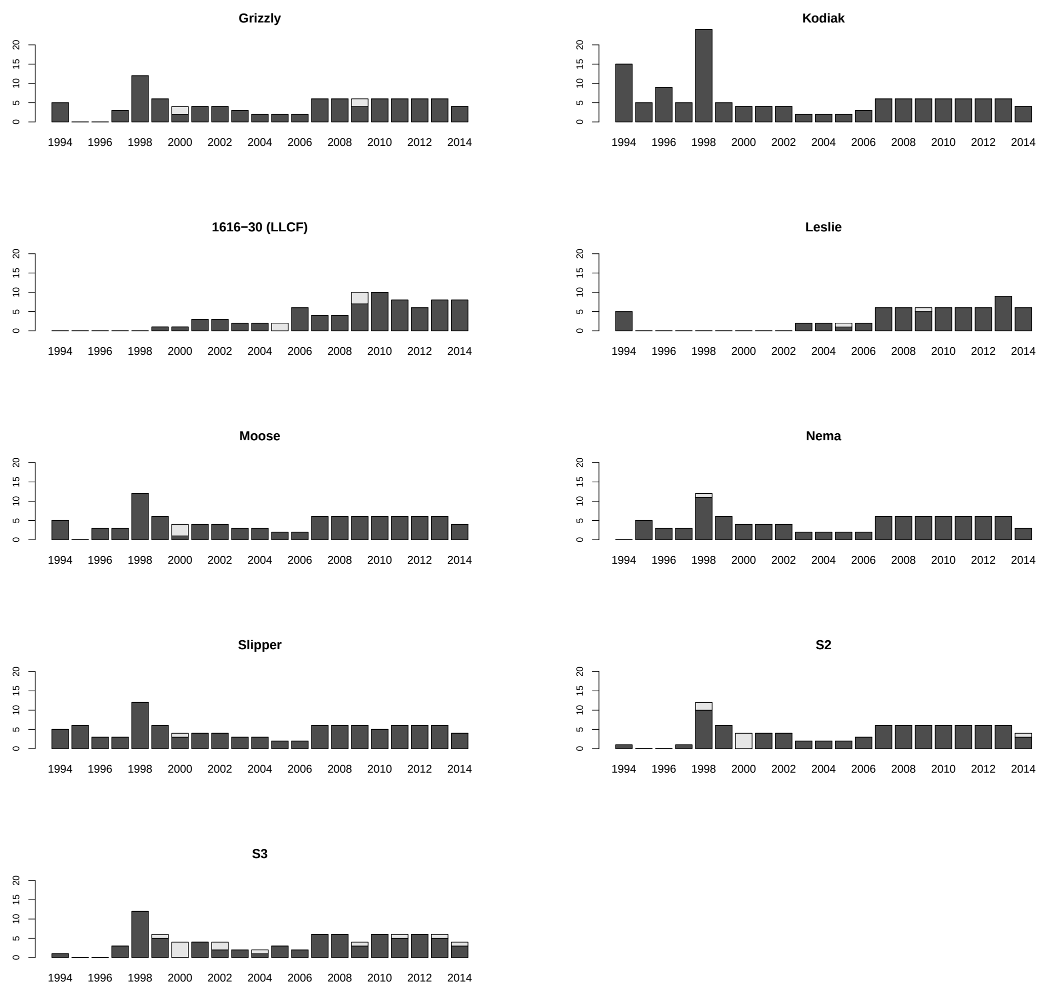
Analysis of August Total Phosphate-P in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

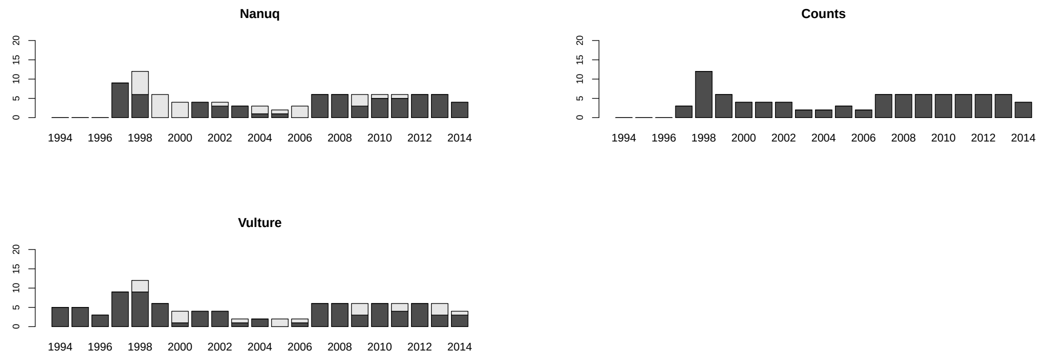
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

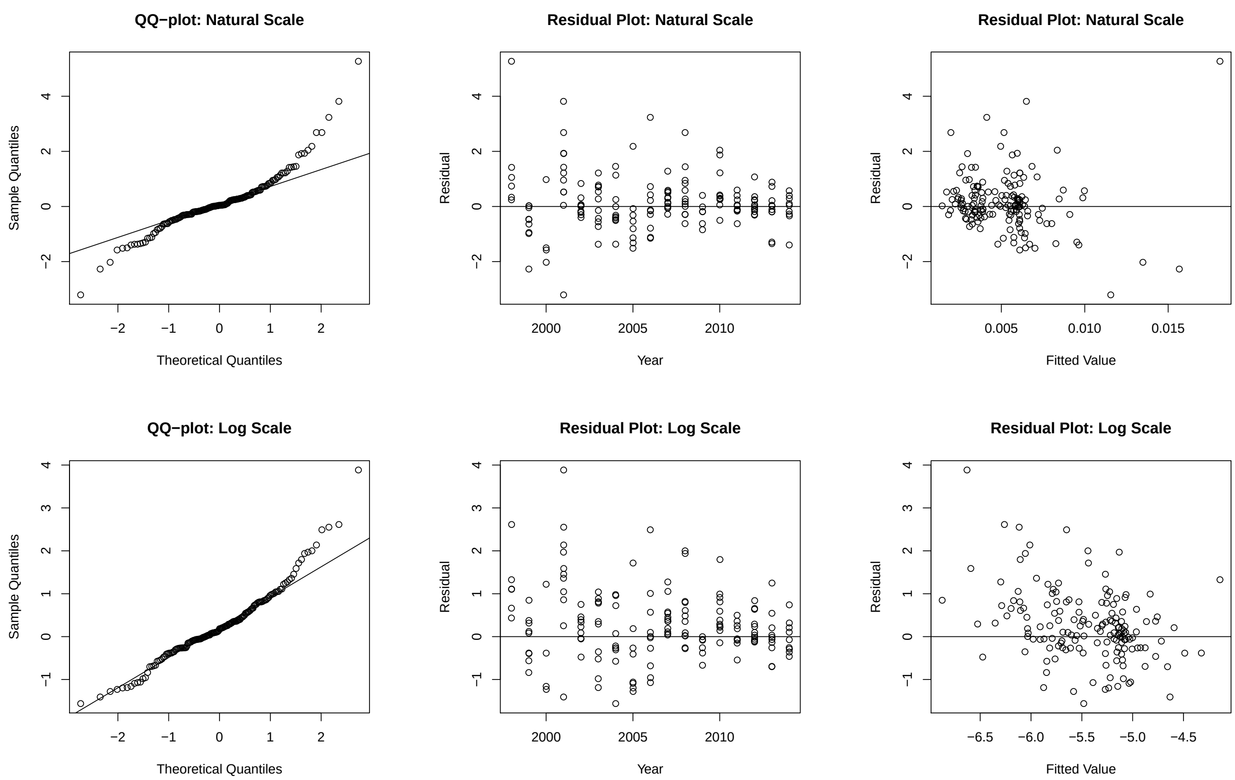


1.2 Reference



Comment:
10-60% of data in Nanuq, Vulture, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
13	1616-30 (LLCF)	2006	0.01	0.00	3.23
29	Counts	2001	0.01	0.01	3.82
68	Kodiak	1998	0.03	0.02	5.27
71	Kodiak	2001	0.01	0.01	-3.21

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
134	Nanuq	2001	0.01	-6.63	3.88

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
100.80	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
2.02	4.00	0.73

- Conclusions:
  The slopes do not differ significantly among reference lakes.

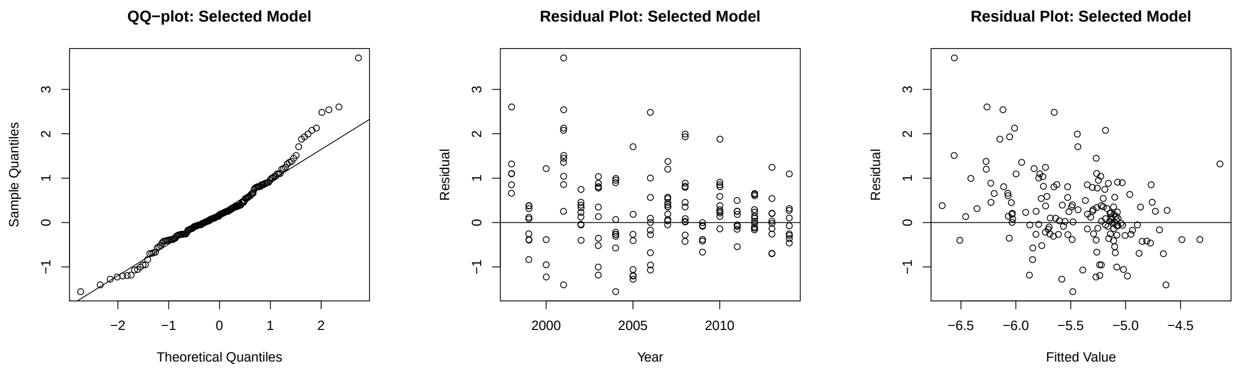
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.049	0.951	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
134	Nanuq	2001	0.01	-6.56	3.71

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.6832	2	0.7106
Kodiak	13.4140	2	0.0012
1616-30 (LLCF)	0.2222	2	0.8949
Leslie	0.0155	2	0.9923
Moose	0.0025	2	0.9988
Nema	1.6926	2	0.4290
Slipper	1.3678	2	0.5047
S2	2.0861	2	0.3524
S3	3.0127	2	0.2217

- Conclusions:
  Kodiak Lake shows significant deviation from the common slope of reference lakes.

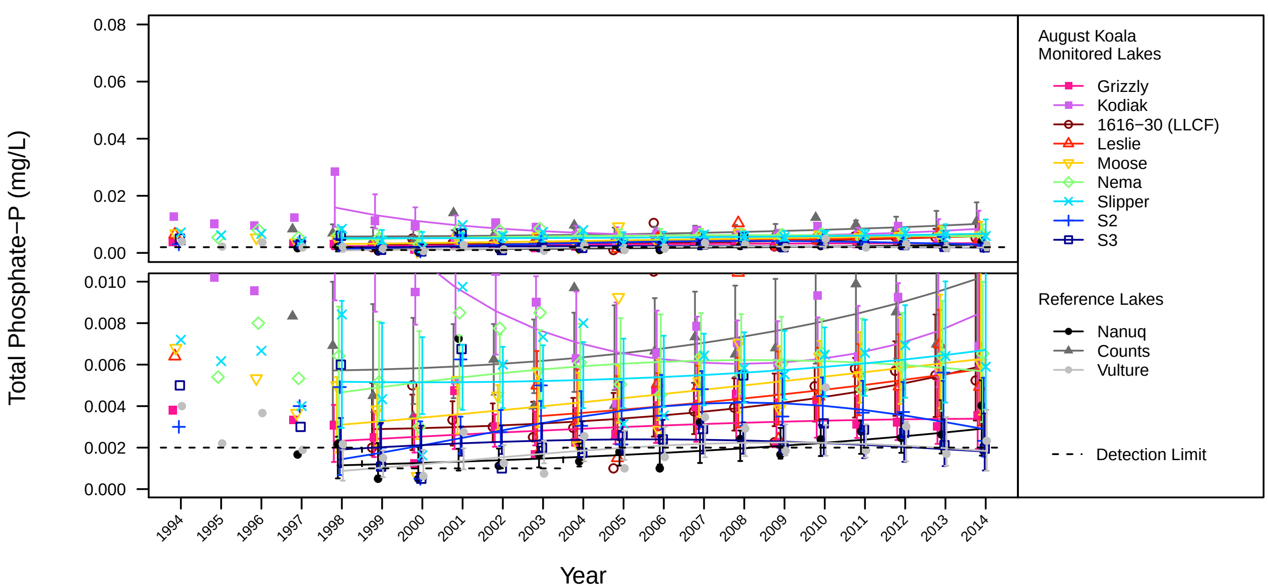
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.6660
Monitored Lake	1616-30 (LLCF)	0.1810
Monitored Lake	Grizzly	0.1170
Monitored Lake	Kodiak	0.4680
Monitored Lake	Leslie	0.1100
Monitored Lake	Moose	0.1410
Monitored Lake	Nema	0.1130
Monitored Lake	S2	0.2400
Monitored Lake	S3	0.0270
Monitored Lake	Slipper	0.0410

- Conclusions:
  Model fit for Kodiak Lake and site S2 is weak. Model fit for 1616-30 (LLCF), Grizzly, Leslie, Moose, Nema, Slipper, and S3 is poor.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total phosphate-P for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.55e-03	3.39e-03	9.67e-04	1.94e-03	5.93e-03	2.83e-03
Kodiak	6.90e-03	8.45e-03	2.41e-03	4.83e-03	1.48e-02	7.04e-03
Leslie	4.93e-03	5.78e-03	1.87e-03	3.06e-03	1.09e-02	5.49e-03
1616-30 (LLCF)	5.24e-03	5.86e-03	1.71e-03	3.31e-03	1.04e-02	5.01e-03
Moose	6.08e-03	6.27e-03	1.79e-03	3.59e-03	1.10e-02	5.23e-03
Nema	6.53e-03	5.68e-03	1.64e-03	3.23e-03	9.99e-03	4.79e-03
Slipper	5.90e-03	6.70e-03	1.91e-03	3.83e-03	1.17e-02	5.59e-03
S2	2.32e-03	2.90e-03	9.11e-04	1.57e-03	5.37e-03	2.67e-03
S3	1.95e-03	1.81e-03	6.47e-04	8.99e-04	3.65e-03	1.89e-03
Nanuq	4.02e-03	2.91e-03	8.75e-04	1.61e-03	5.24e-03	NA
Counts	1.11e-02	1.01e-02	2.89e-03	5.80e-03	1.77e-02	NA
Vulture	2.32e-03	1.84e-03	6.85e-04	8.84e-04	3.82e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Phosphorus	August	Koala	Lake	Water	none	log e	Tobit regression	#2 shared slopes	lake specific	Kodiak

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

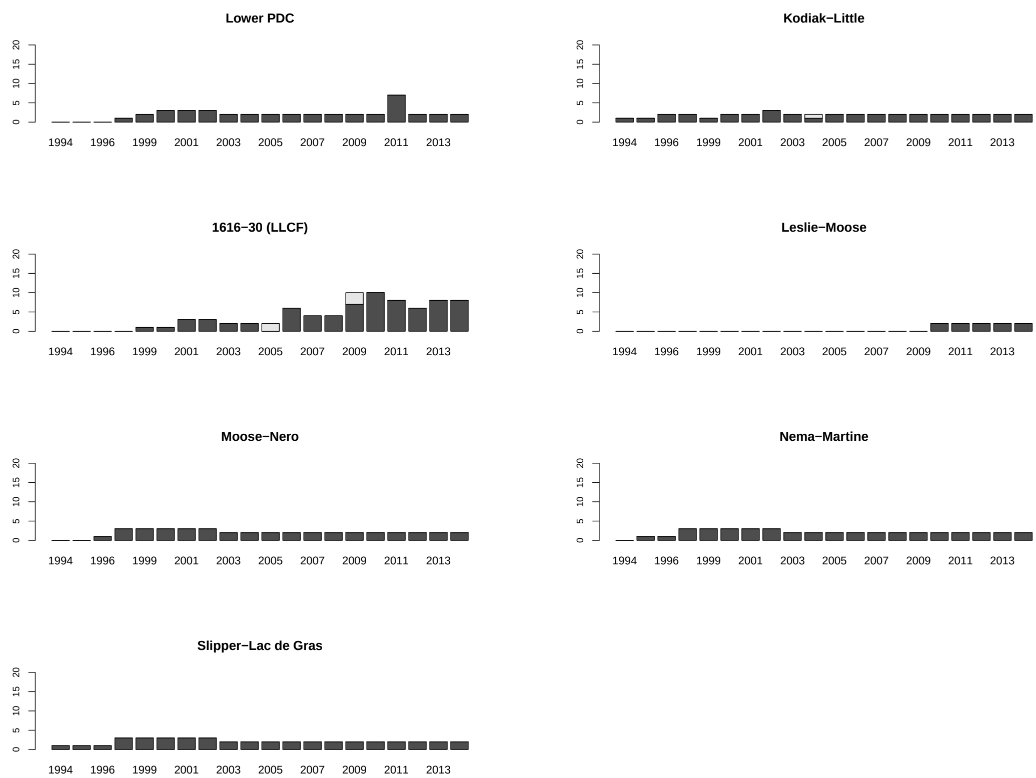
Analysis of August Total Phosphate-P in Koala Watershed Streams

November 10, 2014

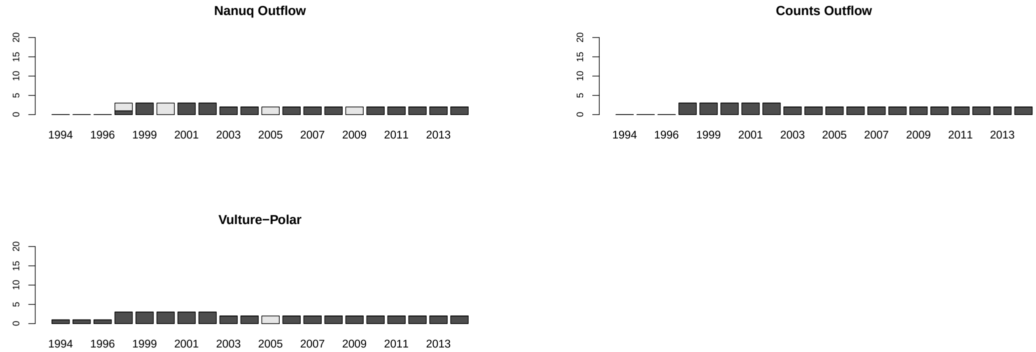
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

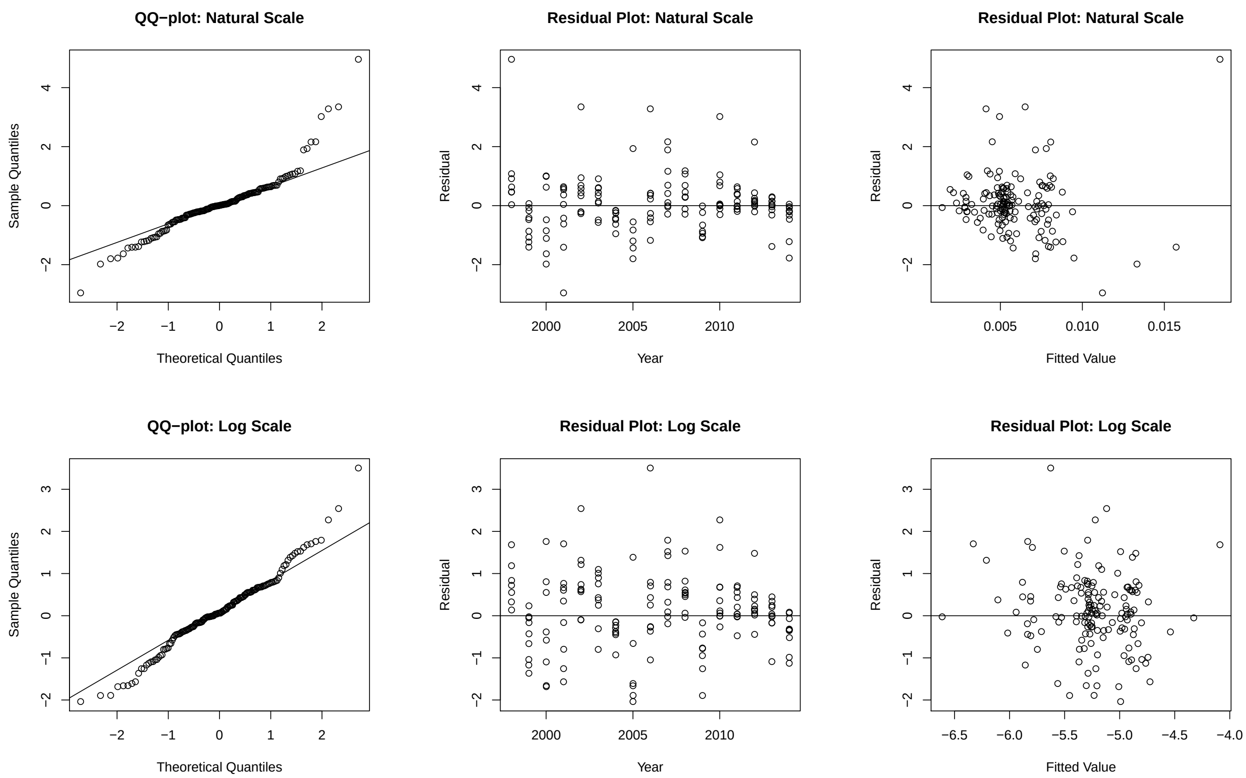


1.2 Reference



Comment:
10-60% of data in Nanuq Outflow was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
13	1616-30 (LLCF)	2006	0.01	0.00	3.28
47	Kodiak-Little	1998	0.03	0.02	4.96
59	Kodiak-Little	2010	0.01	0.00	3.02
156	Nema-Martine	2002	0.01	0.01	3.35

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
13	1616-30 (LLCF)	2006	0.01	-5.63	3.50

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
122.81	6.00	0.00

- Conclusions:
The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
9.84	4.00	0.04

- Conclusions:
The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.762	0.238	0.000	Ref. Model 1

- Conclusions:
AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	0.2878	2	0.8660
Kodiak-Little	21.9540	2	0.0000
Leslie-Moose	0.0654	2	0.9678
1616-30 (LLCF)	8.4229	2	0.0148
Moose-Nero	5.0889	2	0.0785
Nema-Martine	2.8793	2	0.2370
Slipper-Lac de Gras	0.4847	2	0.7848

- Conclusions:
  Kodiak-Little and 1616-30 (LLCF) show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Kodiak-Little-vs-Nanuq Outflow	127.0911	3	0.0000
Kodiak-Little-vs-Counts Outflow	7.4904	3	0.0578
Kodiak-Little-vs-Vulture-Polar	22.5580	3	0.0000
1616-30 (LLCF)-vs-Nanuq Outflow	20.1490	3	0.0002
1616-30 (LLCF)-vs-Counts Outflow	42.8046	3	0.0000
1616-30 (LLCF)-vs-Vulture-Polar	8.1172	3	0.0437

- Conclusions:
  All remaining monitored streams show significant deviation from the common slope of reference streams.

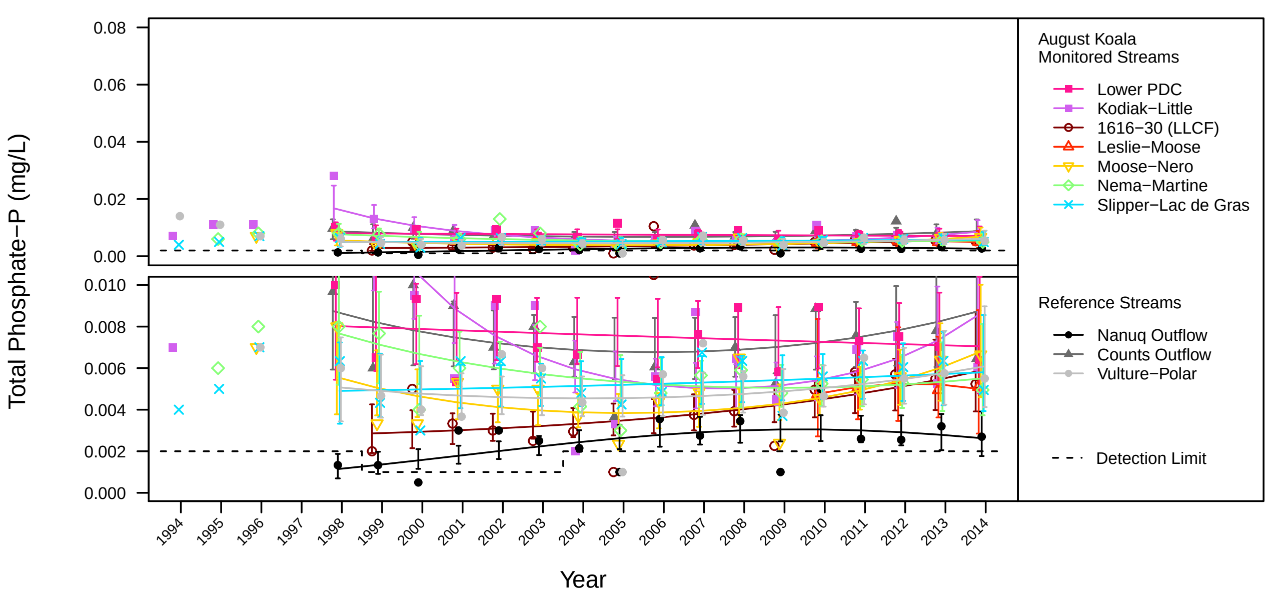
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.0880
Reference Stream	Nanuq Outflow	0.2770
Reference Stream	Vulture-Polar	0.0450
Monitored Stream	1616-30 (LLCF)	0.1820
Monitored Stream	Kodiak-Little	0.3880
Monitored Stream	Leslie-Moose	0.5290
Monitored Stream	Lower PDC	0.0340
Monitored Stream	Moose-Nero	0.2510
Monitored Stream	Nema-Martine	0.1550
Monitored Stream	Slipper-Lac de Gras	0.0540

- Conclusions:
  Model fit for Nanuq Outflow, Kodiak-Little , and Moose-Nero is weak. Model fit for Counts Outflow, Vulture-Polar, 1616-30 (LLCF), Lower PDC, Nema-Martine, and Slipper-Lac de Gras is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total phosphate-P for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	6.40e-03	7.05e-03	1.40e-03	4.78e-03	1.04e-02	4.09e-03
Kodiak-Little	6.05e-03	8.54e-03	1.69e-03	5.79e-03	1.26e-02	4.95e-03
Leslie-Moose	5.10e-03	5.00e-03	1.44e-03	2.85e-03	8.79e-03	4.21e-03
1616-30 (LLCF)	5.24e-03	5.83e-03	1.18e-03	3.91e-03	8.68e-03	3.47e-03
Moose-Nero	6.65e-03	6.79e-03	1.35e-03	4.60e-03	1.00e-02	3.94e-03
Nema-Martine	4.95e-03	5.51e-03	1.09e-03	3.73e-03	8.12e-03	3.19e-03
Slipper-Lac de Gras	4.95e-03	5.80e-03	1.15e-03	3.93e-03	8.55e-03	3.36e-03
Nanuq Outflow	2.70e-03	2.63e-03	5.32e-04	1.77e-03	3.91e-03	NA
Counts Outflow	6.45e-03	8.72e-03	1.73e-03	5.91e-03	1.29e-02	NA
Vulture-Polar	5.50e-03	6.08e-03	1.21e-03	4.12e-03	8.97e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Phosphorus	August	Koala	Stream	Water	none	log e	Tobit regression	#1b separate intercepts & slopes	lake specific	Kodiak-Littl 1616-30 (LLCF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

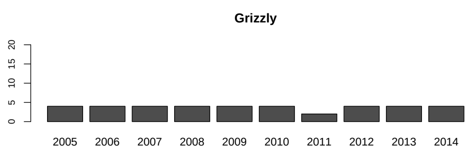
Analysis of April Total Organic Carbon in Lakes of the Koala Watershed and Lac de Gras

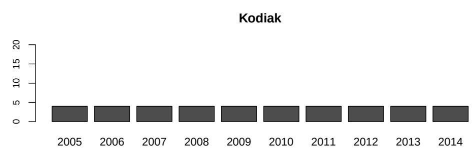
November 10, 2014

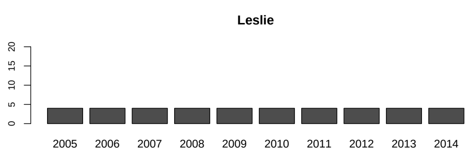
1 Censored Values:

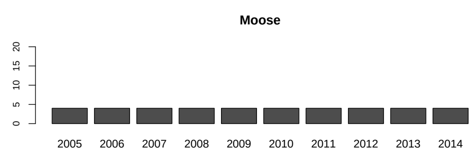
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

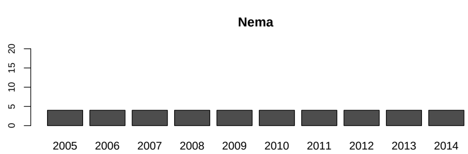
1.1 Monitored

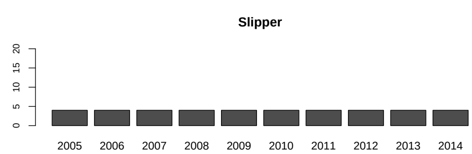


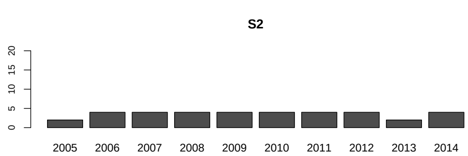




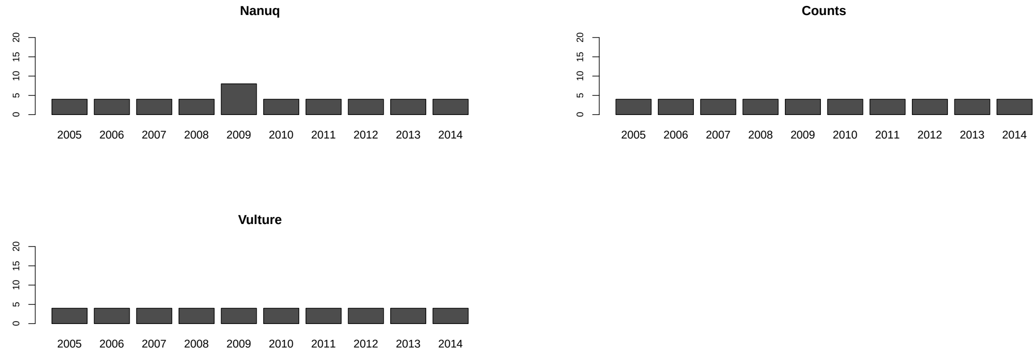






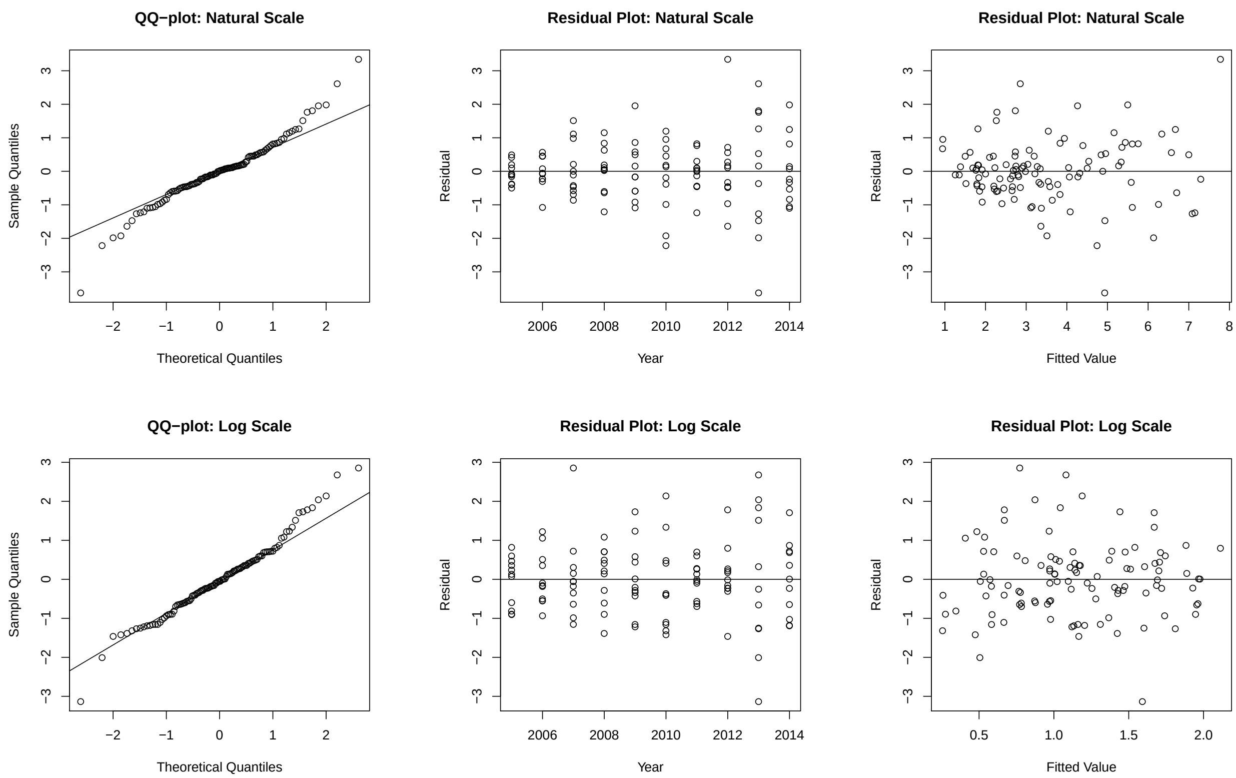


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
82	Kodiak	2012	8.84	7.78	3.34
104	Leslie	2013	3.78	4.93	-3.63

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
104	Leslie	2013	3.78	1.59	-3.14

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.12E-63	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
58.72	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
8.37	4.00	0.08

- Conclusions:
  The slopes do not differ significantly among reference lakes.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. AIC suggests that reference lakes are best modeled using separate slopes and intercepts. Contrasts suggest that reference lakes share a common slope; however, these results are marginally significant, suggesting that there may be important differences in reference lake slopes. Proceeding with monitored contrasts using reference model 1b (fitting separate slopes and intercepts for reference lakes).

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	5.06	2.00	0.08
Kodiak	10.36	2.00	0.01
Leslie	21.65	2.00	0.00
Moose	27.65	2.00	0.00
Nema	18.70	2.00	0.00
Slipper	17.66	2.00	0.00
S2	5.35	2.00	0.07
S3	6.33	2.00	0.04

- Conclusions:
  All monitored lakes except Grizzly, S2, and S3 show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Kodiak-vs-Nanuq	1.5059	3	0.6809
Kodiak-vs-Counts	7.4582	3	0.0586
Kodiak-vs-Vulture	96.4274	3	0.0000
Leslie-vs-Nanuq	1.7740	3	0.6206
Leslie-vs-Counts	11.8048	3	0.0081
Leslie-vs-Vulture	17.5450	3	0.0005
Moose-vs-Nanuq	2.2974	3	0.5130
Moose-vs-Counts	17.9522	3	0.0004
Moose-vs-Vulture	10.9693	3	0.0119
Nema-vs-Nanuq	1.4052	3	0.7043
Nema-vs-Counts	1.6990	3	0.6372
Nema-vs-Vulture	42.9102	3	0.0000
Slipper-vs-Nanuq	1.2982	3	0.7296
Slipper-vs-Counts	8.0926	3	0.0441
Slipper-vs-Vulture	22.6443	3	0.0000

- Conclusions:
  Of the remainining monitored lakes, Leslie, Moose, and Slipper show deviation from the slopes of individual reference lakes. However, the trend in Kodiak and Nema lakes differ from the slope in only one reference lake (i.e., Vulture Lake)

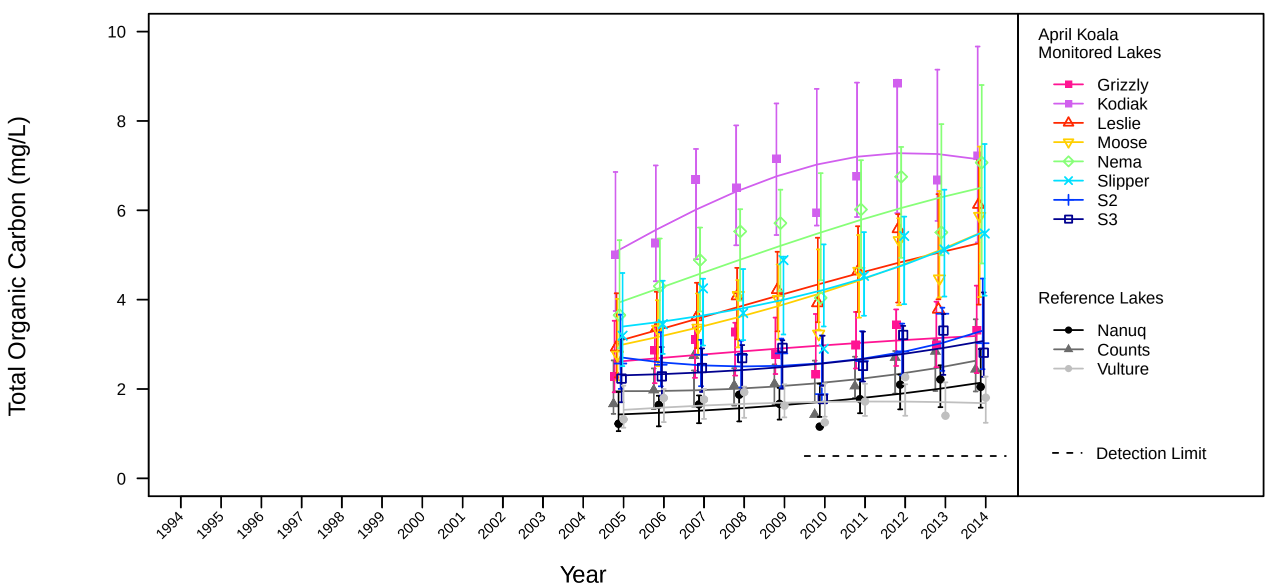
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.2230
Reference Lake	Nanuq	0.4020
Reference Lake	Vulture	0.0450
Monitored Lake	Grizzly	0.2390
Monitored Lake	Kodiak	0.6040
Monitored Lake	Leslie	0.6740
Monitored Lake	Moose	0.7580
Monitored Lake	Nema	0.6090
Monitored Lake	S2	0.2980
Monitored Lake	S3	0.2820
Monitored Lake	Slipper	0.5210

- Conclusions:
  Model fit for Counts, Nanuq, Grizzly, S2 and S3 Lake is weak. Model fit for Vulture Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.32E+00	3.19E+00	4.92E-01	2.36E+00	4.31E+00	1.44E+00
Kodiak	7.22E+00	7.15E+00	1.10E+00	5.28E+00	9.67E+00	3.22E+00
Leslie	6.13E+00	5.26E+00	8.11E-01	3.89E+00	7.12E+00	2.37E+00
Moose	5.87E+00	5.49E+00	8.46E-01	4.06E+00	7.43E+00	2.48E+00
Nema	7.07E+00	6.51E+00	1.00E+00	4.81E+00	8.80E+00	2.94E+00
Slipper	5.48E+00	5.53E+00	8.53E-01	4.09E+00	7.48E+00	2.50E+00
S2	3.02E+00	3.31E+00	5.10E-01	2.44E+00	4.47E+00	1.49E+00
S3	2.81E+00	3.08E+00	4.74E-01	2.27E+00	4.16E+00	1.39E+00
Nanuq	2.05E+00	2.14E+00	3.30E-01	1.58E+00	2.89E+00	
Counts	2.44E+00	2.63E+00	4.06E-01	1.95E+00	3.56E+00	
Vulture	1.81E+00	1.68E+00	2.60E-01	1.24E+00	2.28E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
TOC	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	NA	Leslie Moose Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

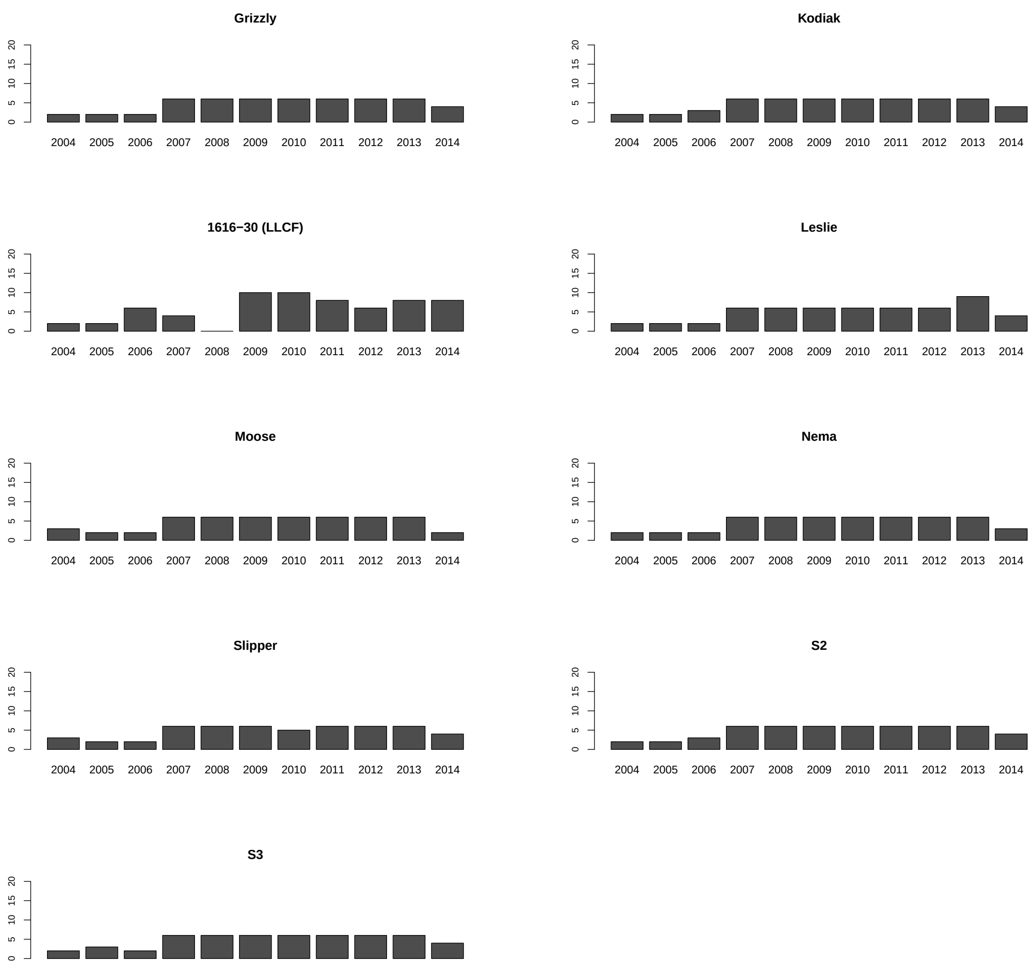
Analysis of August Total Organic Carbon in Lakes of the Koala Watershed and Lac de Gras

November 10, 2014

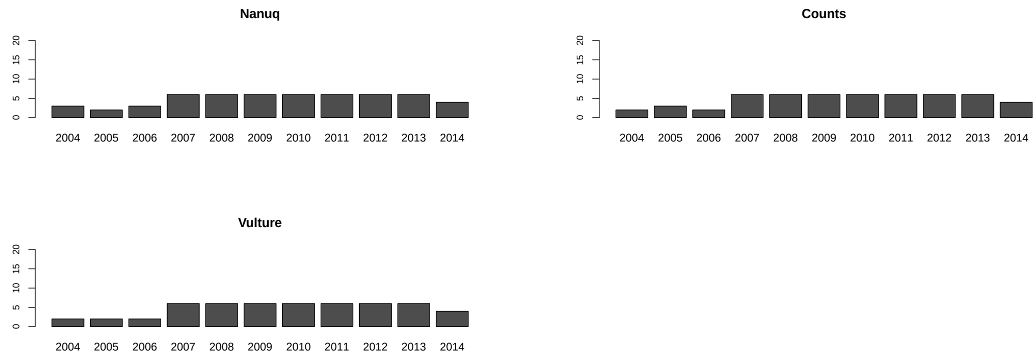
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

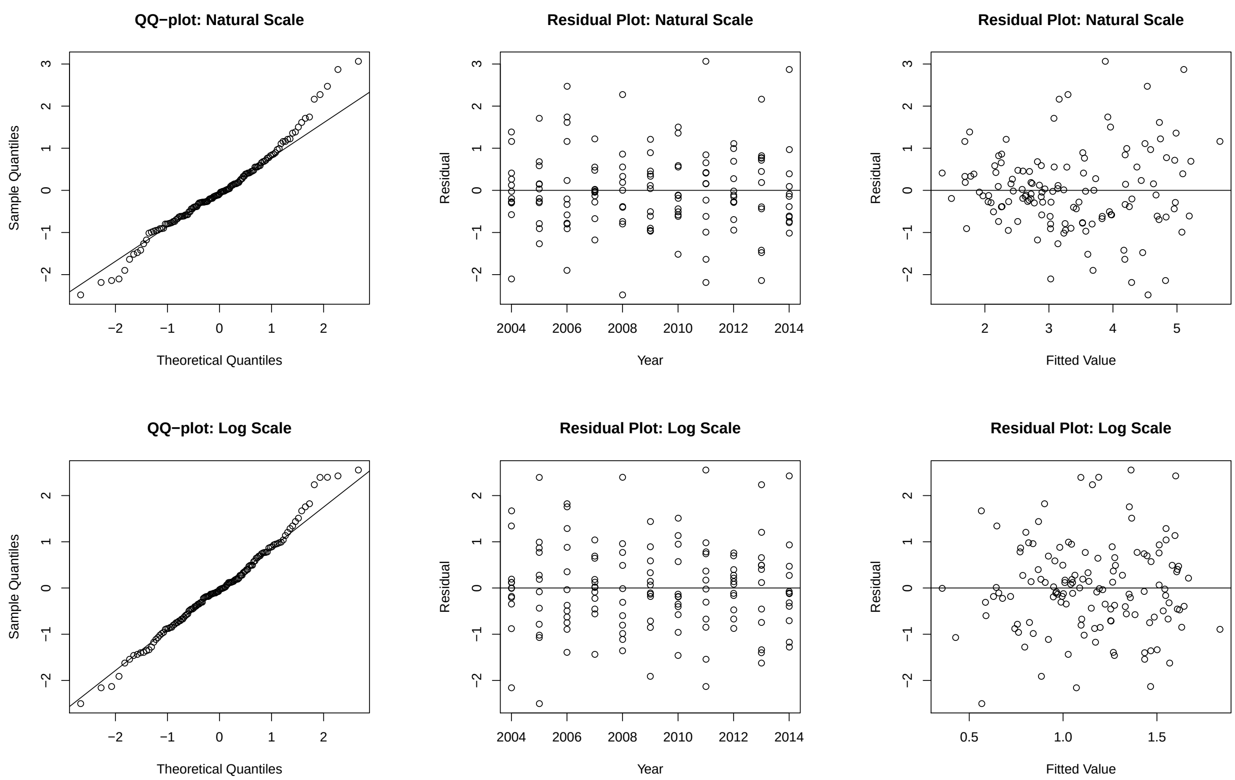


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
18	1616-30 (LLCF)	2011	4.57	3.88	3.06

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
118.70	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
11.48	4.00	0.02

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	3.4404	2	0.1790
Kodiak	5.1098	2	0.0777
1616-30 (LLCF)	37.2987	2	0.0000
Leslie	48.1809	2	0.0000
Moose	32.4062	2	0.0000
Nema	30.3092	2	0.0000
Slipper	19.6616	2	0.0001
S2	3.1978	2	0.2021
S3	0.4716	2	0.7900

- Conclusions:
  Leslie, Moose, Nema, and Slipper lakes show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-30 (LLCF)-vs-Nanuq	4.3703	3	0.2242
1616-30 (LLCF)-vs-Counts	13.3658	3	0.0039
1616-30 (LLCF)-vs-Vulture	15.6036	3	0.0014
Leslie-vs-Nanuq	581.8276	3	0.0000
Leslie-vs-Counts	235.9419	3	0.0000
Leslie-vs-Vulture	543.5216	3	0.0000
Moose-vs-Nanuq	648.8258	3	0.0000
Moose-vs-Counts	269.1795	3	0.0000
Moose-vs-Vulture	604.6520	3	0.0000
Nema-vs-Nanuq	773.9948	3	0.0000
Nema-vs-Counts	348.8004	3	0.0000
Nema-vs-Vulture	727.0197	3	0.0000
Slipper-vs-Nanuq	612.4355	3	0.0000
Slipper-vs-Counts	239.6014	3	0.0000
Slipper-vs-Vulture	565.0737	3	0.0000

- Conclusions:
  All remaining monitored lakes show significant deviation from the slopes of individual reference lakes.

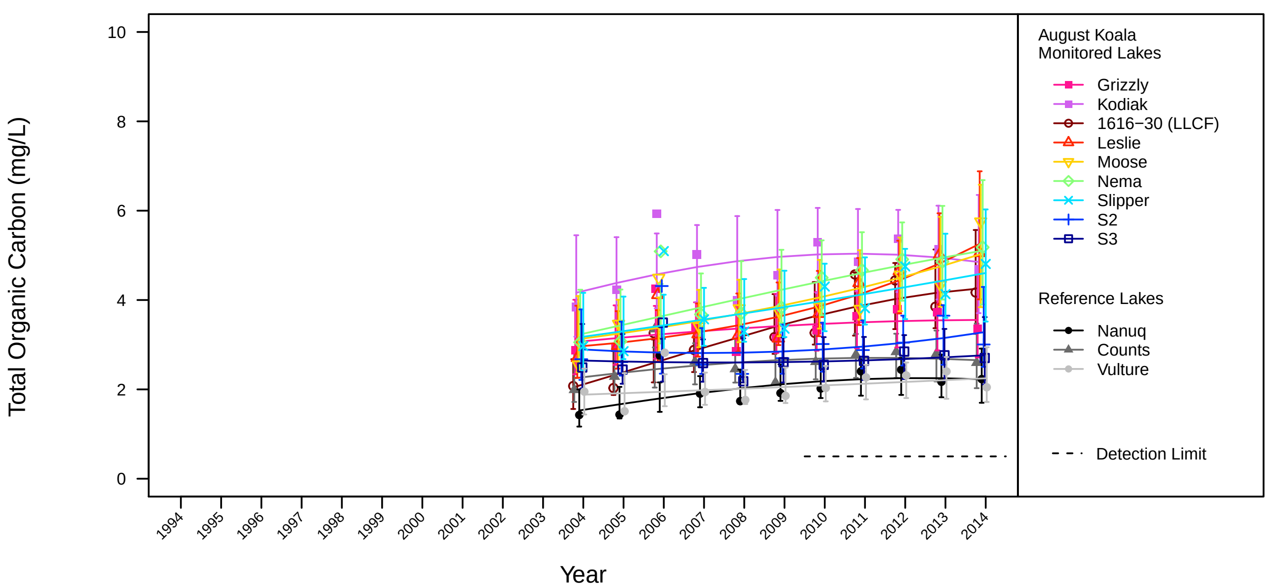
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.1900
Reference Lake	Nanuq	0.4080
Reference Lake	Vulture	0.1230
Monitored Lake	1616-30 (LLCF)	0.8230
Monitored Lake	Grizzly	0.1650
Monitored Lake	Kodiak	0.2230
Monitored Lake	Leslie	0.7620
Monitored Lake	Moose	0.5920
Monitored Lake	Nema	0.6090
Monitored Lake	S2	0.0860
Monitored Lake	S3	0.0280
Monitored Lake	Slipper	0.3830

- Conclusions:
Model fit for Nanuq, Kodiak, and Slipper is weak. Model fit for Counts, Vulture, Grizzly, S2, and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.35E+00	3.55E+00	4.88E-01	2.72E+00	4.65E+00	1.43E+00
Kodiak	4.69E+00	4.85E+00	6.67E-01	3.71E+00	6.35E+00	1.95E+00
Leslie	5.05E+00	5.26E+00	7.22E-01	4.02E+00	6.88E+00	2.11E+00
1616-30 (LLCF)	4.17E+00	4.25E+00	5.85E-01	3.24E+00	5.57E+00	1.71E+00
Moose	5.75E+00	5.03E+00	6.91E-01	3.84E+00	6.58E+00	2.02E+00
Nema	5.18E+00	5.11E+00	7.02E-01	3.90E+00	6.68E+00	2.05E+00
Slipper	4.81E+00	4.61E+00	6.33E-01	3.52E+00	6.03E+00	1.85E+00
S2	3.00E+00	3.28E+00	4.51E-01	2.50E+00	4.29E+00	1.32E+00
S3	2.70E+00	2.76E+00	3.80E-01	2.11E+00	3.62E+00	1.11E+00
Nanuq	2.23E+00	2.23E+00	3.06E-01	1.70E+00	2.91E+00	
Counts	2.60E+00	2.65E+00	3.65E-01	2.03E+00	3.47E+00	
Vulture	2.05E+00	2.25E+00	3.09E-01	1.72E+00	2.94E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
TOC	August	Koala	Lake	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	NA	1616-30 (LLCF) Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

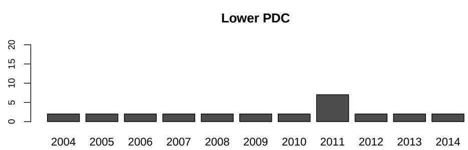
Analysis of August Total Organic Carbon in Koala Watershed Streams

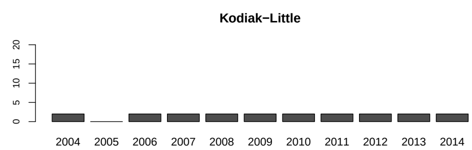
November 10, 2014

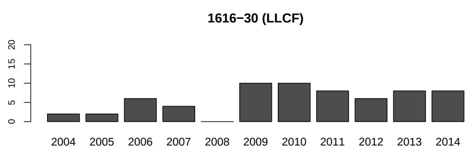
1 Censored Values:

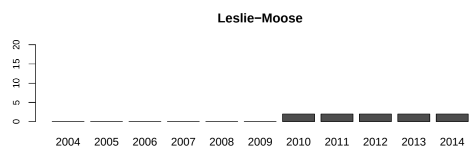
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

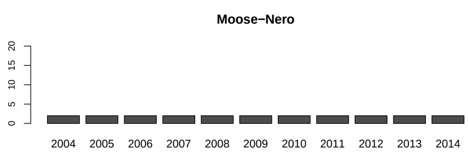
1.1 Monitored

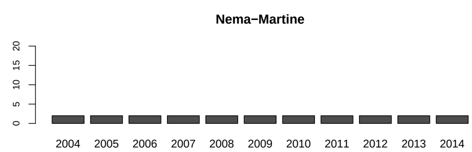


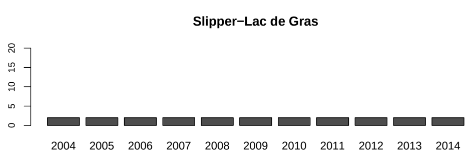




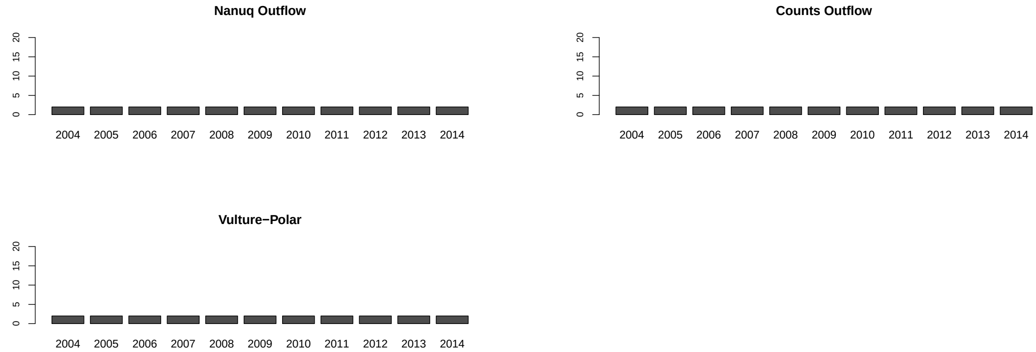






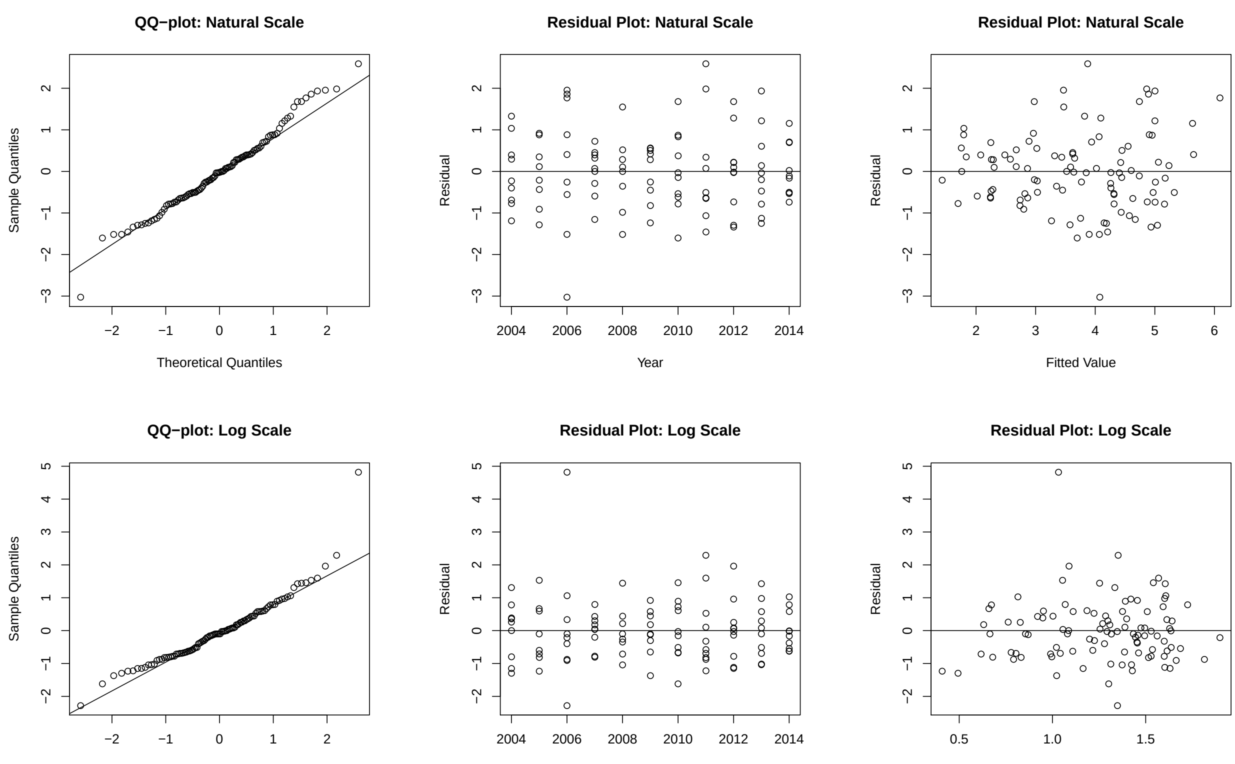


1.2 Reference



Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
13	1616-30 (LLCF)	2006	3.26	4.08	-3.03

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
139	Nanuq Outflow	2006	4.00	1.03	4.82

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
21.29	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
7.57	4.00	0.11

- Conclusions:
  The slopes do not differ significantly among reference streams.

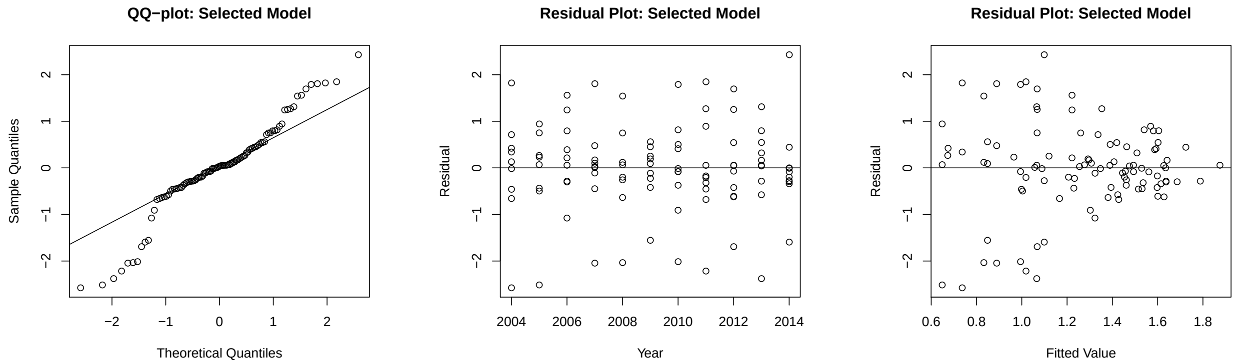
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference streams are best modeled using separate slopes and intercepts, contrasts suggest that reference streams share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference streams) to avoid defaulting to comparing trends in monitored streams against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference stream slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
Lower PDC	0.1447	2	0.9302
Kodiak-Little	1.0432	2	0.5936
Leslie-Moose	0.1764	2	0.9156
1616-30 (LLCF)	2.2787	2	0.3200
Moose-Nero	2.2468	2	0.3252
Nema-Martine	3.9470	2	0.1390
Slipper-Lac de Gras	0.6079	2	0.7379

- Conclusions:
  No significant deviations were found when comparing monitored streams to reference streams.

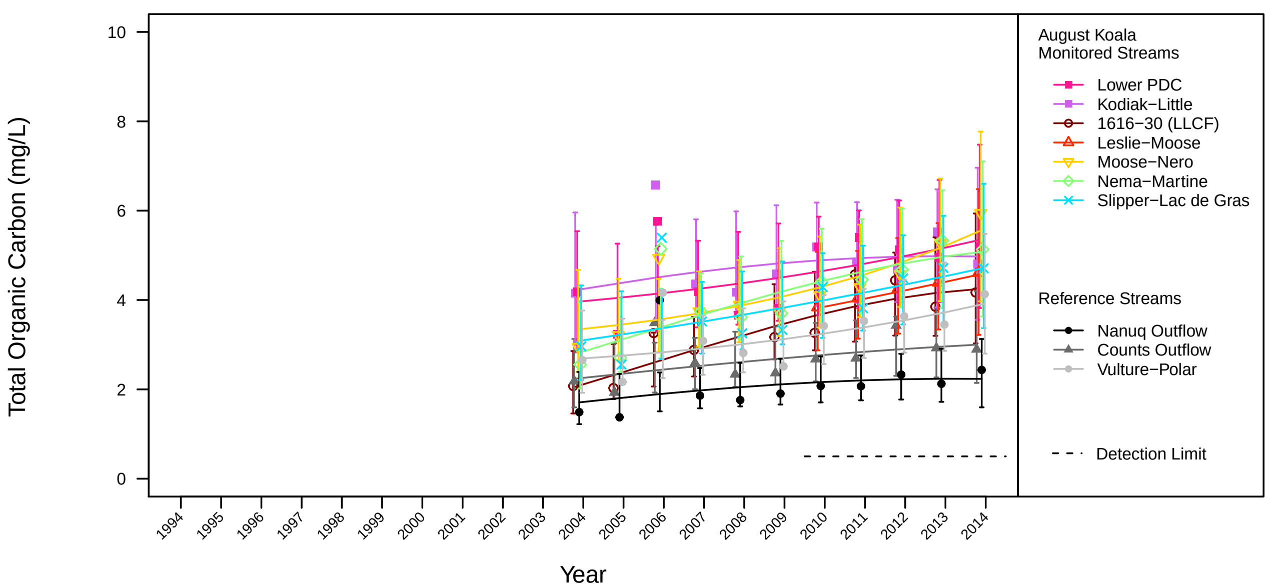
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.1240
Monitored Stream	1616-30 (LLCF)	0.8240
Monitored Stream	Kodiak-Little	0.1300
Monitored Stream	Leslie-Moose	0.9770
Monitored Stream	Lower PDC	0.2840
Monitored Stream	Moose-Nero	0.6610
Monitored Stream	Nema-Martine	0.6260
Monitored Stream	Slipper-Lac de Gras	0.3750

- Conclusions:
  Model fit for the Lower PDC and Slipper-Lac de Gras is weak. Model fit for pooled reference streams and Kodiak-Little is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	5.19E+00	5.35E+00	9.16E-01	3.82E+00	7.48E+00	2.68E+00
Kodiak-Little	4.80E+00	4.98E+00	8.52E-01	3.56E+00	6.96E+00	2.49E+00
Leslie-Moose	4.61E+00	4.57E+00	8.16E-01	3.22E+00	6.48E+00	2.39E+00
1616-30 (LLCF)	4.17E+00	4.24E+00	7.28E-01	3.03E+00	5.94E+00	2.13E+00
Moose-Nero	5.95E+00	5.55E+00	9.51E-01	3.97E+00	7.77E+00	2.78E+00
Nema-Martine	5.13E+00	5.08E+00	8.70E-01	3.63E+00	7.11E+00	2.55E+00
Slipper-Lac de Gras	4.71E+00	4.72E+00	8.08E-01	3.37E+00	6.60E+00	2.36E+00
Nanuq Outflow	2.44E+00	2.24E+00	3.83E-01	1.60E+00	3.13E+00	
Counts Outflow	2.90E+00	3.00E+00	5.14E-01	2.14E+00	4.20E+00	
Vulture-Polar	4.13E+00	3.92E+00	6.71E-01	2.80E+00	5.48E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Becnh-mark	Significant Monitored Con-trasts*
TOC	August	Koala	Stream	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

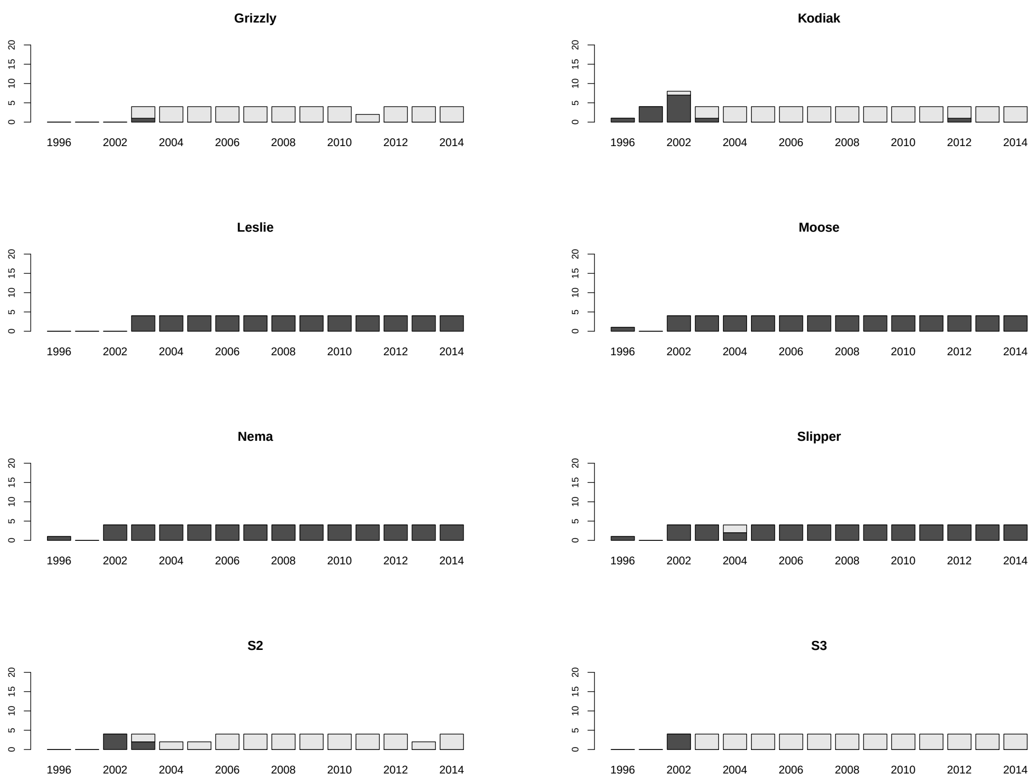
Analysis of April Total Antimony in Lakes of the Koala Watershed and Lac de Gras

November 14, 2014

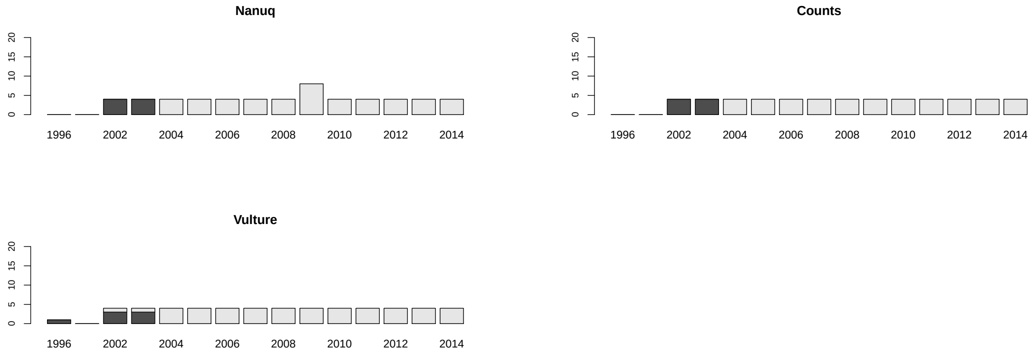
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

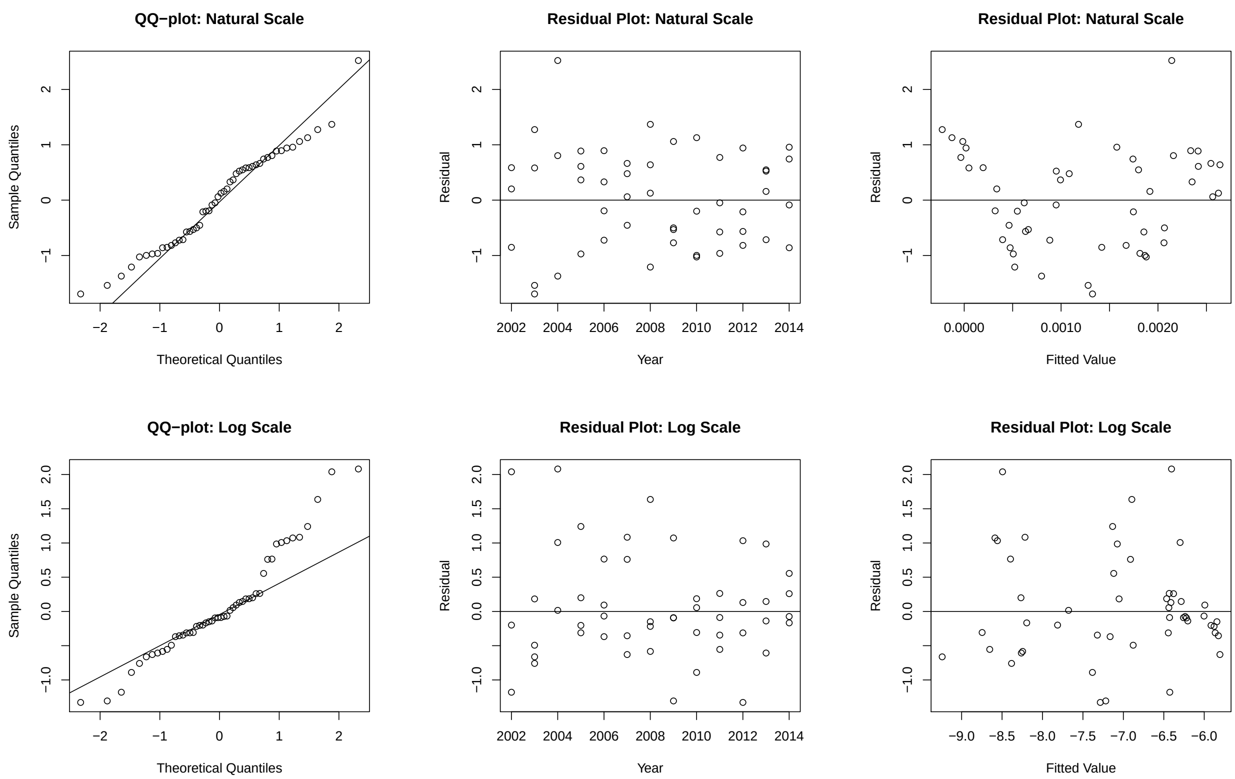


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Grizzly, and Kodiak lakes, and sites S2 and S3, was less than the detection limit. These lakes were excluded from further analyses. None of the remaining lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	5.69E-154	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Leslie	6.18	2.00	0.05
Moose	10.08	2.00	0.01
Nema	1.85	2.00	0.40
Slipper	0.00	2.00	1.00

- Conclusions:
  Leslie and Moose lakes show significant deviation from a slope of zero.

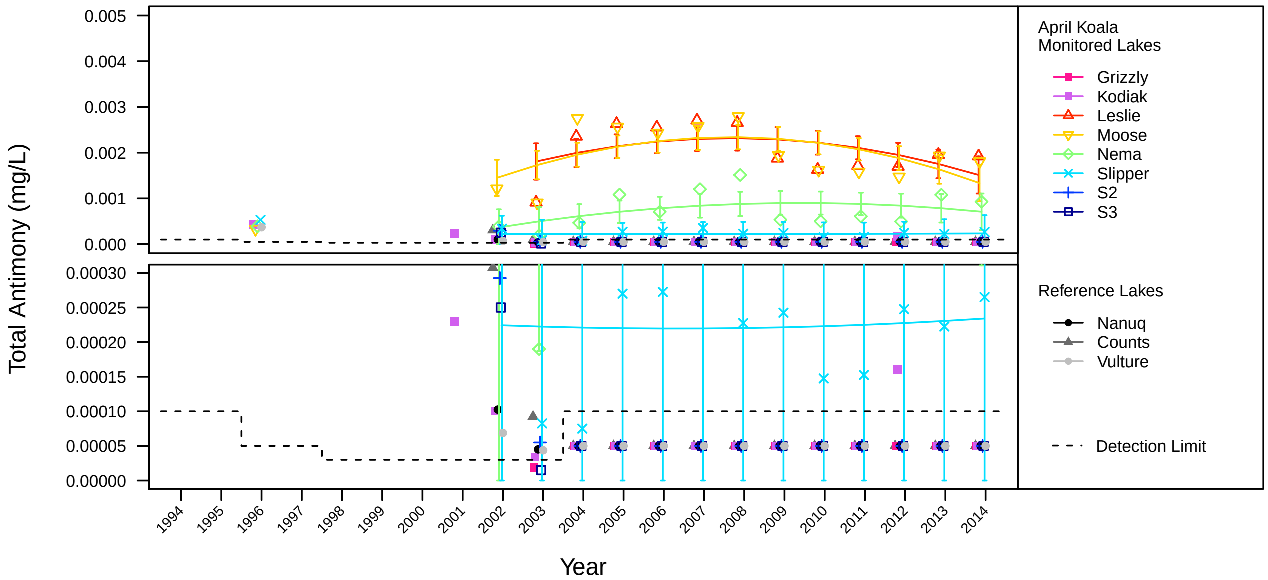
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Leslie	0.2360
Monitored Lake	Moose	0.3170
Monitored Lake	Nema	0.1960
Monitored Lake	Slipper	0.0040

- Conclusions:
  Model fit for Leslie and Moose lakes is weak. Model fit for Nema and Slipper lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total antimony for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie	1.92e-03	1.51e-03	2.07e-04	1.11e-03	1.92e-03	6.06e-04
Moose	1.81e-03	1.34e-03	2.03e-04	9.37e-04	1.73e-03	5.94e-04
Nema	9.28e-04	7.09e-04	2.03e-04	3.11e-04	1.11e-03	5.94e-04
Slipper	2.65e-04	2.34e-04	2.03e-04	0.00e+00	6.32e-04	5.94e-04
Nanuq	5.00e-05	NA	NA	NA	NA	NA
Counts	5.00e-05	NA	NA	NA	NA	NA
Vulture	5.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Antimony	April	Koala	Lake	Water	Counts Nanuq Vulture Grizzly Kodiak S2 S3	none	linear mixed effects regression	#1a slope of zero	0.02	Leslie Moose

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

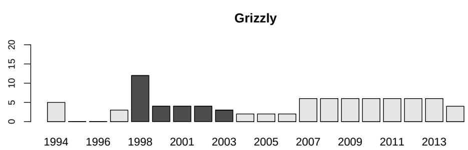
Analysis of August Total Antimony in Lakes of the Koala Watershed and Lac de Gras

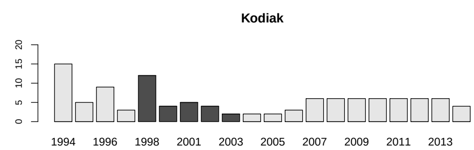
November 12, 2014

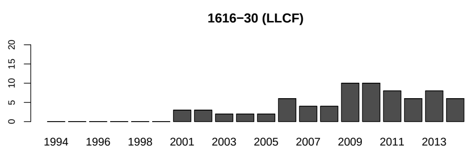
1 Censored Values:

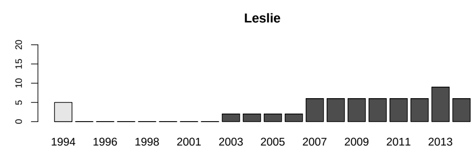
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

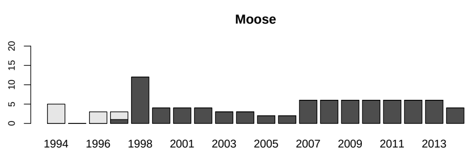
1.1 Monitored

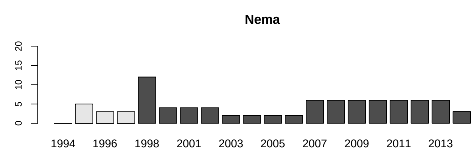


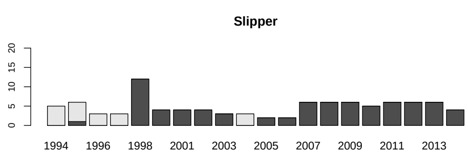


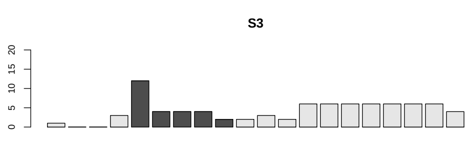




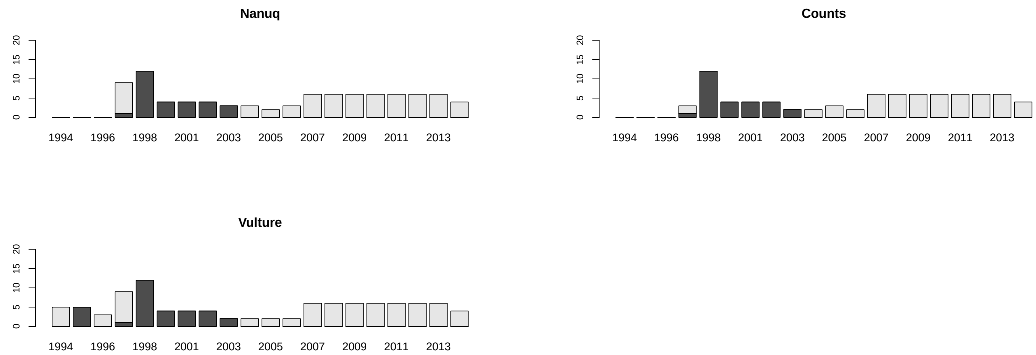






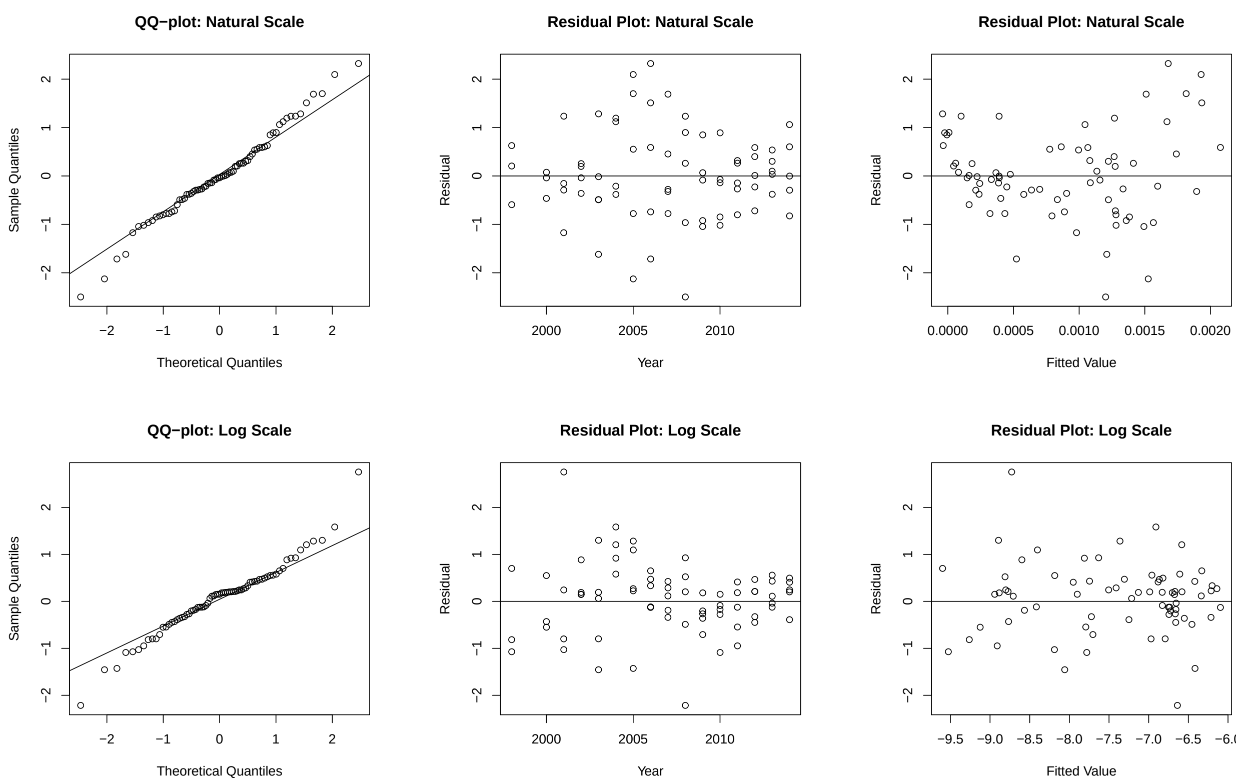


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Grizzly, Kodiak lakes, and sites S2 and S3, was less than the detection limit. These lakes were excluded from further analyses. None of the remaining lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the un-transformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-30 (LLCF)	24.5277	2	0.0000
Leslie	7.6552	2	0.0218
Moose	15.4388	2	0.0004
Nema	2.3698	2	0.3058
Slipper	0.1009	2	0.9508

- Conclusions:
  1616-300 (LLCF), Leslie, and Moose show significant deviation from a slope of zero.

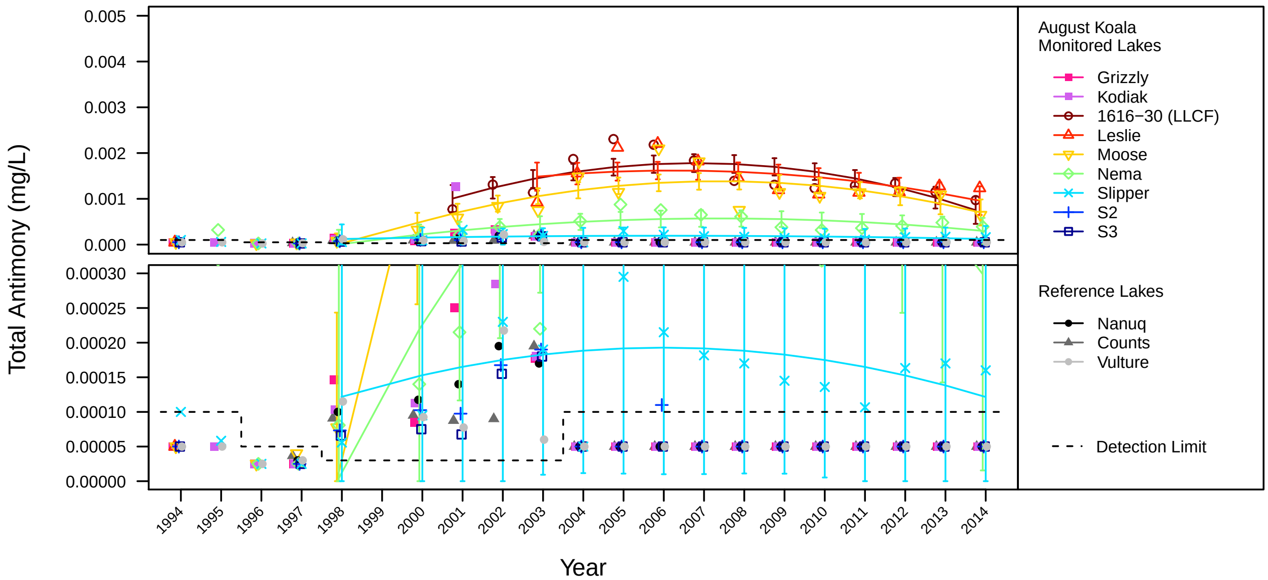
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-30 (LLCF)	0.4960
Monitored Lake	Leslie	0.2510
Monitored Lake	Moose	0.6070
Monitored Lake	Nema	0.5100
Monitored Lake	Slipper	0.1040

- Conclusions:
  Model fit for 1616-30 (LLCF) and Leslie Lake is weak. Model fit for Slipper Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total antimony for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie	1.23e-03	9.59e-04	1.60e-04	6.46e-04	1.27e-03	4.67e-04
1616-30 (LLCF)	9.72e-04	7.52e-04	1.53e-04	4.53e-04	1.05e-03	4.47e-04
Moose	6.45e-04	7.02e-04	1.45e-04	4.18e-04	9.86e-04	4.24e-04
Nema	3.90e-04	2.99e-04	1.45e-04	1.55e-05	5.83e-04	4.24e-04
Slipper	1.60e-04	1.22e-04	1.45e-04	0.00e+00	4.06e-04	4.24e-04
Nanuq	5.00e-05	NA	NA	NA	NA	NA
Counts	5.00e-05	NA	NA	NA	NA	NA
Vulture	5.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Antimony	August	Koala	Lake	Water	Counts Nanuq Vulture Grizzly Kodiak S2 S3	none	linear mixed effects regression	#1a slope of zero	0.02	1616-30 (LLCF) Leslie Moose

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

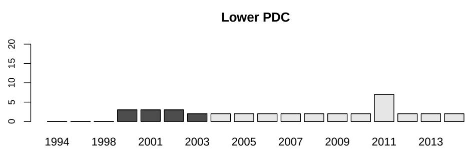
Analysis of August Total Antimony in Koala Watershed Streams

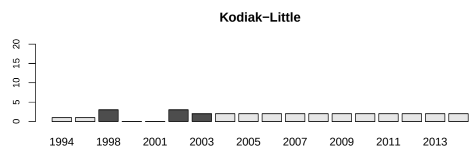
November 12, 2014

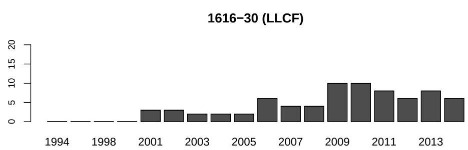
1 Censored Values:

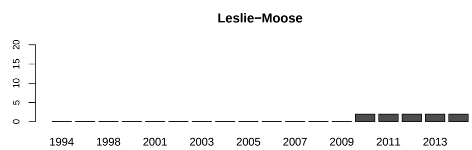
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

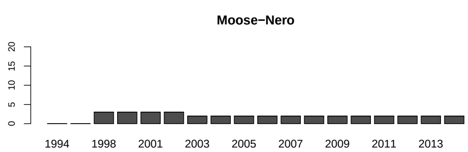
1.1 Monitored

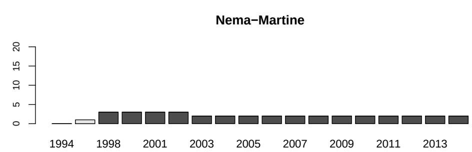


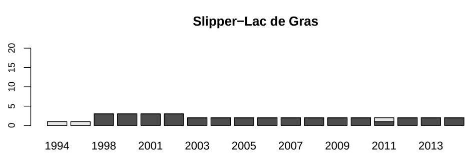




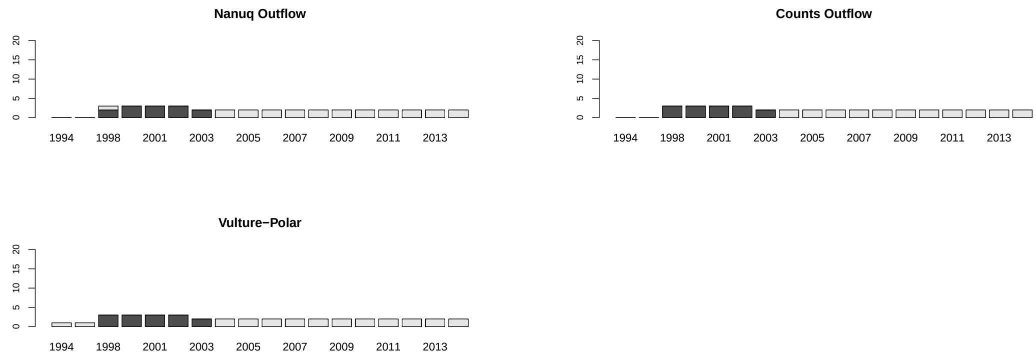






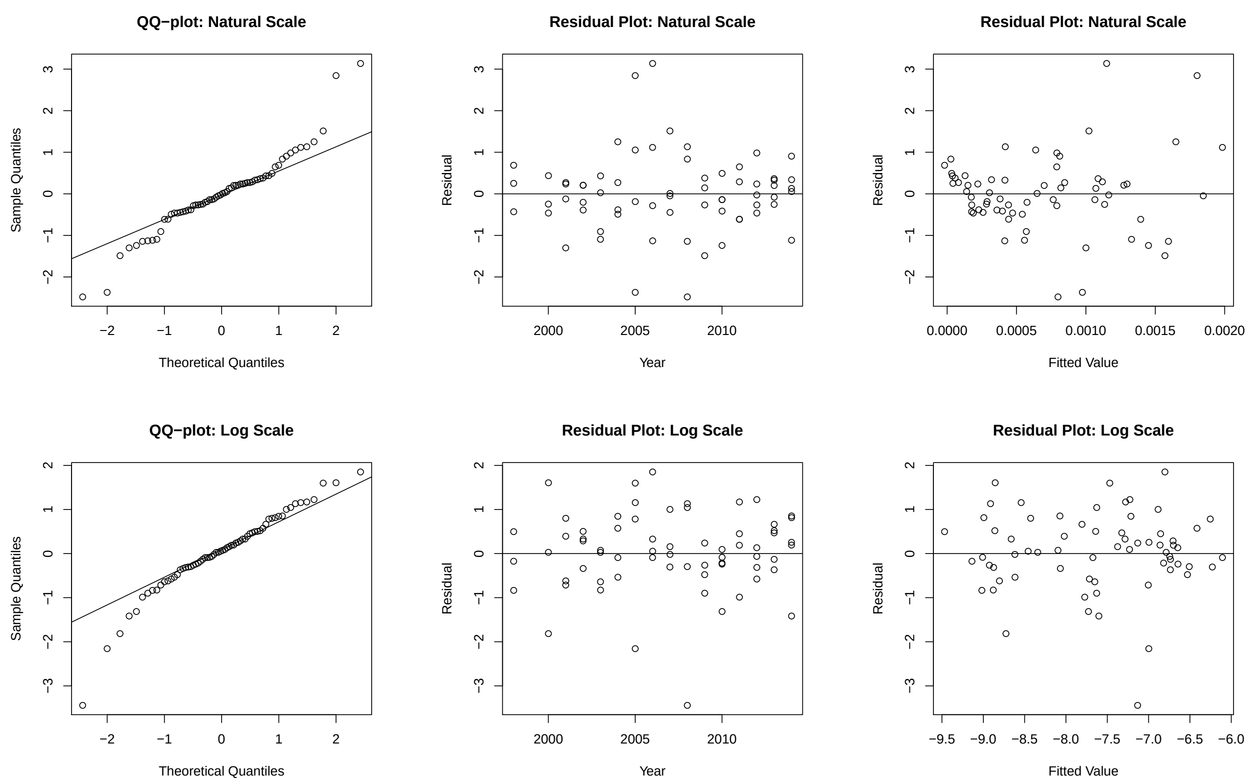


1.2 Reference



Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar, Kodiak-Little, and the Lower PDC was less than the detection limit. These streams were excluded from further analyses. None of the remaining streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
118	Moose-Nero	2006	0.00	0.00	3.14

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.00	-7.13	-3.44

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Leslie-Moose	0.8508	2	0.6535
1616-30 (LLCF)	11.6081	2	0.0030
Moose-Nero	18.4228	2	0.0001
Nema-Martine	15.7393	2	0.0004
Slipper-Lac de Gras	1.7164	2	0.4239

- Conclusions:
  1616-30 (LLCF), Moose-Nero, and Nema-Martine show significant deviation from a slope of zero.

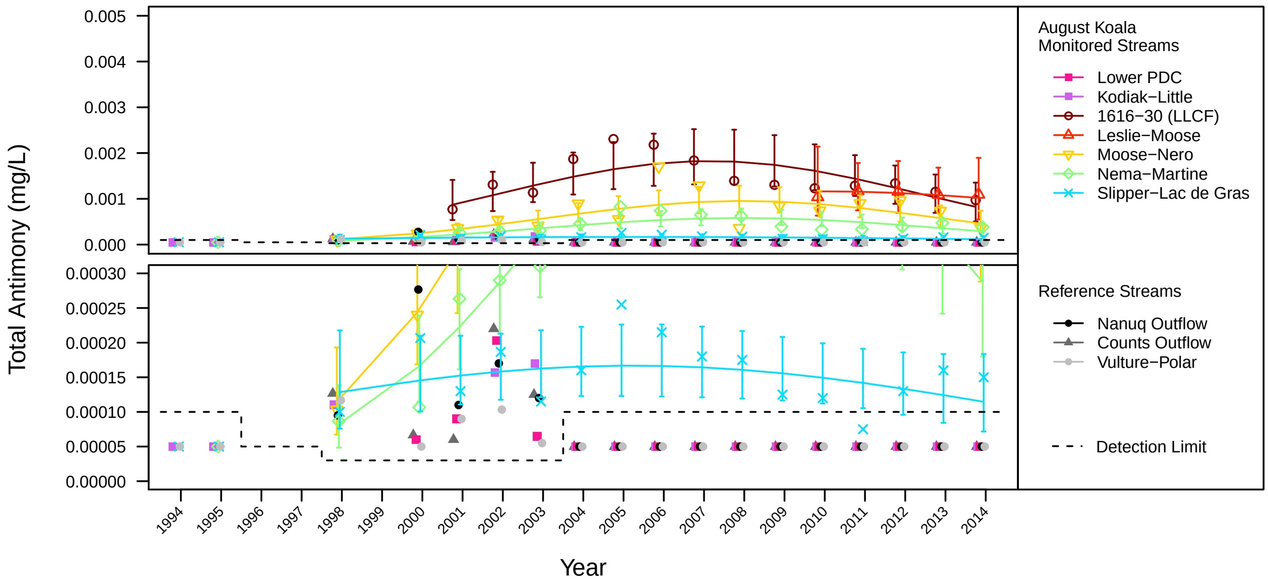
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-30 (LLCF)	0.6060
Monitored Stream	Leslie-Moose	0.4460
Monitored Stream	Moose-Nero	0.7050
Monitored Stream	Nema-Martine	0.7630
Monitored Stream	Slipper-Lac de Gras	0.1390

- Conclusions:
  Model fit for Leslie-Moose is weak. Model fit for Slipper-Lac de Gras is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total antimony for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie-Moose	1.10e-03	1.02e-03	3.23e-04	5.48e-04	1.90e-03	9.44e-04
1616-30 (LLCF)	9.72e-04	8.26e-04	2.08e-04	5.03e-04	1.35e-03	6.10e-04
Moose-Nero	3.60e-04	4.61e-04	1.11e-04	2.88e-04	7.38e-04	3.24e-04
Nema-Martine	3.80e-04	2.88e-04	6.91e-05	1.80e-04	4.61e-04	2.02e-04
Slipper-Lac de Gras	1.50e-04	1.15e-04	2.75e-05	7.16e-05	1.84e-04	8.05e-05
Nanuq Outflow	5.00e-05	NA	NA	NA	NA	NA
Counts Outflow	5.00e-05	NA	NA	NA	NA	NA
Vulture-Polar	5.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Antimony	August	Koala	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar Kodiak-Little Lower PDC	log e	linear mixed effects regression	#1a slope of zero	0.02	1616-30 (LLCF) Moose-Nero Nema-Martine

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

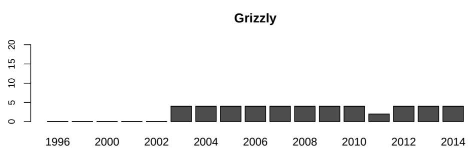
Analysis of April Total Arsenic in Lakes of the Koala Watershed and Lac de Gras

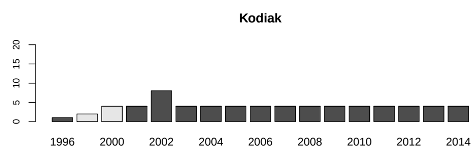
November 12, 2014

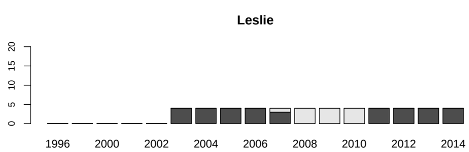
1 Censored Values:

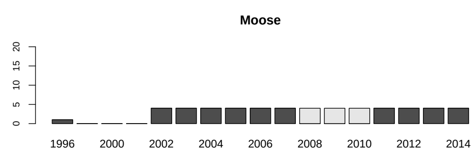
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

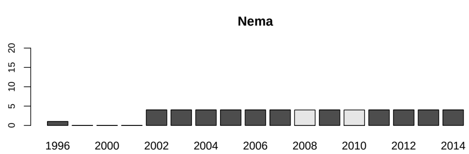
1.1 Monitored

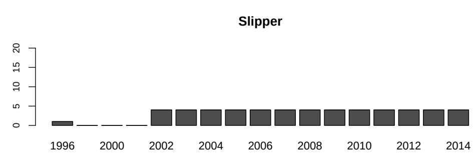




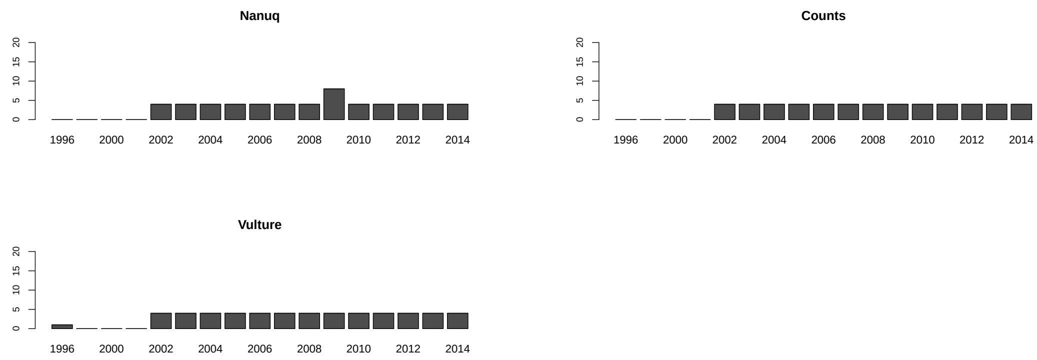






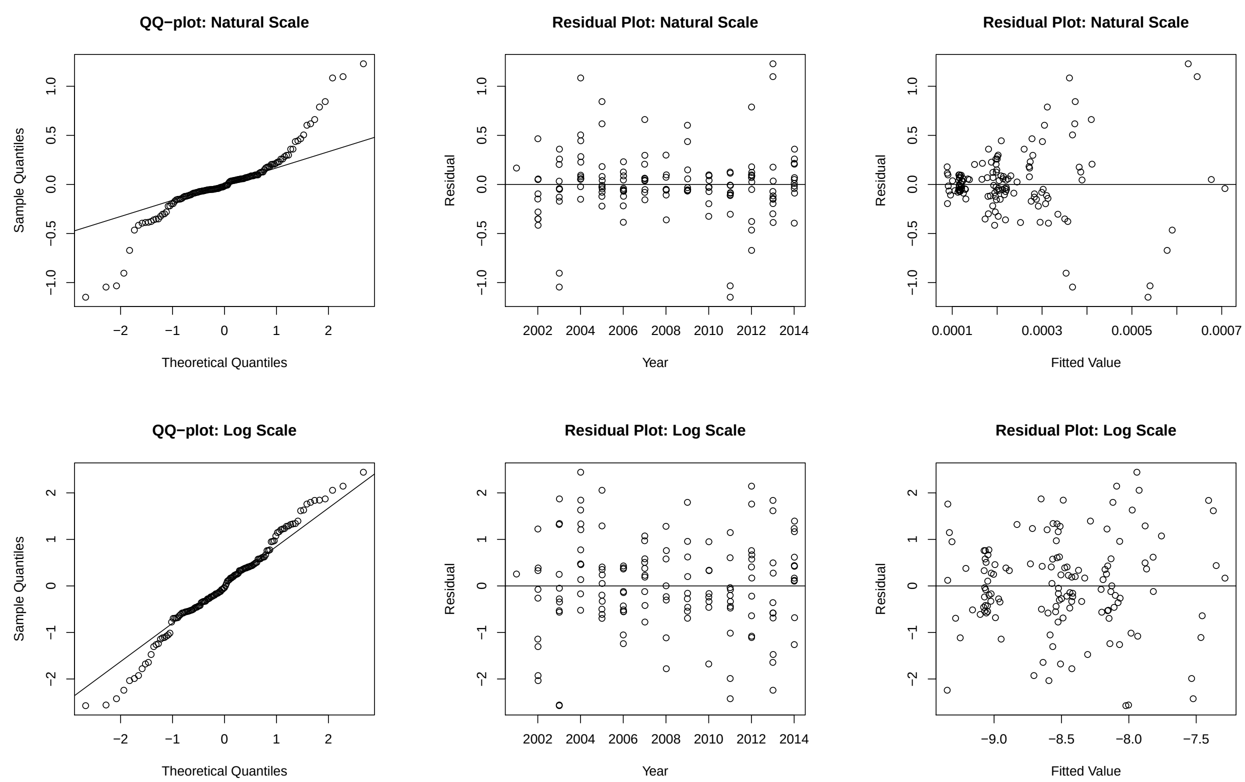


1.2 Reference



Comment:
10-60% of data in Leslie, Moose, and Nema lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	0.00E+00	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
124.85	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
23.80	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.999	0.001	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	0.2288	2	0.8919
Kodiak	0.6061	2	0.7386
Leslie	28.9639	2	0.0000
Moose	28.9037	2	0.0000
Nema	9.2459	2	0.0098
Slipper	5.6078	2	0.0606
S2	1.2718	2	0.5295
S3	2.0192	2	0.3644

- Conclusions:
  Leslie, Moose, and Nema lakes show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Leslie-vs-Nanuq	570.4019	3	0.0000
Leslie-vs-Counts	224.0270	3	0.0000
Leslie-vs-Vulture	431.9058	3	0.0000
Moose-vs-Nanuq	621.5701	3	0.0000
Moose-vs-Counts	246.5324	3	0.0000
Moose-vs-Vulture	476.2008	3	0.0000
Nema-vs-Nanuq	380.6954	3	0.0000
Nema-vs-Counts	100.4080	3	0.0000
Nema-vs-Vulture	266.1534	3	0.0000

- Conclusions:
  Leslie, Moose, and Nema lakes show significant deviation from the slopes of individual reference lakes.

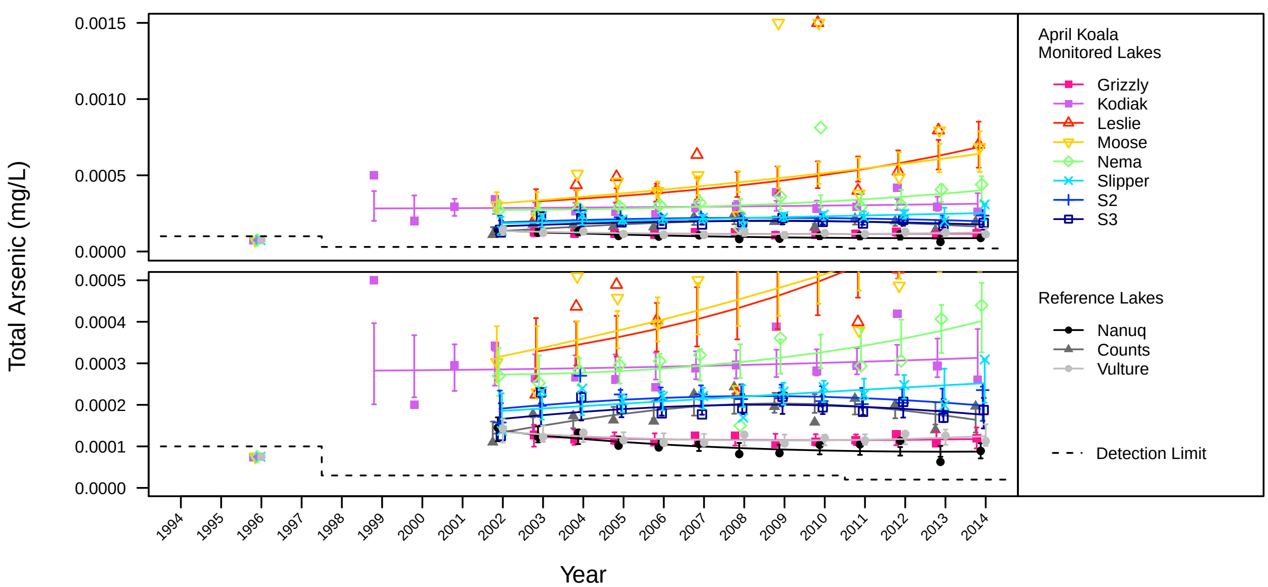
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4160
Reference Lake	Nanuq	0.5000
Reference Lake	Vulture	0.3290
Monitored Lake	Grizzly	0.0950
Monitored Lake	Kodiak	0.0260
Monitored Lake	Leslie	0.2160
Monitored Lake	Moose	0.1990
Monitored Lake	Nema	0.1280
Monitored Lake	S2	0.1430
Monitored Lake	S3	0.1540
Monitored Lake	Slipper	0.2650

- Conclusions:
Model fit for Counts, Vulture, Leslie, and Slipper lakes is weak. Model fit for Grizzly, Kodiak, Moose, Nema, S2, and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total arsenic for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	1.20e-04	1.18e-04	1.28e-05	9.52e-05	1.46e-04	3.73e-05
Kodiak	2.60e-04	3.13e-04	3.20e-05	2.56e-04	3.83e-04	9.36e-05
Leslie	7.01e-04	6.84e-04	7.64e-05	5.50e-04	8.52e-04	2.24e-04
Moose	6.84e-04	6.41e-04	6.79e-05	5.21e-04	7.89e-04	1.99e-04
Nema	4.40e-04	4.01e-04	4.24e-05	3.26e-04	4.94e-04	1.24e-04
Slipper	3.09e-04	2.52e-04	2.66e-05	2.05e-04	3.10e-04	7.77e-05
S2	2.36e-04	1.99e-04	2.09e-05	1.62e-04	2.44e-04	6.12e-05
S3	1.88e-04	1.76e-04	1.86e-05	1.43e-04	2.17e-04	5.43e-05
Nanuq	8.90e-05	8.74e-05	9.21e-06	7.11e-05	1.07e-04	NA
Counts	1.97e-04	1.64e-04	1.73e-05	1.33e-04	2.02e-04	NA
Vulture	1.13e-04	1.25e-04	1.31e-05	1.01e-04	1.53e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Arsenic	April	Koala	Lake	Water	none	log e	Tobit regression	#1b separate intercepts & slopes	0.005	Leslie Moose Nema

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

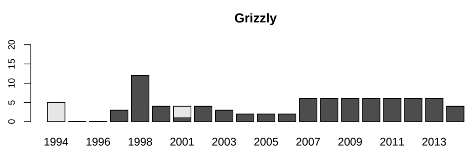
Analysis of August Total Arsenic in Lakes of the Koala Watershed and Lac de Gras

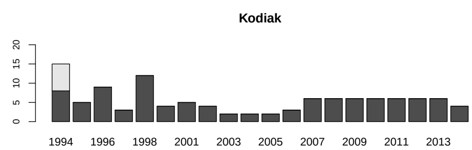
November 12, 2014

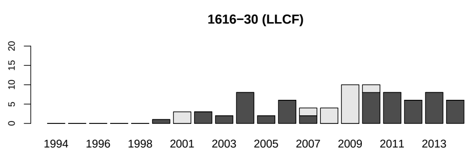
1 Censored Values:

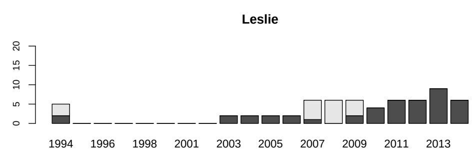
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

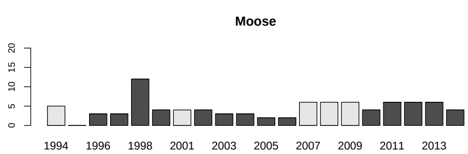
1.1 Monitored

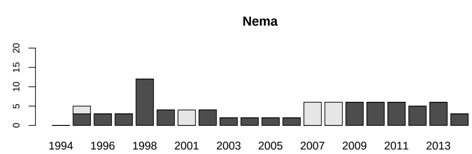


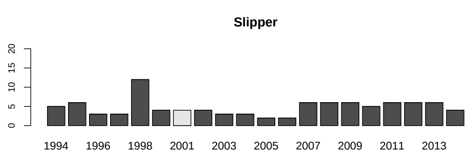


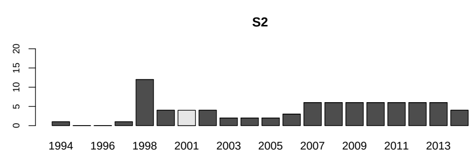




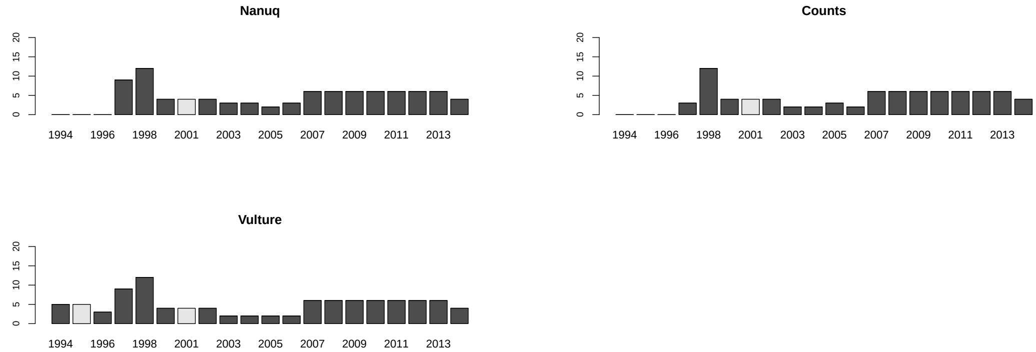






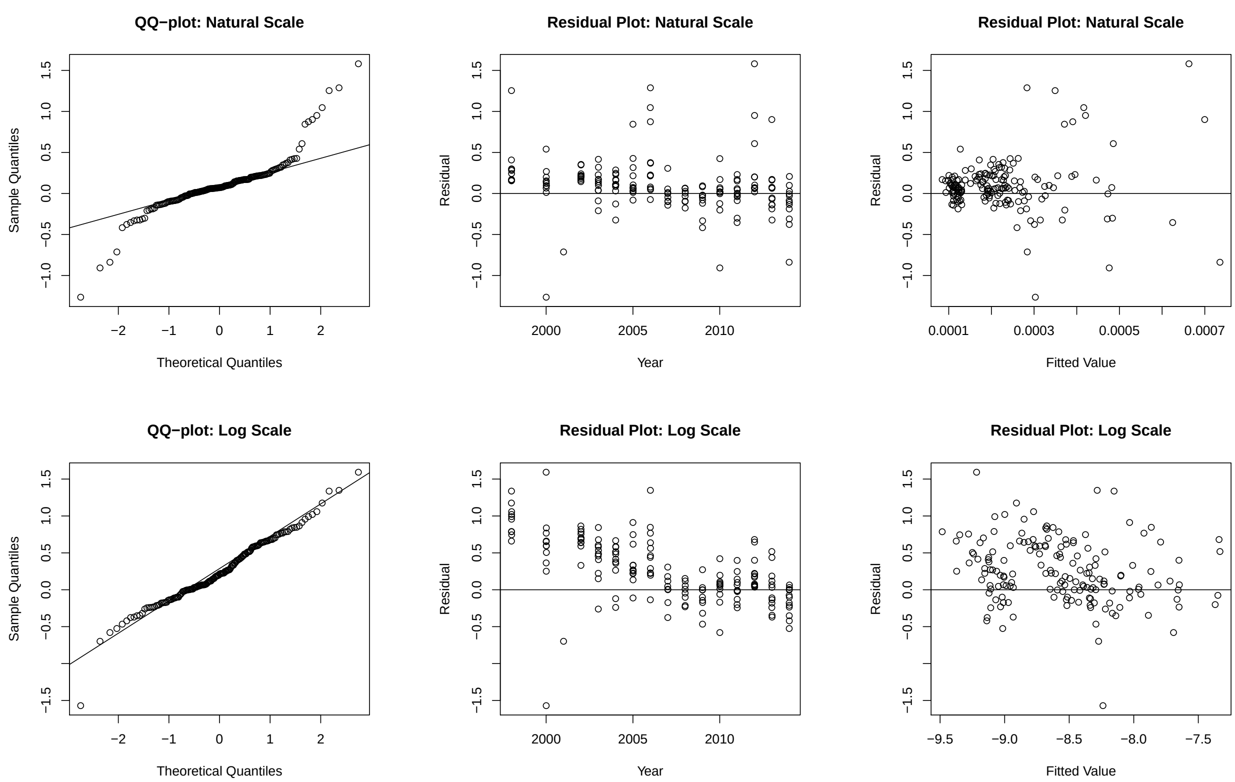


1.2 Reference



Comment:
10-60% of data in Leslie, Moose, and Nema lakes, and the 1616-30 (LLCF) was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
18.71	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
0.35	4.00	0.99

- Conclusions:
  The slopes do not differ significantly among reference lakes.

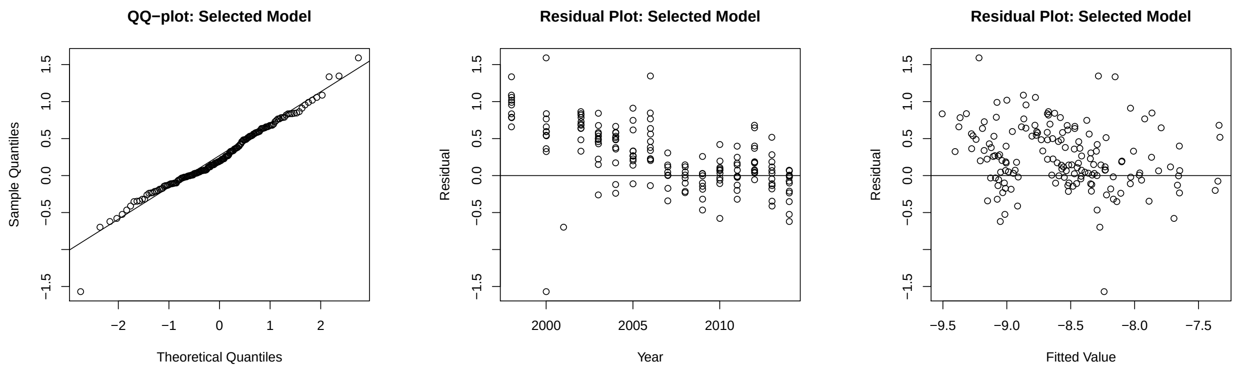
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.021	0.977	0.001	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.0555	2	0.9726
Kodiak	1.4665	2	0.4803
1616-30 (LLCF)	14.2746	2	0.0008
Leslie	0.6905	2	0.7081
Moose	5.1313	2	0.0769
Nema	1.2665	2	0.5309
Slipper	1.6812	2	0.4315
S2	0.2428	2	0.8857
S3	0.0619	2	0.9695

- Conclusions:
  Only 1616-30 (LLCF) showed a significant deviations from the common slope reference lakes.

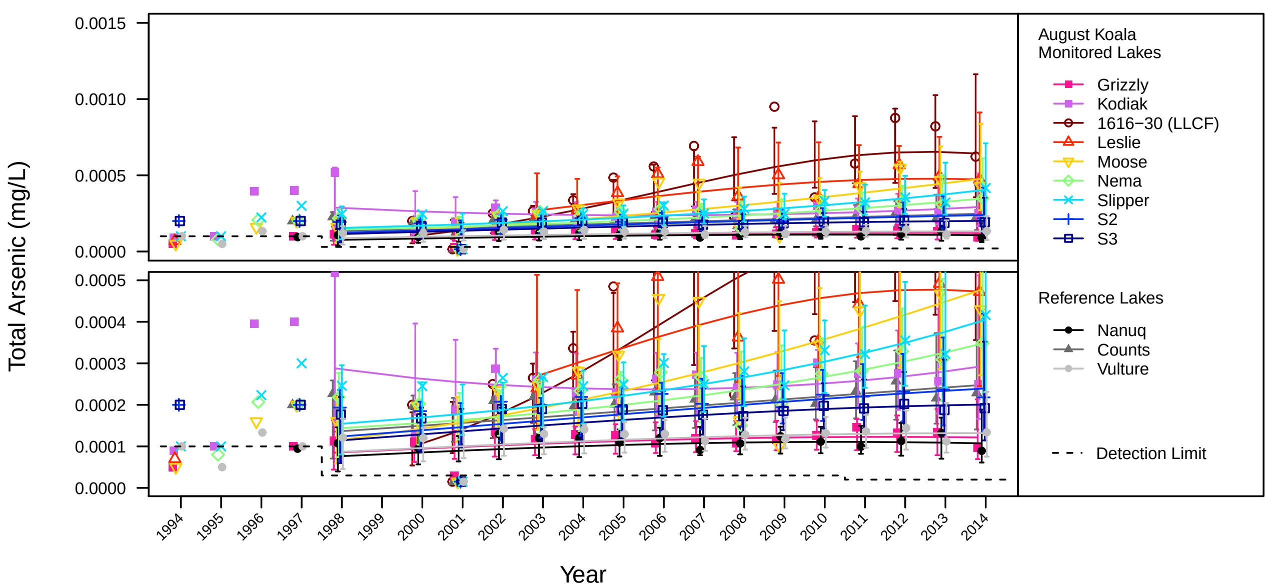
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.2460
Monitored Lake	1616-30 (LLCF)	0.4310
Monitored Lake	Grizzly	0.0940
Monitored Lake	Kodiak	0.0630
Monitored Lake	Leslie	0.4930
Monitored Lake	Moose	0.2510
Monitored Lake	Nema	0.1460
Monitored Lake	S2	0.0980
Monitored Lake	S3	0.0790
Monitored Lake	Slipper	0.1640

- Conclusions:
  Model fit for pooled reference lakes, 1616-30 (LLCF), Leslie, and Moose lakes is weak. Model fit for Grizzly, Kodiak, Nema, Slipper, S2, and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total arsenic for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	9.65e-05	1.22e-04	3.49e-05	6.93e-05	2.13e-04	1.02e-04
Kodiak	2.50e-04	2.92e-04	8.37e-05	1.66e-04	5.12e-04	2.45e-04
Leslie	4.72e-04	4.73e-04	1.58e-04	2.45e-04	9.12e-04	4.64e-04
1616-30 (LLCF)	6.23e-04	6.44e-04	1.94e-04	3.56e-04	1.16e-03	5.69e-04
Moose	4.30e-04	4.76e-04	1.37e-04	2.71e-04	8.37e-04	4.01e-04
Nema	3.49e-04	3.48e-04	9.99e-05	1.98e-04	6.11e-04	2.92e-04
Slipper	4.16e-04	4.05e-04	1.16e-04	2.31e-04	7.10e-04	3.40e-04
S2	2.18e-04	2.39e-04	6.86e-05	1.36e-04	4.20e-04	2.01e-04
S3	1.92e-04	2.01e-04	5.75e-05	1.14e-04	3.52e-04	1.68e-04
Nanuq	8.93e-05	1.07e-04	3.08e-05	6.12e-05	1.88e-04	NA
Counts	2.28e-04	2.47e-04	7.09e-05	1.41e-04	4.34e-04	NA
Vulture	1.34e-04	1.32e-04	3.78e-05	7.52e-05	2.32e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Arsenic	August	Koala	Lake	Water	none	log e	Tobit regression	#2 shared slopes	0.005	1616-30 (LLCF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

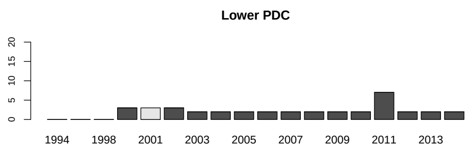
Analysis of August Total Arsenic in Koala Watershed Streams

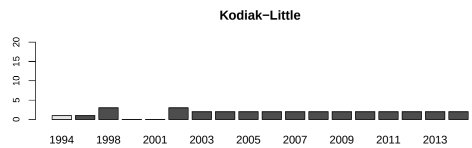
November 12, 2014

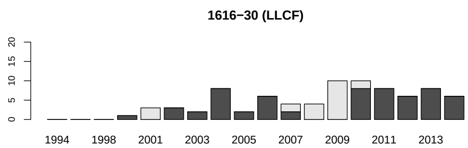
1 Censored Values:

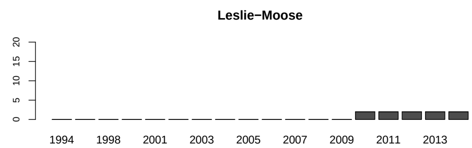
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

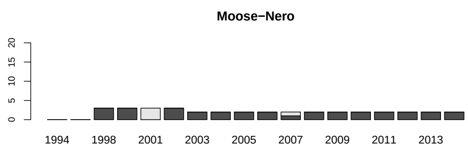
1.1 Monitored

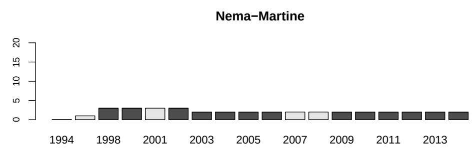


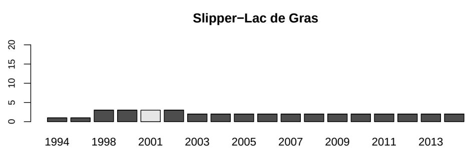




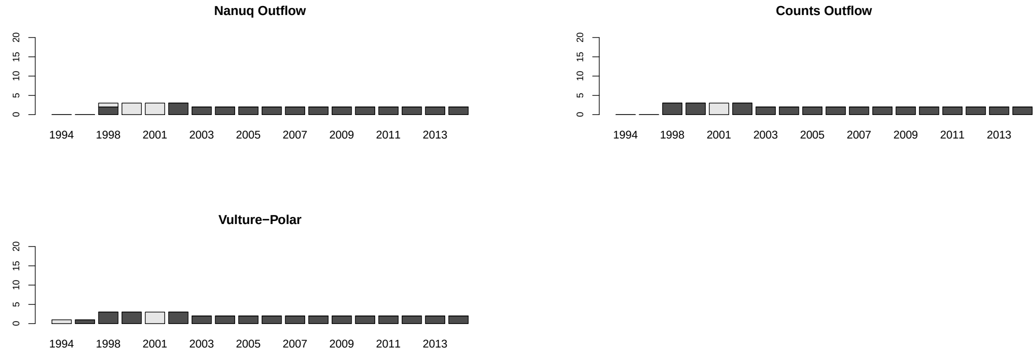






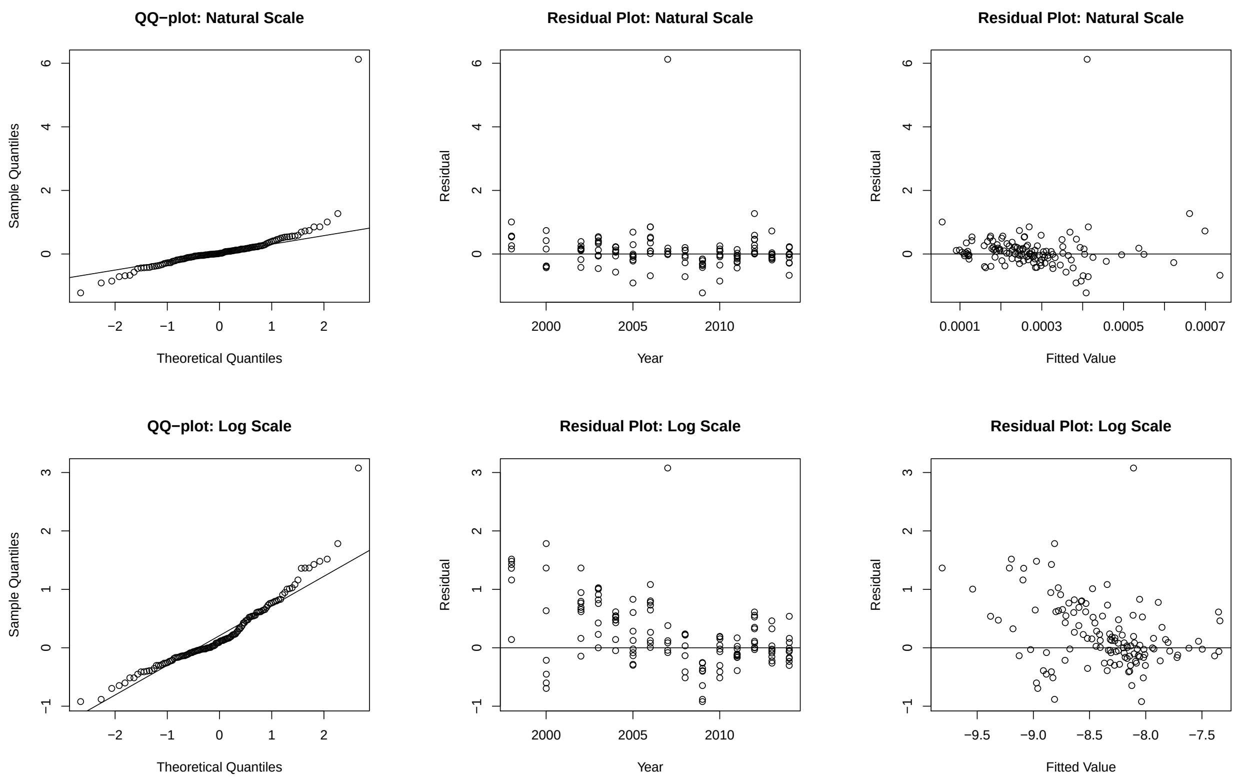


1.2 Reference



Comment:
10-60% of data in Counts Outflow, Nanuq Outflow, 1616-30 (LLCF), Moose-Nero, and Nema-Martine was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
35	Counts Outflow	2007	0.00	0.00	6.12

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
35	Counts Outflow	2007	0.00	-8.11	3.08

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. AIC reveals that the data is modeled with no transformation. Proceeding with analysis using the untransformed "natural model". Results should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
16.30	6.00	0.01

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
2.64	4.00	0.62

- Conclusions:
  The slopes do not differ significantly among reference streams.

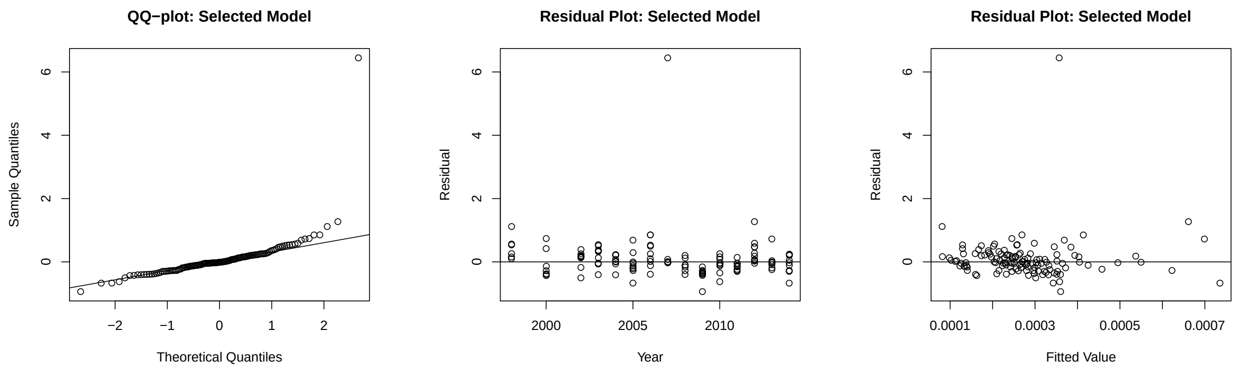
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.064	0.929	0.007	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
35	Counts Outflow	2007	0.00	0.00	6.44

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
Lower PDC	0.2235	2	0.8943
Kodiak-Little	2.4267	2	0.2972
Leslie-Moose	1.5096	2	0.4701
1616-30 (LLCF)	11.4015	2	0.0033
Moose-Nero	1.7870	2	0.4092
Nema-Martine	1.2000	2	0.5488
Slipper-Lac de Gras	1.0502	2	0.5915

- Conclusions:
  1616-30 (LLCF) shows significant deviation from the common slope of reference streams.

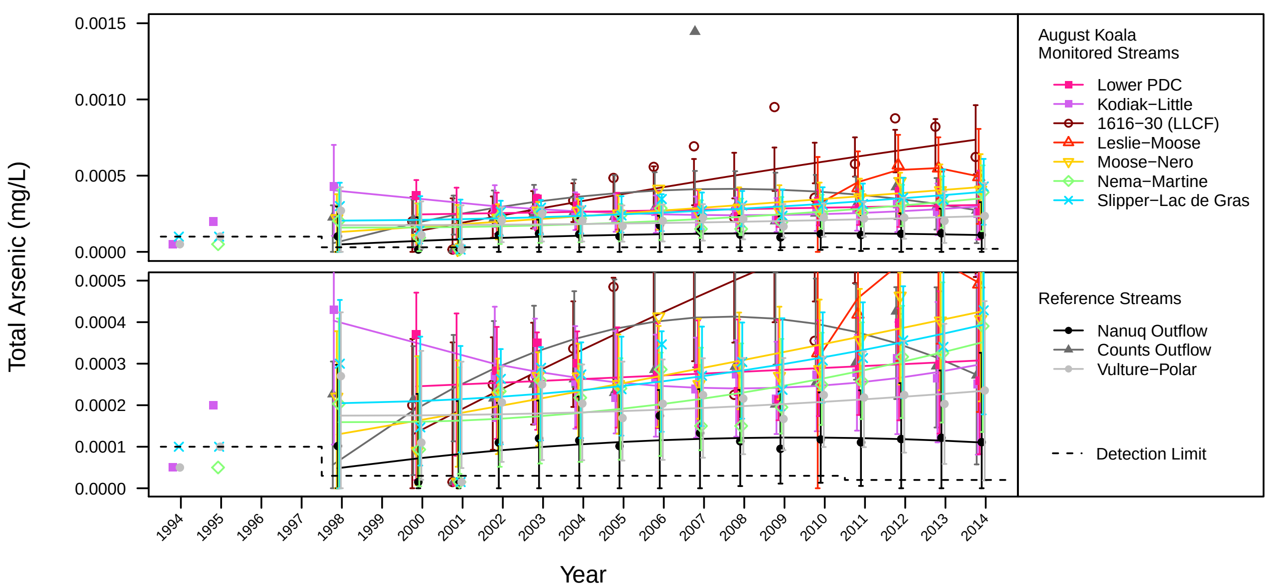
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.2460
Monitored Stream	1616-30 (LLCF)	0.5250
Monitored Stream	Kodiak-Little	0.6790
Monitored Stream	Leslie-Moose	0.9320
Monitored Stream	Lower PDC	0.0510
Monitored Stream	Moose-Nero	0.6010
Monitored Stream	Nema-Martine	0.4750
Monitored Stream	Slipper-Lac de Gras	0.4260

- Conclusions:
  Model fit for pooled reference streams, Nema-Martine, and Slipper-Lac de Gras is weak. Model fit for the Lower PDC is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total arsenic for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	2.59e-04	3.08e-04	1.15e-04	8.22e-05	5.33e-04	3.37e-04
Kodiak-Little	2.51e-04	2.97e-04	1.10e-04	8.10e-05	5.13e-04	3.23e-04
Leslie-Moose	4.91e-04	4.95e-04	1.59e-04	1.84e-04	8.07e-04	4.65e-04
1616-30 (LLCF)	6.23e-04	7.36e-04	1.16e-04	5.09e-04	9.62e-04	3.39e-04
Moose-Nero	4.07e-04	4.25e-04	1.10e-04	2.09e-04	6.41e-04	3.22e-04
Nema-Martine	3.90e-04	3.52e-04	1.10e-04	1.36e-04	5.67e-04	3.22e-04
Slipper-Lac de Gras	4.29e-04	3.94e-04	1.10e-04	1.78e-04	6.10e-04	3.22e-04
Nanuq Outflow	1.11e-04	1.10e-04	1.10e-04	0.00e+00	3.26e-04	NA
Counts Outflow	2.72e-04	2.73e-04	1.10e-04	5.74e-05	4.89e-04	NA
Vulture-Polar	2.36e-04	2.35e-04	1.10e-04	1.88e-05	4.51e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Arsenic	August	Koala	Stream	Water	none	none	Tobit regression	#2 shared slopes	0.005	1616-30 (LLCF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

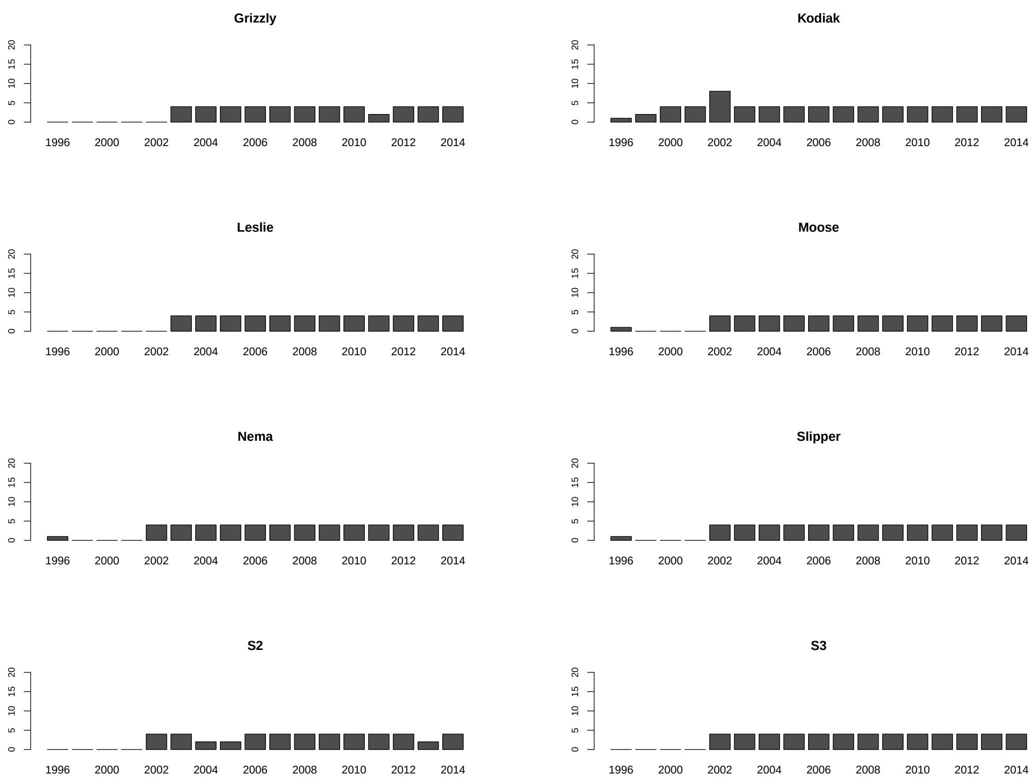
Analysis of April Total Barium in Lakes of the Koala Watershed and Lac de Gras

November 12, 2014

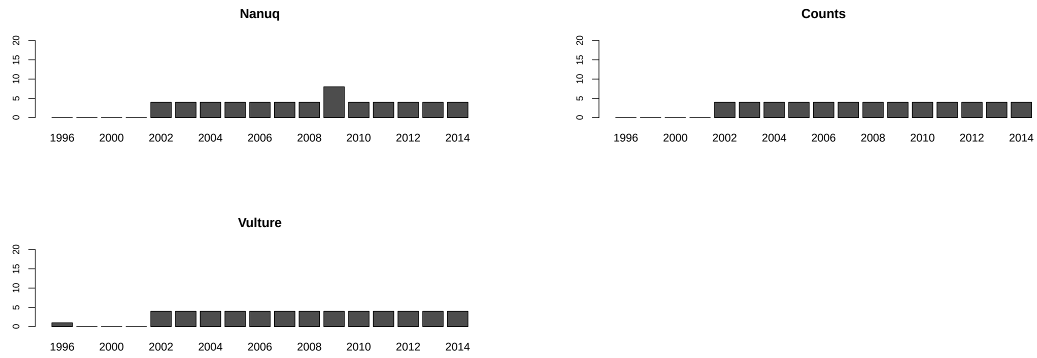
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

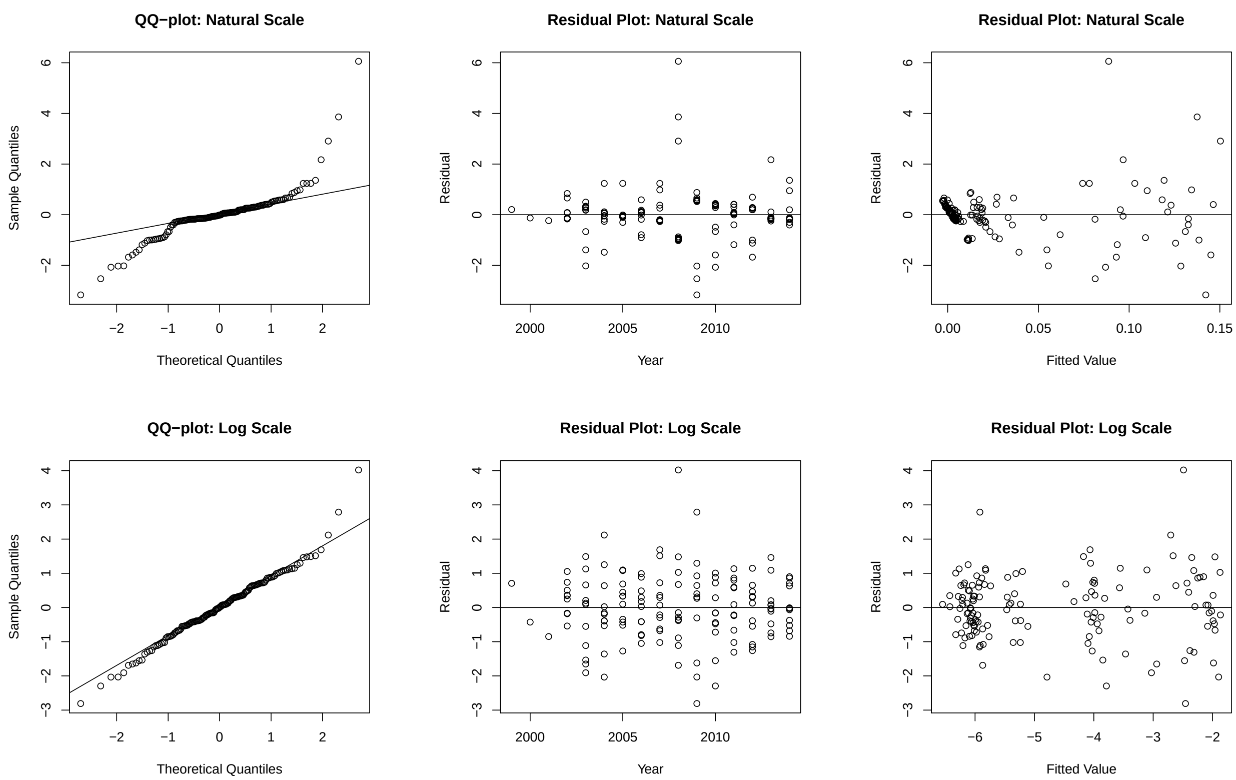


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
100	Leslie	2009	0.11	0.14	-3.17
120	Moose	2008	0.17	0.14	3.86
162	Nema	2008	0.14	0.09	6.06

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	0.14	-2.49	4.02

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	4.43E-171	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
7895.91	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
2.99	4.00	0.56

- Conclusions:
  The slopes do not differ significantly among reference lakes.

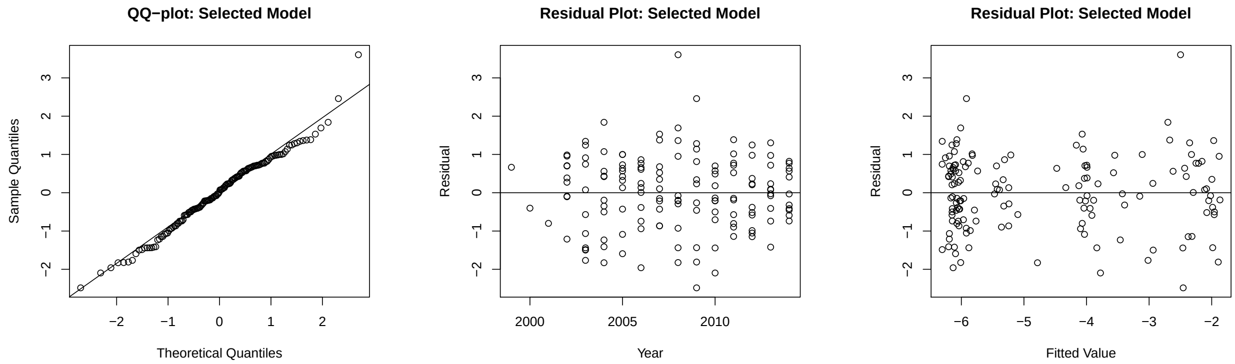
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	0.14	-2.50	3.61

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	1.39	2.00	0.50
Kodiak	1.19	2.00	0.55
Leslie	18.02	2.00	0.00
Moose	24.14	2.00	0.00
Nema	59.71	2.00	0.00
Slipper	68.65	2.00	0.00
S2	1.59	2.00	0.45
S3	2.91	2.00	0.23

- Conclusions:
  Leslie, Moose, Nema, and Slipper lakes show significant deviation from the common slope of reference lakes.

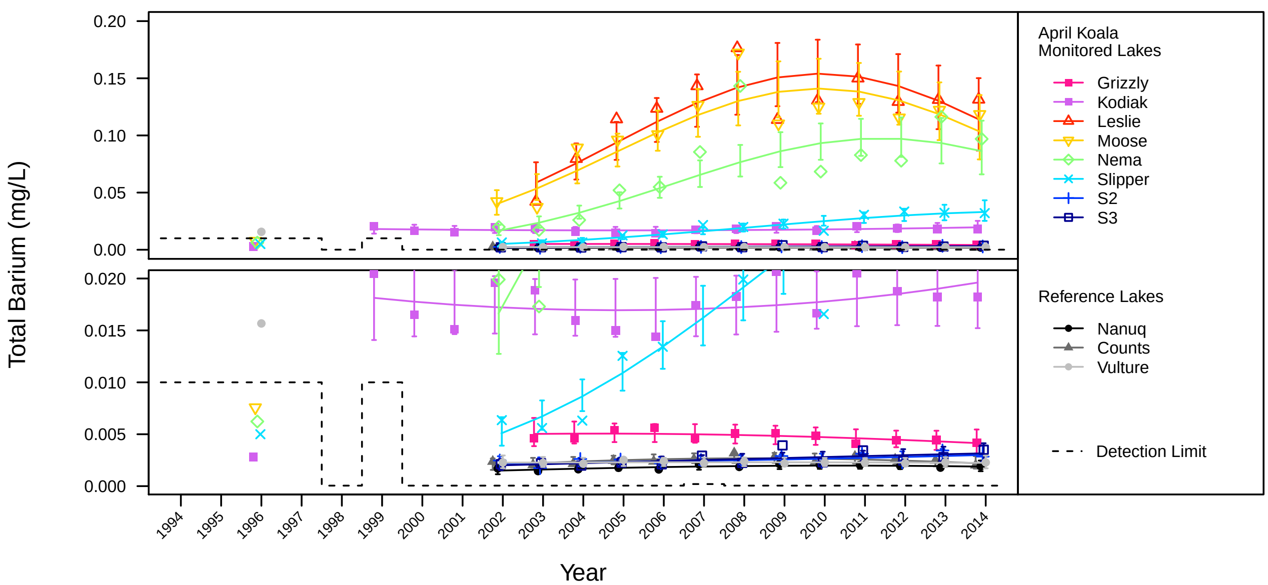
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1160
Monitored Lake	Grizzly	0.4740
Monitored Lake	Kodiak	0.1410
Monitored Lake	Leslie	0.7460
Monitored Lake	Moose	0.8270
Monitored Lake	Nema	0.7980
Monitored Lake	S2	0.3340
Monitored Lake	S3	0.4270
Monitored Lake	Slipper	0.9070

- Conclusions:
  Model fit for Grizzly Lake, and sites S2 and S3 is weak. Model fit for pooled reference lakes and Kodiak Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total barium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	4.19e-03	4.15e-03	5.80e-04	3.15e-03	5.46e-03	1.70e-03
Kodiak	1.82e-02	1.96e-02	2.54e-03	1.52e-02	2.53e-02	7.42e-03
Leslie	1.32e-01	1.14e-01	1.60e-02	8.68e-02	1.50e-01	4.67e-02
Moose	1.18e-01	1.03e-01	1.42e-02	7.90e-02	1.35e-01	4.15e-02
Nema	9.69e-02	8.63e-02	1.18e-02	6.59e-02	1.13e-01	3.46e-02
Slipper	3.20e-02	3.31e-02	4.53e-03	2.53e-02	4.32e-02	1.33e-02
S2	2.85e-03	3.00e-03	4.12e-04	2.29e-03	3.93e-03	1.20e-03
S3	3.51e-03	3.16e-03	4.33e-04	2.41e-03	4.13e-03	1.27e-03
Nanuq	1.92e-03	1.89e-03	2.59e-04	1.44e-03	2.47e-03	NA
Counts	2.01e-03	2.21e-03	3.03e-04	1.69e-03	2.90e-03	NA
Vulture	2.29e-03	2.24e-03	3.08e-04	1.72e-03	2.94e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Barium	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	1	Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

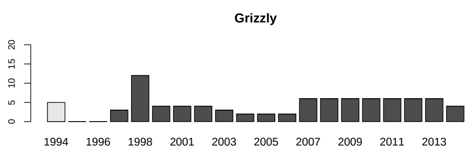
Analysis of August Total Barium in Lakes of the Koala Watershed and Lac de Gras

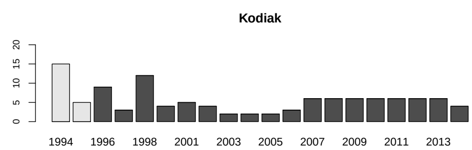
November 12, 2014

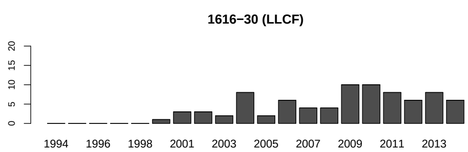
1 Censored Values:

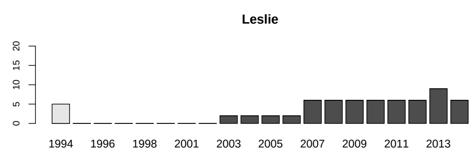
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

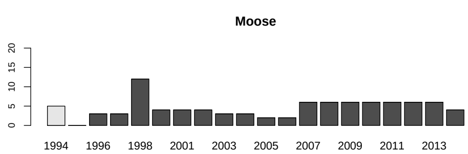
1.1 Monitored

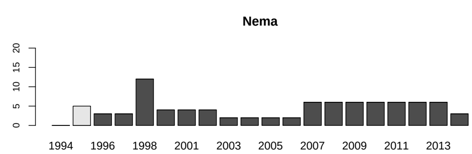


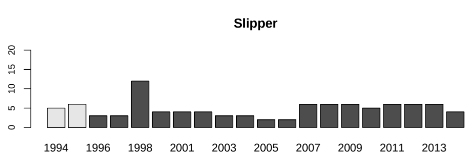




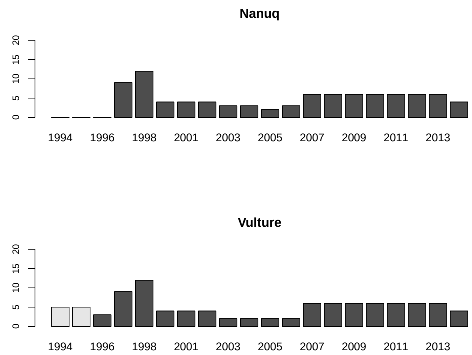






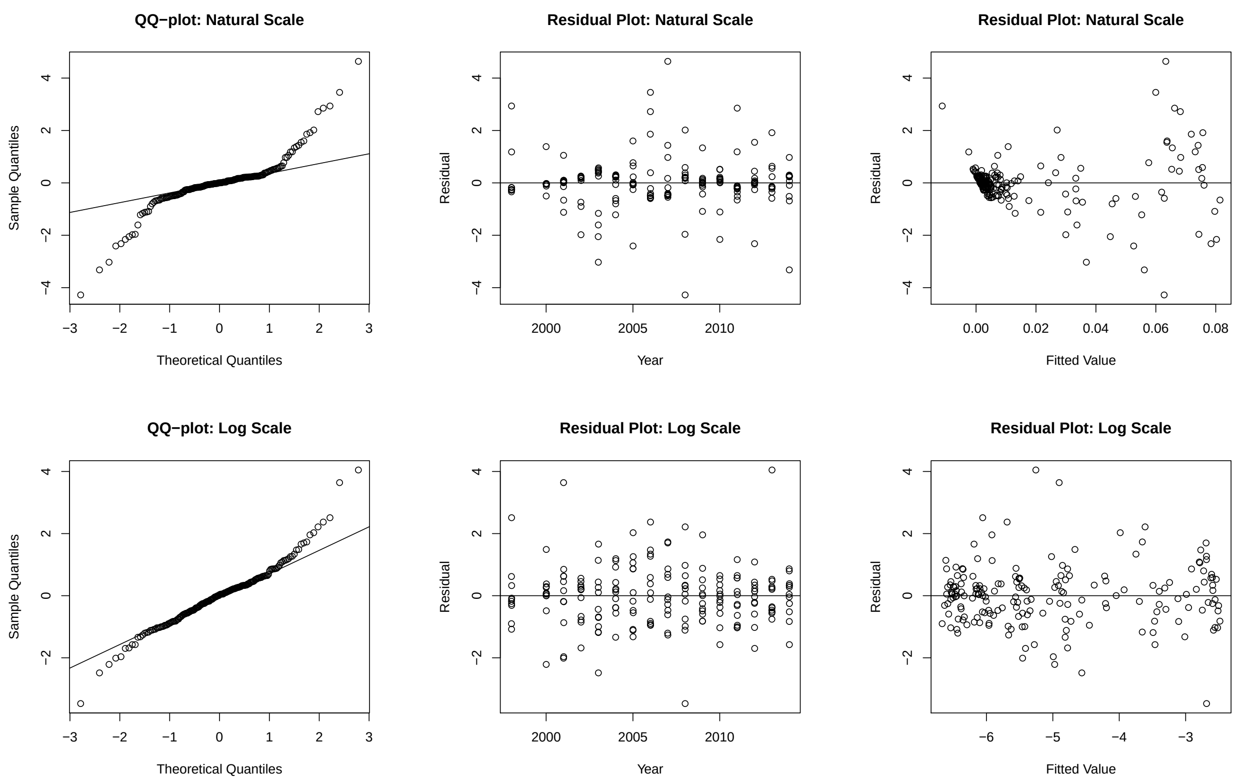


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
115	Moose	2003	0.02	0.04	-3.03
118	Moose	2006	0.08	0.06	3.46
119	Moose	2007	0.09	0.06	4.64
120	Moose	2008	0.04	0.06	-4.27
126	Moose	2014	0.04	0.06	-3.32

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
71	Kodiak	2001	0.01	-4.90	3.64
120	Moose	2008	0.04	-2.68	-3.48
188	S2	2013	0.01	-5.26	4.05

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
81.74	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
0.11	4.00	1.00

- Conclusions:
  The slopes do not differ significantly among reference lakes.

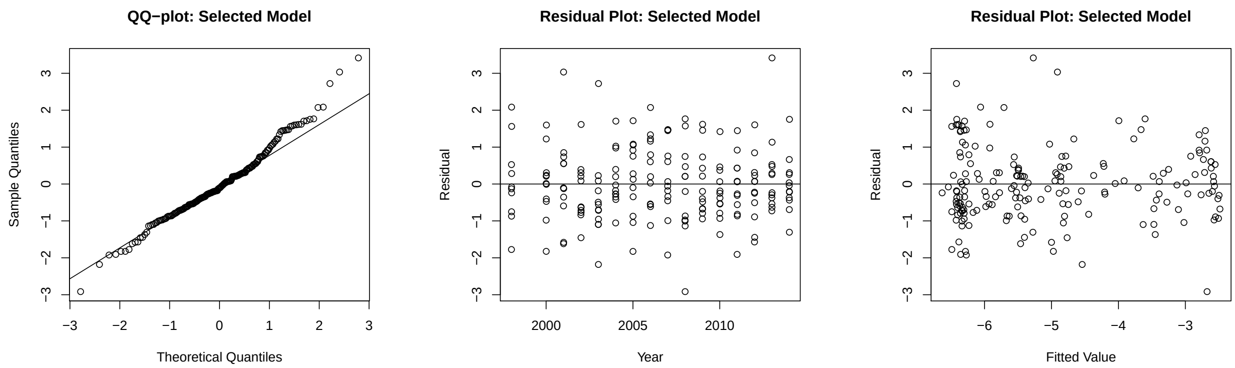
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
71	Kodiak	2001	0.01	-4.91	3.03
188	S2	2013	0.01	-5.27	3.42

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.1657	2	0.9205
Kodiak	0.1396	2	0.9326
1616-30 (LLCF)	21.2657	2	0.0000
Leslie	29.1221	2	0.0000
Moose	264.0117	2	0.0000
Nema	238.7813	2	0.0000
Slipper	117.3182	2	0.0000
S2	50.3744	2	0.0000
S3	19.1211	2	0.0001

- Conclusions:
  All monitored lakes except Grizzly and Kodiak show significant deviation from the common slope of reference lakes.

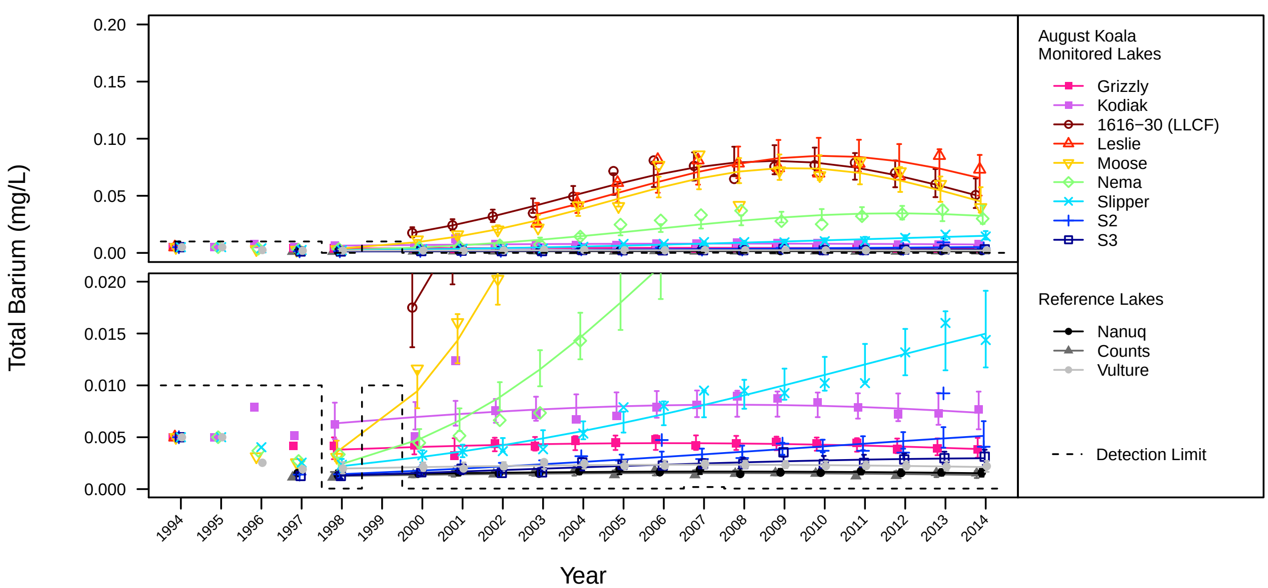
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0650
Monitored Lake	1616-30 (LLCF)	0.9560
Monitored Lake	Grizzly	0.2650
Monitored Lake	Kodiak	0.1330
Monitored Lake	Leslie	0.7570
Monitored Lake	Moose	0.9430
Monitored Lake	Nema	0.9170
Monitored Lake	S2	0.7030
Monitored Lake	S3	0.7900
Monitored Lake	Slipper	0.9570

- Conclusions:
  Model fit for Grizzly Lake is weak. Model fit for pooled reference lakes and Kodiak Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total barium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	3.83e-03	3.87e-03	4.82e-04	3.03e-03	4.94e-03	1.41e-03
Kodiak	7.67e-03	7.36e-03	9.18e-04	5.77e-03	9.40e-03	2.69e-03
Leslie	7.31e-02	6.56e-02	8.97e-03	5.02e-02	8.58e-02	2.63e-02
1616-30 (LLCF)	5.07e-02	5.06e-02	6.51e-03	3.93e-02	6.51e-02	1.91e-02
Moose	3.99e-02	4.51e-02	5.62e-03	3.53e-02	5.75e-02	1.64e-02
Nema	3.00e-02	3.24e-02	4.04e-03	2.54e-02	4.14e-02	1.18e-02
Slipper	1.44e-02	1.50e-02	1.87e-03	1.17e-02	1.91e-02	5.46e-03
S2	4.09e-03	5.13e-03	6.39e-04	4.02e-03	6.55e-03	1.87e-03
S3	3.13e-03	2.98e-03	3.71e-04	2.33e-03	3.80e-03	1.09e-03
Nanuq	1.58e-03	1.53e-03	1.91e-04	1.20e-03	1.95e-03	NA
Counts	1.54e-03	1.37e-03	1.71e-04	1.07e-03	1.75e-03	NA
Vulture	2.21e-03	2.12e-03	2.65e-04	1.66e-03	2.71e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Barium	August	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	1	1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

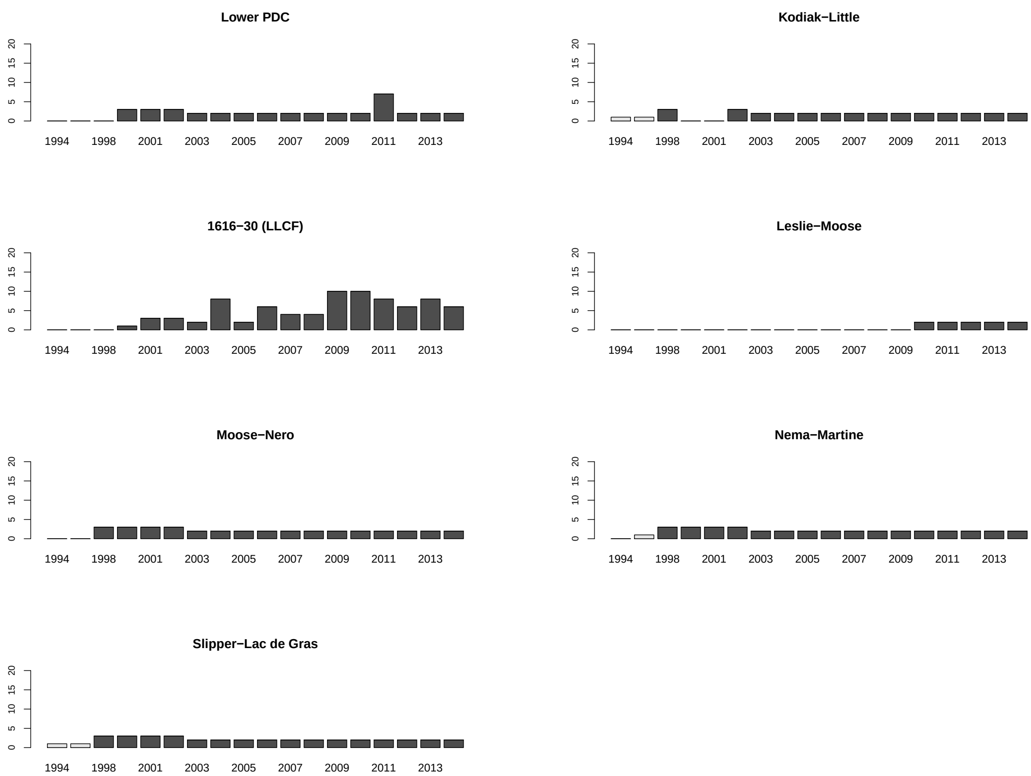
Analysis of August Total Barium in Koala Watershed Streams

November 12, 2014

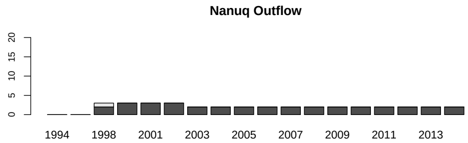
1 Censored Values:

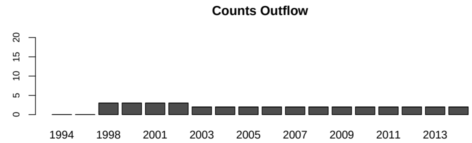
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

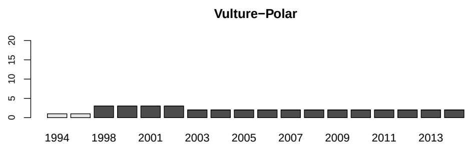
1.1 Monitored



1.2 Reference

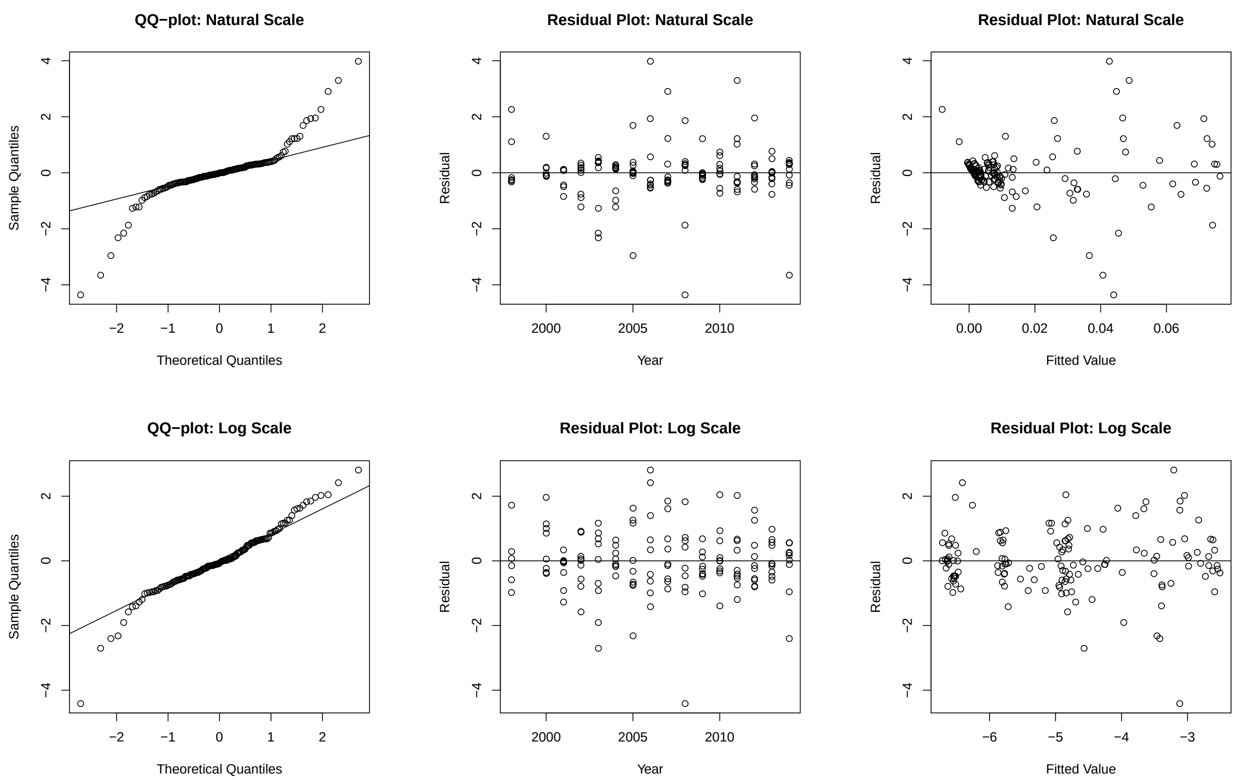






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
118	Moose-Nero	2006	0.06	0.04	3.98
120	Moose-Nero	2008	0.02	0.04	-4.36
123	Moose-Nero	2011	0.06	0.05	3.30
126	Moose-Nero	2014	0.02	0.04	-3.66

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.02	-3.12	-4.41

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
238.28	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
27.31	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	2.2955	2	0.3173
Kodiak-Little	2.7207	2	0.2566
Leslie-Moose	0.8148	2	0.6654
1616-30 (LLCF)	120.5596	2	0.0000
Moose-Nero	135.4614	2	0.0000
Nema-Martine	167.2968	2	0.0000
Slipper-Lac de Gras	87.7942	2	0.0000

- Conclusions:
  1616-30 (LLCF), Moose-Nero, Nema-Martine, and Slipper-Lac de Gras show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-30 (LLCF)-vs-Nanuq Outflow	173.9690	3	0.0000
1616-30 (LLCF)-vs-Counts Outflow	113.7459	3	0.0000
1616-30 (LLCF)-vs-Vulture-Polar	54.9343	3	0.0000
Moose-Nero-vs-Nanuq Outflow	2999.3853	3	0.0000
Moose-Nero-vs-Counts Outflow	3020.4003	3	0.0000
Moose-Nero-vs-Vulture-Polar	1702.7681	3	0.0000
Nema-Martine-vs-Nanuq Outflow	2209.8441	3	0.0000
Nema-Martine-vs-Counts Outflow	2227.0069	3	0.0000
Nema-Martine-vs-Vulture-Polar	1151.7579	3	0.0000
Slipper-Lac de Gras-vs-Nanuq Outflow	941.1184	3	0.0000
Slipper-Lac de Gras-vs-Counts Outflow	939.2070	3	0.0000
Slipper-Lac de Gras-vs-Vulture-Polar	318.3227	3	0.0000

- Conclusions:
  All remaining monitored streams show significant deviation from the common slope of reference streams.

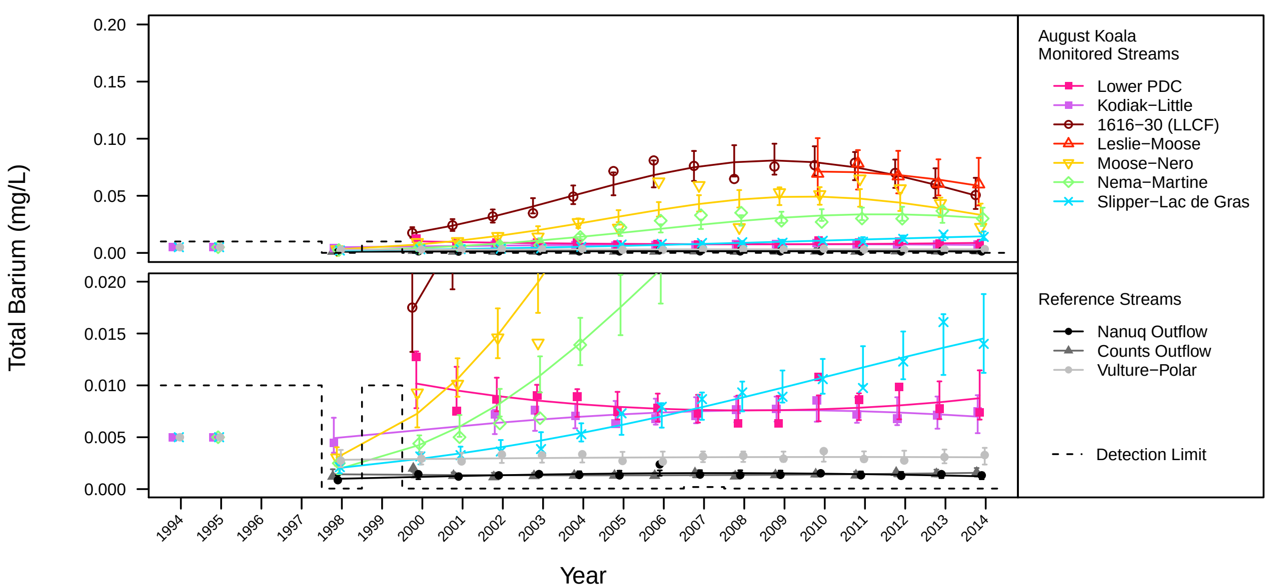
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.1430
Reference Stream	Nanuq Outflow	0.3920
Reference Stream	Vulture-Polar	0.0770
Monitored Stream	1616-30 (LLCF)	0.9570
Monitored Stream	Kodiak-Little	0.6400
Monitored Stream	Leslie-Moose	0.6230
Monitored Stream	Lower PDC	0.2200
Monitored Stream	Moose-Nero	0.8640
Monitored Stream	Nema-Martine	0.9380
Monitored Stream	Slipper-Lac de Gras	0.9660

- Conclusions:
  Model fit for Nanuq Outflow and the Lower PDC is weak. Model fit for Counts Outflow and Vulture-Polar is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total barium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	7.41e-03	8.76e-03	1.20e-03	6.70e-03	1.15e-02	3.50e-03
Kodiak-Little	7.48e-03	6.99e-03	9.23e-04	5.39e-03	9.05e-03	2.70e-03
Leslie-Moose	6.01e-02	5.88e-02	1.04e-02	4.16e-02	8.32e-02	3.05e-02
1616-30 (LLCF)	5.07e-02	5.03e-02	6.87e-03	3.85e-02	6.57e-02	2.01e-02
Moose-Nero	2.26e-02	3.33e-02	4.40e-03	2.57e-02	4.31e-02	1.29e-02
Nema-Martine	3.01e-02	3.06e-02	4.03e-03	2.36e-02	3.96e-02	1.18e-02
Slipper-Lac de Gras	1.40e-02	1.45e-02	1.92e-03	1.12e-02	1.88e-02	5.61e-03
Nanuq Outflow	1.32e-03	1.24e-03	1.63e-04	9.55e-04	1.60e-03	NA
Counts Outflow	1.60e-03	1.57e-03	2.07e-04	1.21e-03	2.03e-03	NA
Vulture-Polar	3.28e-03	3.07e-03	4.05e-04	2.37e-03	3.98e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Barium	August	Koala	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	1	1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

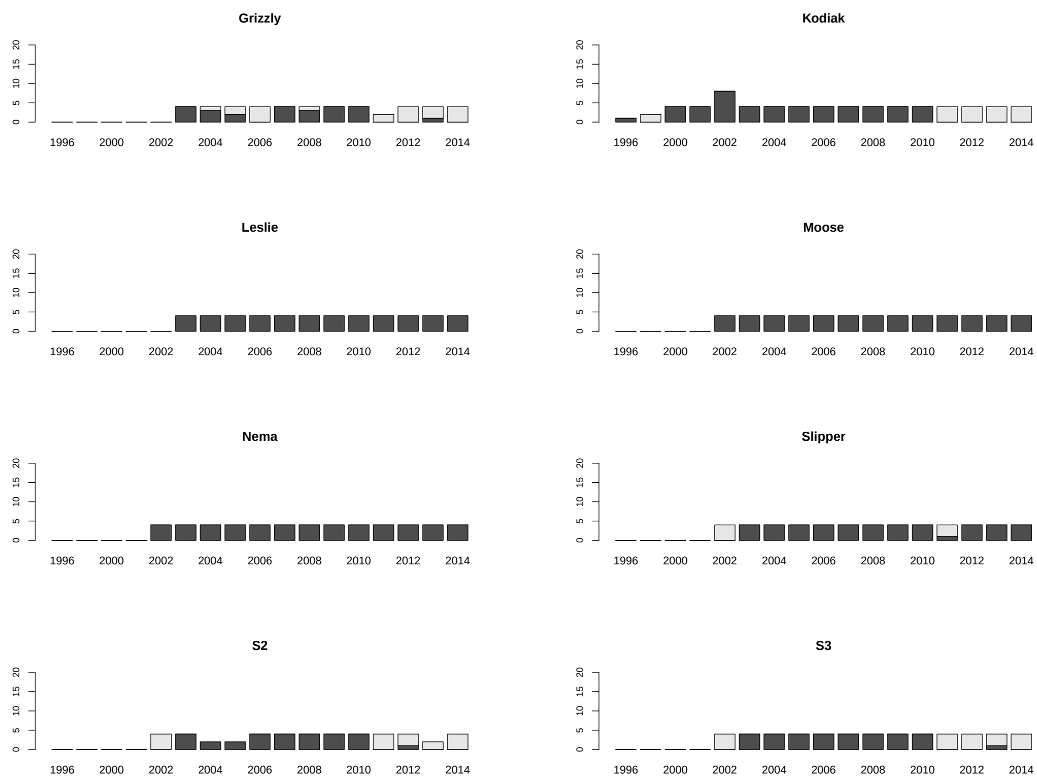
Analysis of April Total Boron in Lakes of the Koala Watershed and Lac de Gras

November 12, 2014

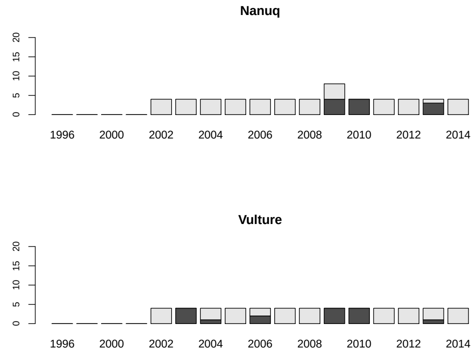
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

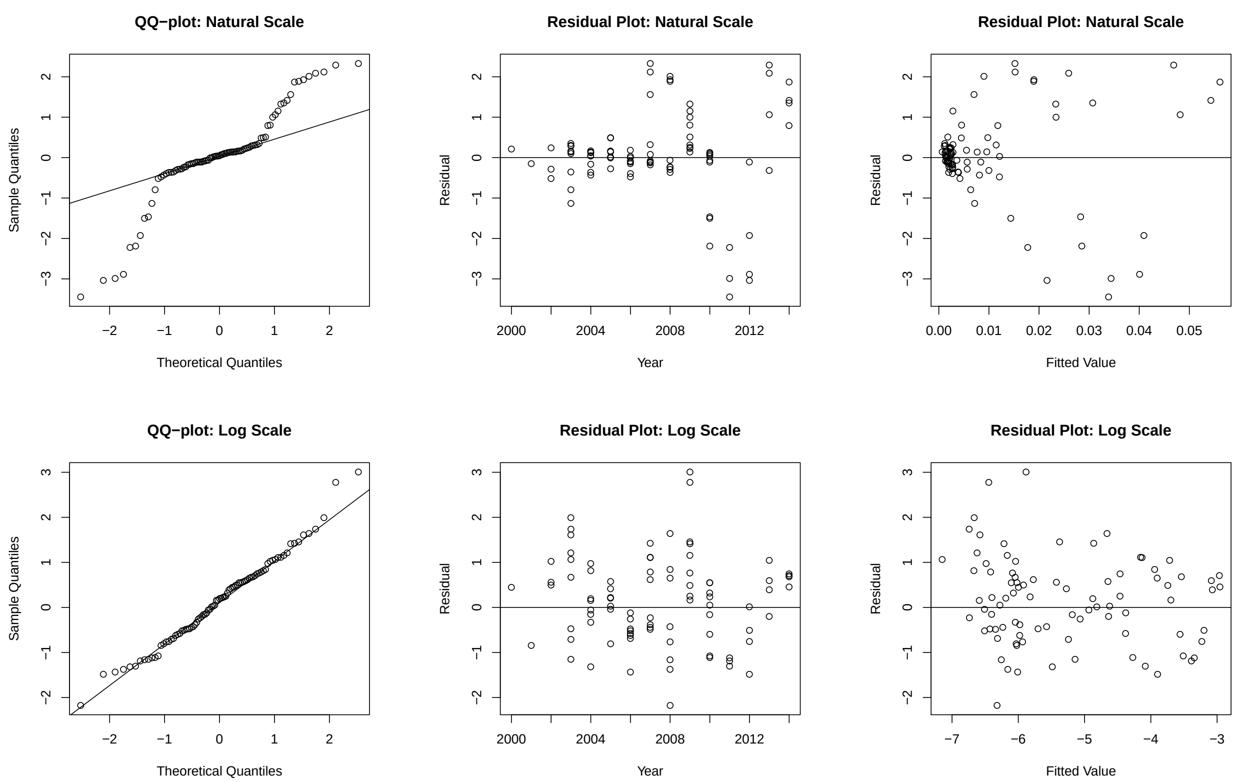


1.2 Reference



Comment:
Greater than 60% of data in Nanuq and Vulture lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Counts, Grizzly, Kodiak, Slipper, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
123	Moose	2011	0.03	0.03	-3.45
166	Nema	2012	0.01	0.02	-3.04

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
79	Kodiak	2009	0.01	-5.88	3.01

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	7.61E-160	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

Two of three reference lakes were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	25.6087	2	0.0000
Kodiak	4.3495	2	0.1136
Leslie	122.5303	2	0.0000
Moose	152.3241	2	0.0000
Nema	140.3951	2	0.0000
Slipper	129.6215	2	0.0000
S2	8.1505	2	0.0170
S3	9.9441	2	0.0069

- Conclusions:
  All monitored lakes except Kodiak show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Grizzly-vs-Counts	7.3033	3	0.0628
Leslie-vs-Counts	442.4580	3	0.0000
Moose-vs-Counts	449.5786	3	0.0000
Nema-vs-Counts	220.1012	3	0.0000
Slipper-vs-Counts	41.2632	3	0.0000
S2-vs-Counts	2.2963	3	0.5132
S3-vs-Counts	0.4189	3	0.9363

- Conclusions:
  Leslie, Moose, Nema, and Slipper lakes show significant deviation from the common slope of the one reference lake.

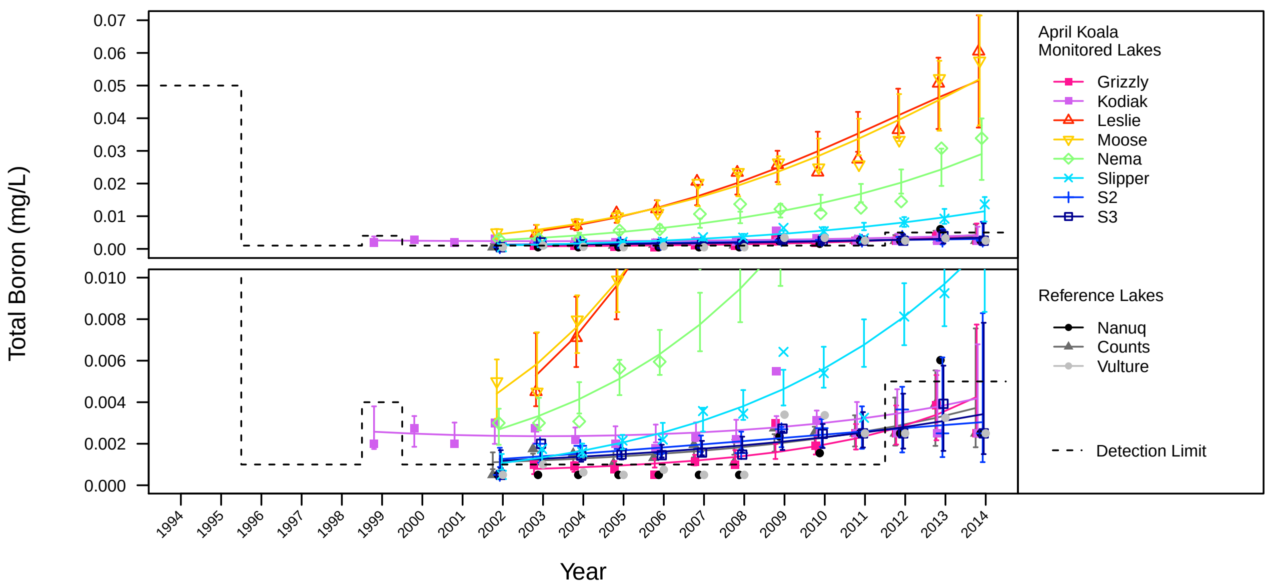
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.5610
Monitored Lake	Grizzly	0.7050
Monitored Lake	Kodiak	0.3100
Monitored Lake	Leslie	0.9540
Monitored Lake	Moose	0.9550
Monitored Lake	Nema	0.9100
Monitored Lake	S2	0.4290
Monitored Lake	S3	0.5340
Monitored Lake	Slipper	0.8410

- Conclusions:
  Model fit for Kodiak Lake and site S2 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total boron for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	2.50e-03	4.25e-03	1.30e-03	2.34e-03	7.74e-03	3.80e-03
Kodiak	2.50e-03	4.19e-03	1.03e-03	2.58e-03	6.79e-03	3.02e-03
Leslie	6.05e-02	5.15e-02	8.62e-03	3.71e-02	7.15e-02	2.52e-02
NA						
Moose	5.76e-02	5.20e-02	8.45e-03	3.78e-02	7.15e-02	2.47e-02
Nema	3.39e-02	2.90e-02	4.72e-03	2.11e-02	3.99e-02	1.38e-02
Slipper	1.36e-02	1.15e-02	1.89e-03	8.35e-03	1.59e-02	5.52e-03
S2	2.50e-03	3.04e-03	1.56e-03	1.11e-03	8.29e-03	4.55e-03
S3	2.50e-03	3.43e-03	1.44e-03	1.50e-03	7.83e-03	4.23e-03
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	2.50e-03	3.72e-03	1.34e-03	1.83e-03	7.55e-03	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Boron	April	Koala	Lake	Water	Nanuq Vulture	log e	Tobit regression	#1b separate intercepts & slopes	1.5	Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

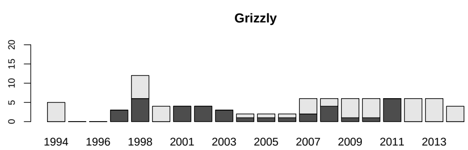
Analysis of August Total Boron in Lakes of the Koala Watershed and Lac de Gras

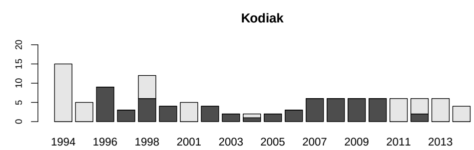
November 12, 2014

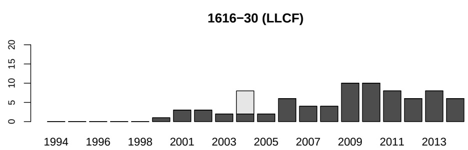
1 Censored Values:

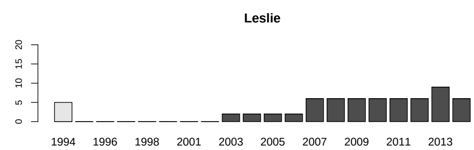
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

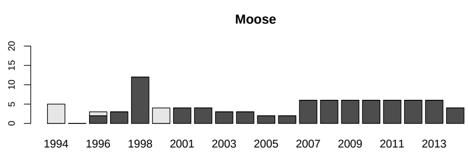
1.1 Monitored

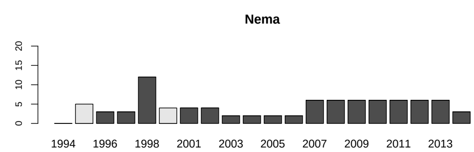


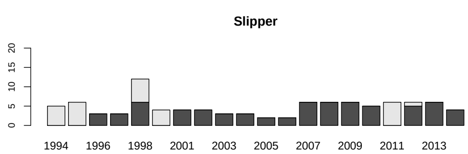


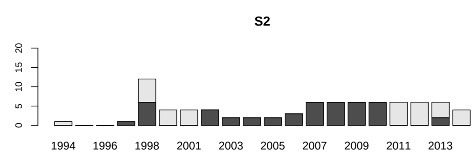




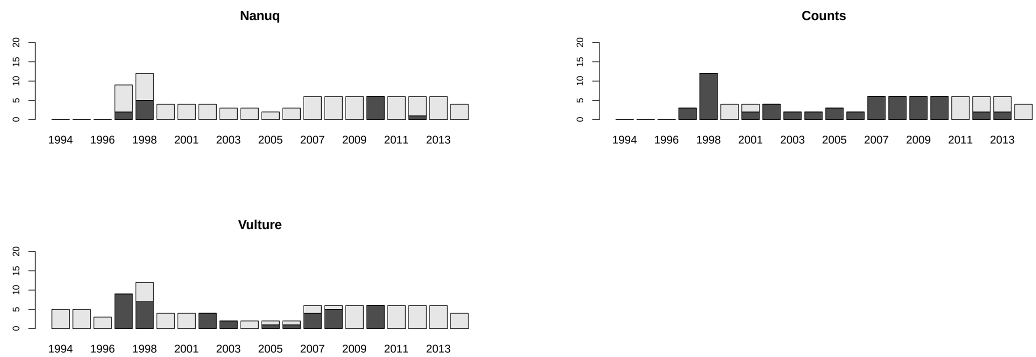






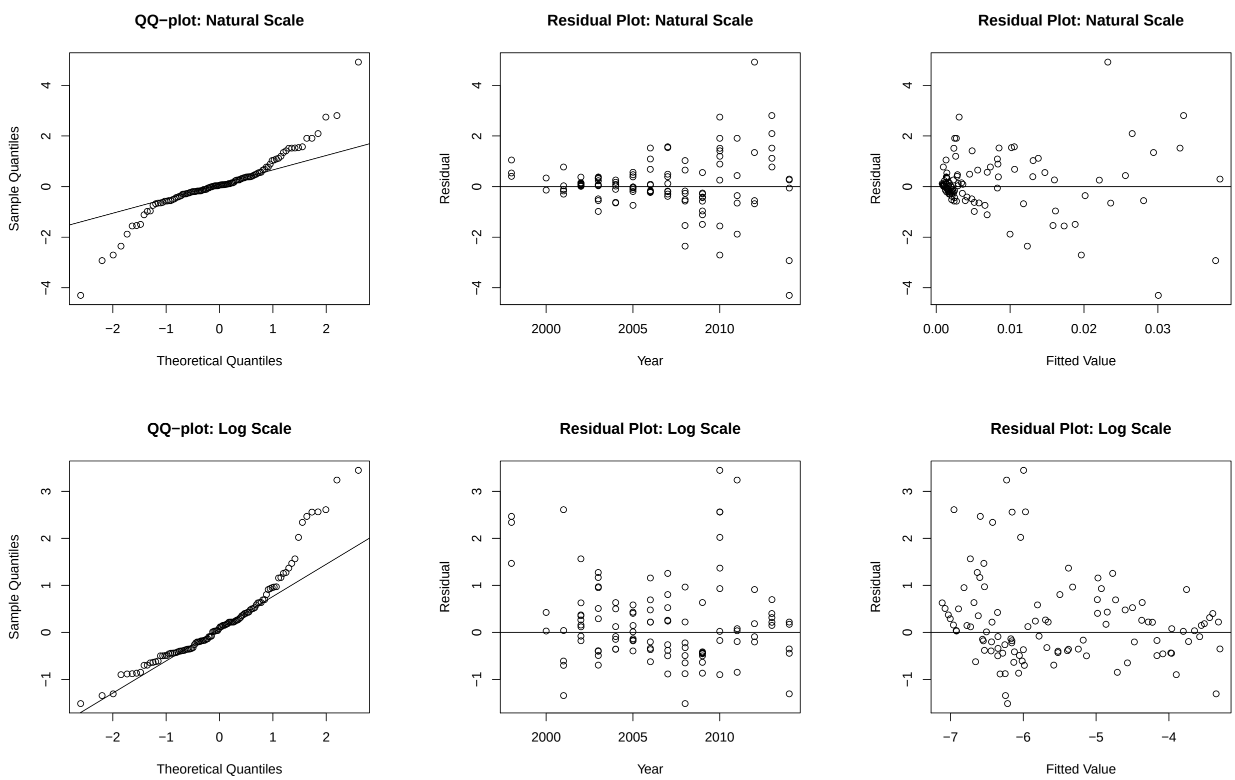


1.2 Reference



Comment:
Greater than 60% of data in Nanuq and Vulture lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Counts, Grizzly, Kodiak, Moose, Slipper, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
124	Moose	2012	0.03	0.02	4.92
126	Moose	2014	0.02	0.03	-4.30

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
38	Counts	2010	0.01	-6.00	3.45
60	Grizzly	2011	0.01	-6.23	3.24

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

Two of three reference lakes were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Grizzly	20.7903	2	0.0000
Kodiak	13.7909	2	0.0010
1616-30 (LLCF)	125.2320	2	0.0000
Leslie	54.2337	2	0.0000
Moose	134.1302	2	0.0000
Nema	84.6162	2	0.0000
Slipper	60.7154	2	0.0000
S2	13.5833	2	0.0011
S3	17.1500	2	0.0002

- Conclusions:
  All monitored lakes show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Grizzly-vs-Counts	9.5221	3	0.0231
Kodiak-vs-Counts	1.4841	3	0.6859
1616-30 (LLCF)-vs-Counts	174.5797	3	0.0000
Leslie-vs-Counts	156.3653	3	0.0000
Moose-vs-Counts	127.5150	3	0.0000
Nema-vs-Counts	43.4306	3	0.0000
Slipper-vs-Counts	13.2022	3	0.0042
S2-vs-Counts	3.8255	3	0.2809
S3-vs-Counts	6.8051	3	0.0784

- Conclusions:
  All monitored lakes except Kodiak, S2 and S3 show significant deviation from the slope of the one reference lake.

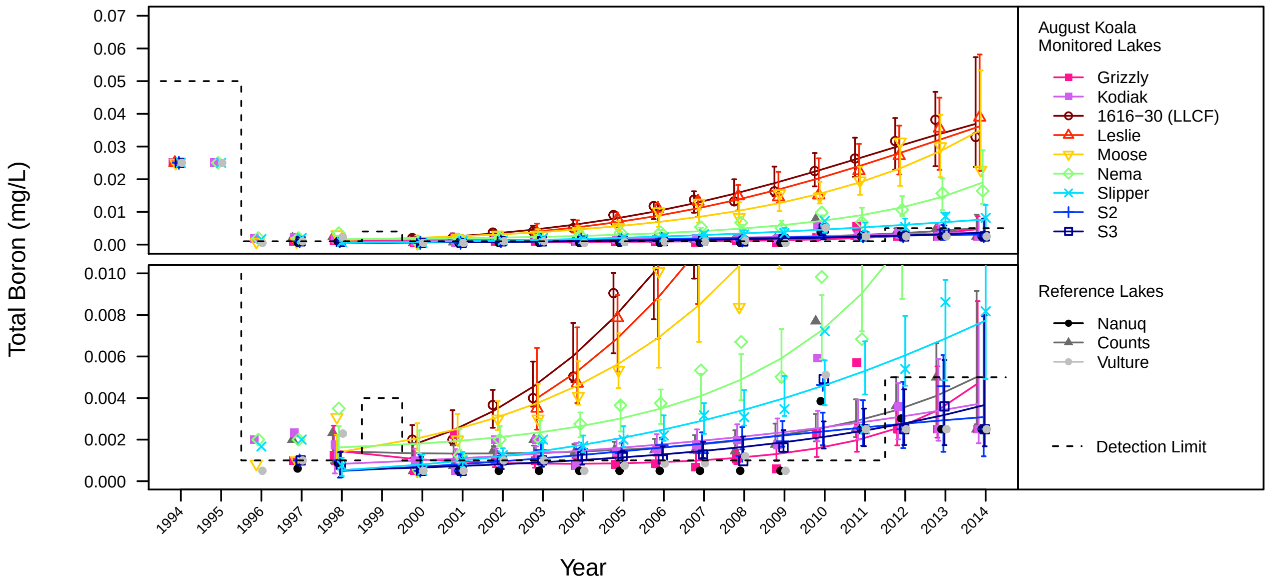
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4400
Monitored Lake	1616-30 (LLCF)	0.9820
Monitored Lake	Grizzly	0.5240
Monitored Lake	Kodiak	0.5020
Monitored Lake	Leslie	0.9570
Monitored Lake	Moose	0.8090
Monitored Lake	Nema	0.7610
Monitored Lake	S2	0.6960
Monitored Lake	S3	0.7550
Monitored Lake	Slipper	0.8810

- Conclusions:
  Model fit for Counts Lake is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total boron for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	2.50e-03	4.70e-03	1.47e-03	2.55e-03	8.66e-03	4.29e-03
Kodiak	2.50e-03	3.72e-03	1.35e-03	1.83e-03	7.57e-03	3.95e-03
Leslie	3.89e-02	3.62e-02	8.77e-03	2.25e-02	5.82e-02	2.57e-02
1616-30 (LLCF)	3.29e-02	3.69e-02	8.29e-03	2.38e-02	5.73e-02	2.43e-02
Moose	2.29e-02	3.50e-02	7.49e-03	2.30e-02	5.33e-02	2.19e-02
Nema	1.64e-02	1.90e-02	4.06e-03	1.25e-02	2.89e-02	1.19e-02
Slipper	8.17e-03	7.72e-03	1.77e-03	4.92e-03	1.21e-02	5.19e-03
S2	2.50e-03	3.08e-03	1.49e-03	1.20e-03	7.93e-03	4.35e-03
S3	2.50e-03	3.66e-03	1.46e-03	1.68e-03	7.98e-03	4.26e-03
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	2.50e-03	5.01e-03	1.54e-03	2.74e-03	9.16e-03	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Boron	August	Koala	Lake	Water	Nanuq Vulture	log e	Tobit regression	#1b separate intercepts & slopes	1.5	Grizzly 1616-30 (LLCF) Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

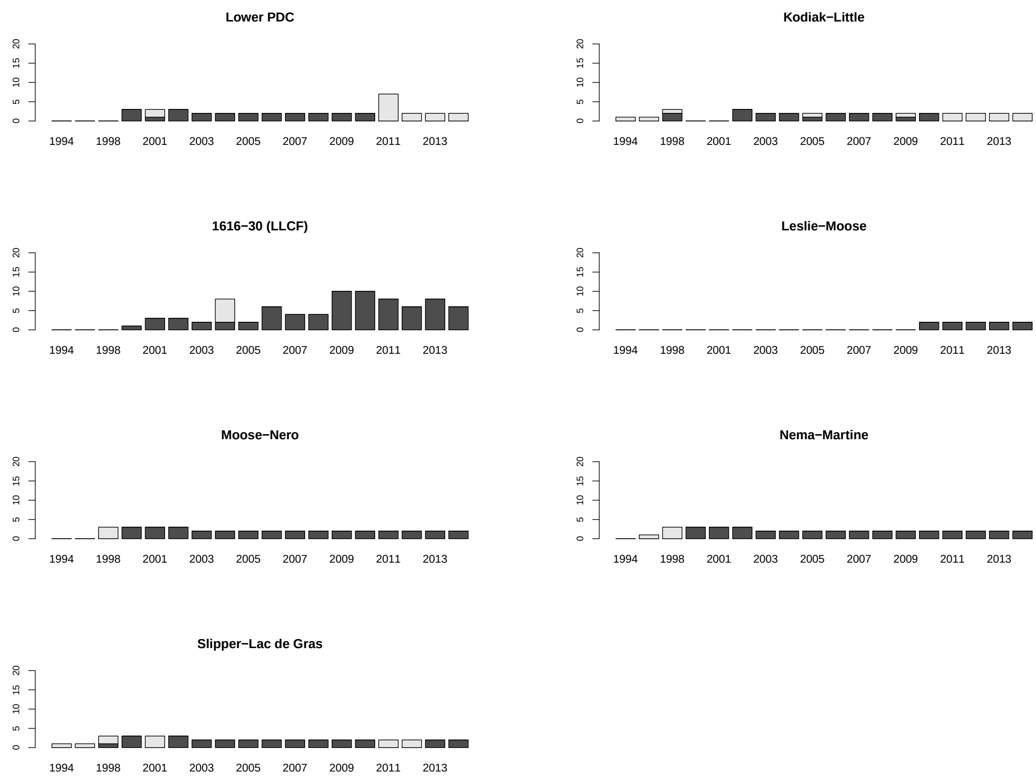
Analysis of August Total Boron in Koala Watershed Streams

November 7, 2014

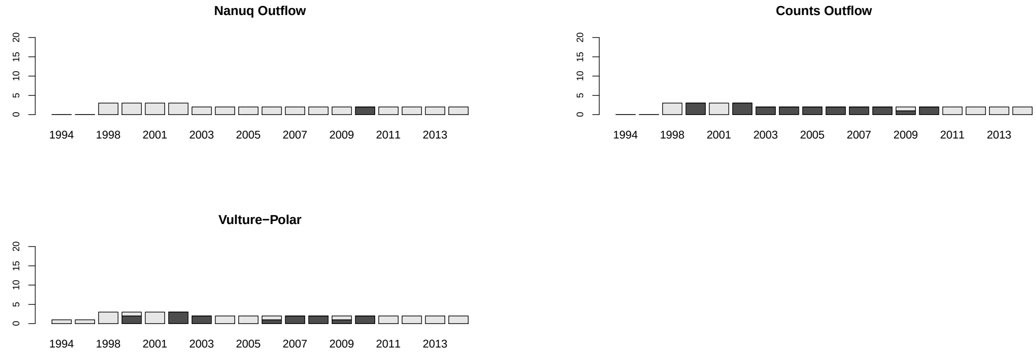
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

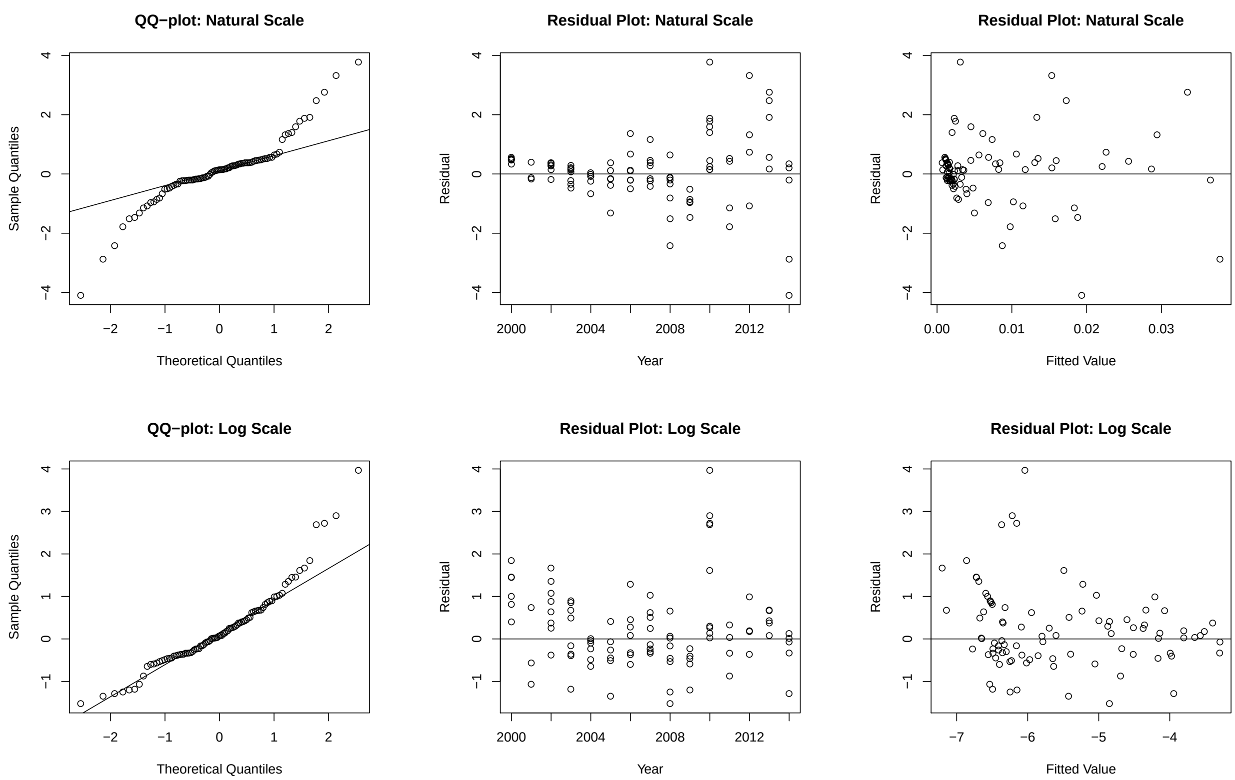


1.2 Reference



Comment:
Greater than 60% of data in Nanuq Outflow was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Counts Outflow, Vulture-Polar, Kodiak-Little, the Lower PDC, and Slipper-Lac de Gras was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
101	Lower PDC	2010	0.01	0.00	3.78
124	Moose-Nero	2012	0.02	0.02	3.32
126	Moose-Nero	2014	0.01	0.02	-4.10

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
101	Lower PDC	2010	0.01	-6.04	3.97

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
10.15	3.00	0.02

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
1.64	2.00	0.44

- Conclusions:
  The slopes do not differ significantly among reference streams.

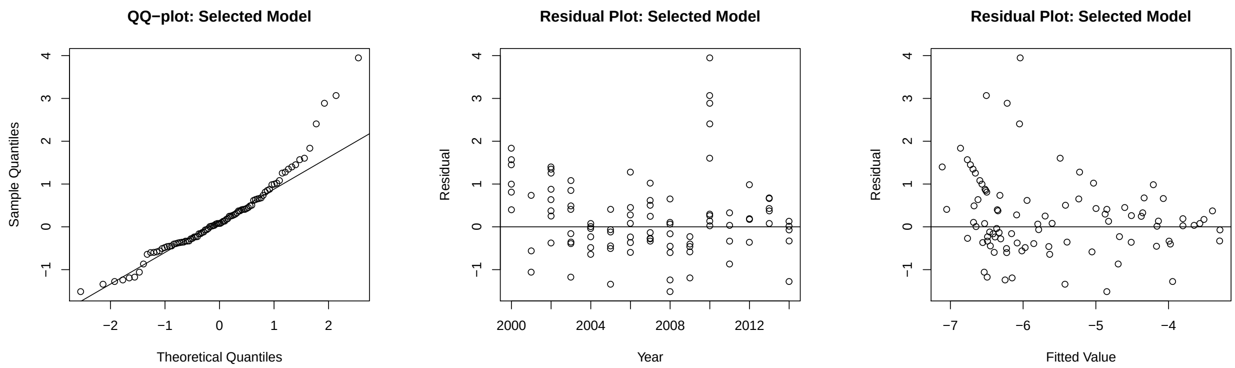
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.440	0.509	0.051	Indistinguishable support for 2 & 1; choose Model 2.

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
101	Lower PDC	2010	0.01	-6.04	3.95
206	Vulture-Polar	2010	0.00	-6.51	3.07

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference stream slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
Lower PDC	0.6155	2	0.7351
Kodiak-Little	0.5367	2	0.7647
Leslie-Moose	0.7771	2	0.6780
1616-30 (LLCF)	26.5423	2	0.0000
Moose-Nero	18.1199	2	0.0001
Nema-Martine	13.9074	2	0.0010
Slipper-Lac de Gras	4.8352	2	0.0891

- Conclusions:
  1616-30 (LLCF), Moose-Nero, and Nema-Martine show significant deviation from the common slope of reference streams.

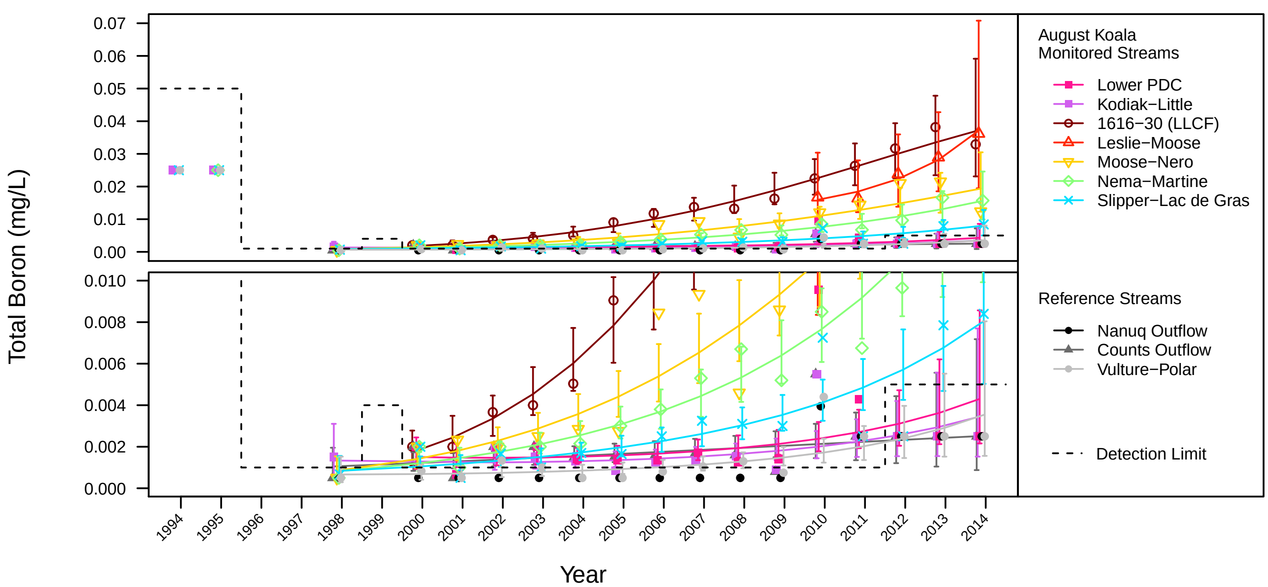
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.4520
Monitored Stream	1616-30 (LLCF)	0.9820
Monitored Stream	Kodiak-Little	0.4010
Monitored Stream	Leslie-Moose	0.9540
Monitored Stream	Lower PDC	0.3130
Monitored Stream	Moose-Nero	0.8840
Monitored Stream	Nema-Martine	0.9240
Monitored Stream	Slipper-Lac de Gras	0.7100

- Conclusions:
  Model fit for pooled reference streams, Kodiak-Little, and the Lower PDC is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total boron for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	2.50e-03	4.30e-03	1.51e-03	2.16e-03	8.57e-03	4.43e-03
Kodiak-Little	2.50e-03	3.43e-03	1.41e-03	1.52e-03	7.70e-03	4.14e-03
Leslie-Moose	3.62e-02	3.71e-02	1.22e-02	1.95e-02	7.08e-02	3.58e-02
1616-30 (LLCF)	3.29e-02	3.70e-02	8.86e-03	2.31e-02	5.91e-02	2.59e-02
Moose-Nero	1.23e-02	1.94e-02	4.48e-03	1.23e-02	3.05e-02	1.31e-02
Nema-Martine	1.57e-02	1.56e-02	3.62e-03	9.92e-03	2.46e-02	1.06e-02
Slipper-Lac de Gras	8.40e-03	8.03e-03	1.92e-03	5.03e-03	1.28e-02	5.62e-03
Nanuq Outflow	2.50e-03	NA	NA	NA	NA	NA
Counts Outflow	2.50e-03	2.51e-03	1.35e-03	8.75e-04	7.18e-03	NA
Vulture-Polar	2.50e-03	3.54e-03	1.48e-03	1.56e-03	8.04e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	CCME Guidline	Significant Monitored Con-trasts*
Boron	August	Koala	Stream	Water	Nanuq Outflow	log e	Tobit regression	#2 shared slopes	1.5	1616-30 (LLCF) Moose-Nero Nema-Martine

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

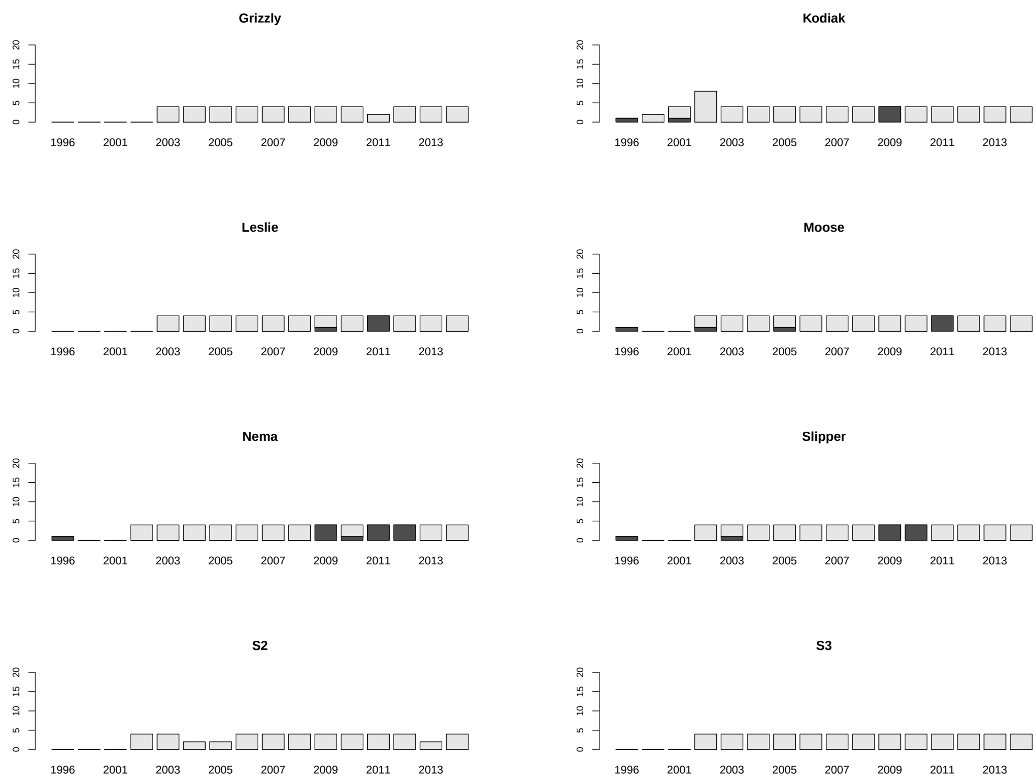
Analysis of April Total Cadmium in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

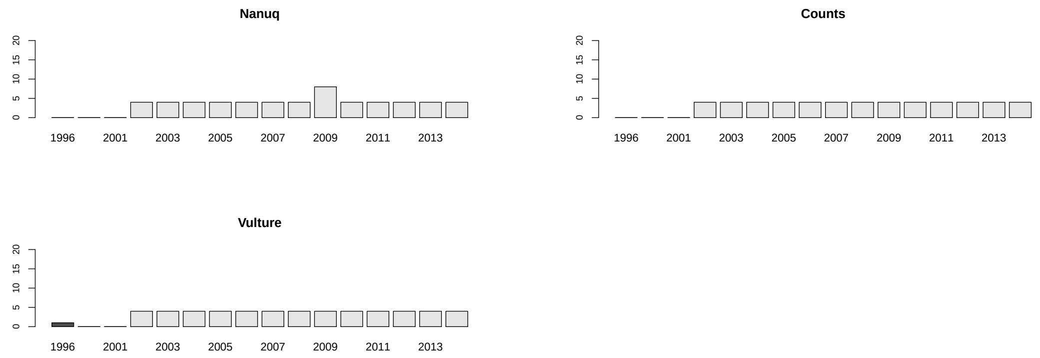
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

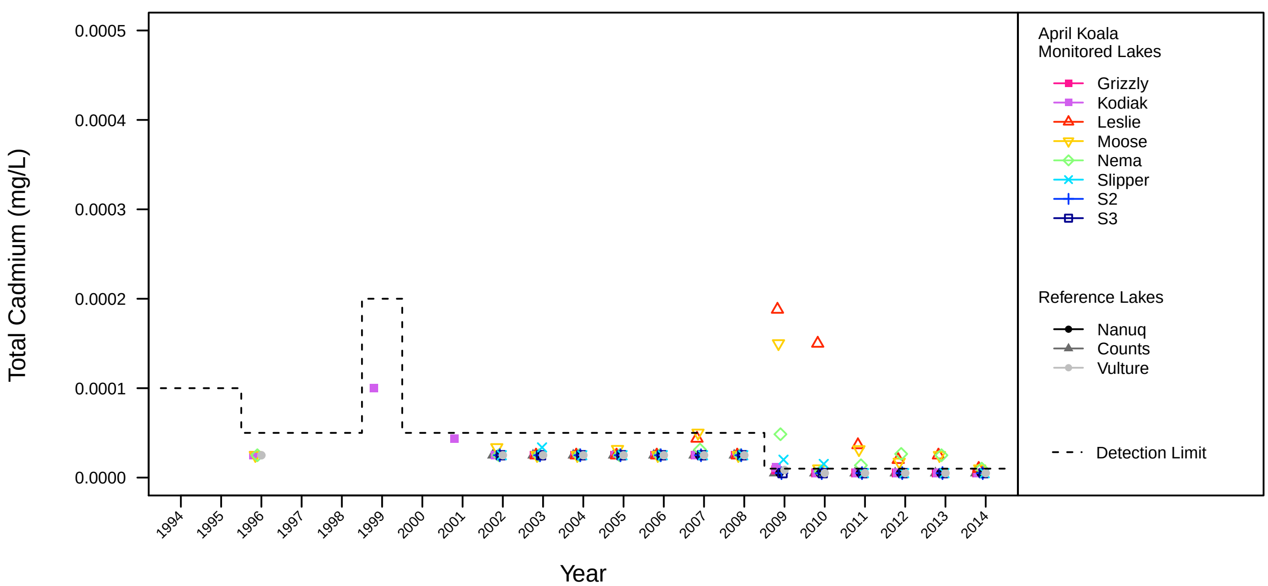


1.2 Reference



Comment:
Greater than 60% of data in all reference and monitored lakes was less than the detection limit. All lakes were excluded from further analyses. Statistical tests not performed. Note: 1616-30 (LLCF) was not monitored in April.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Cadmium	April	Koala	Lake	Water	ALL	NA	NA	NA	hardness-dependent	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

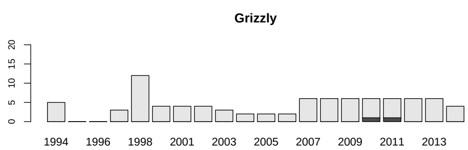
Analysis of August Total Cadmium in Lakes of the Koala Watershed and Lac de Gras

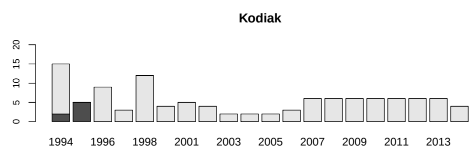
November 13, 2014

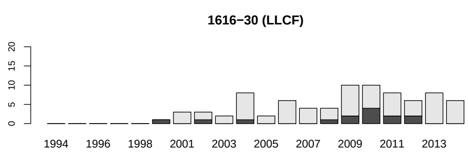
1 Censored Values:

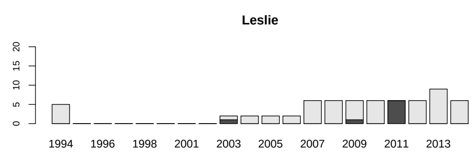
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

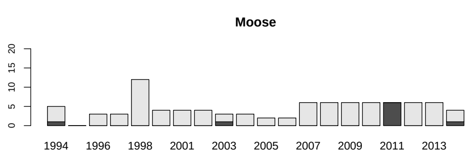
1.1 Monitored

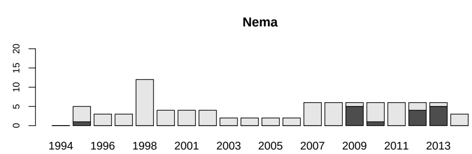




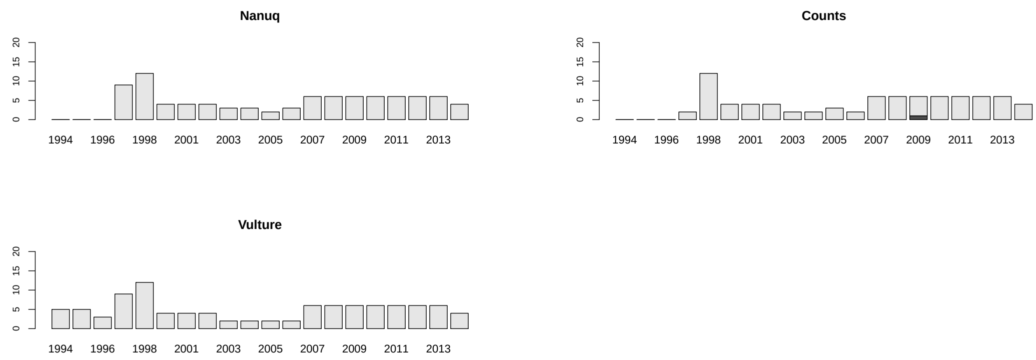






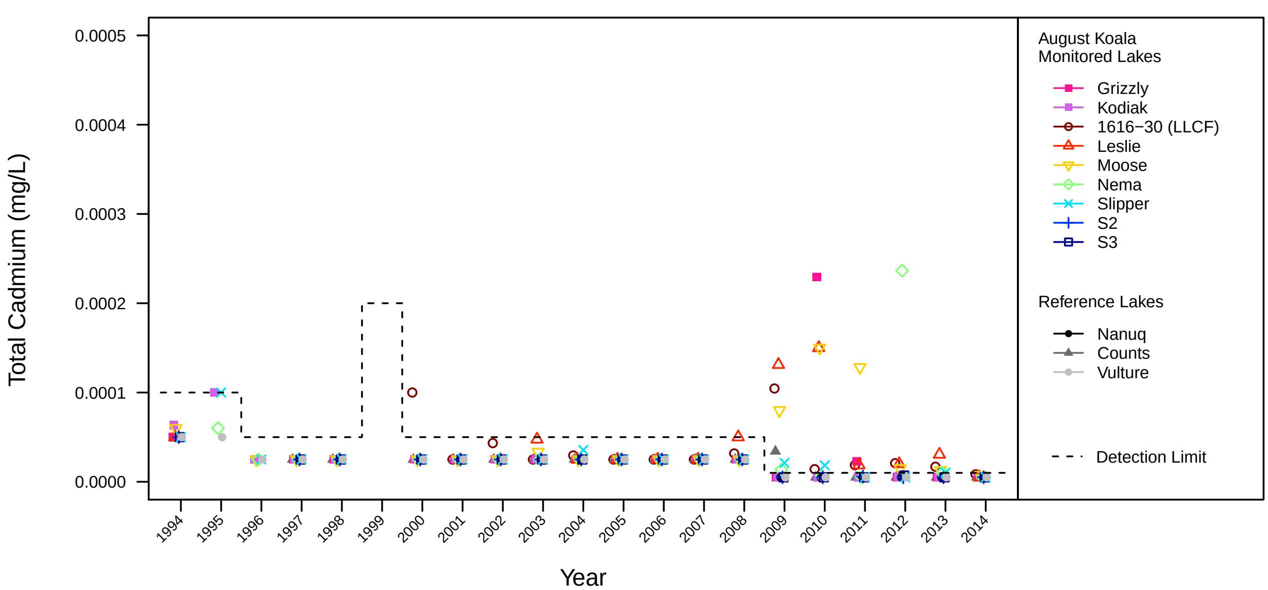


1.2 Reference



Comment:
Greater than 60% of data in all reference and monitored lakes was less than the detection limit. All lakes were excluded from further analyses. Statistical tests not performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Cadmium	August	Koala	Lake	Water	ALL	NA	NA	NA	hardness-dependent	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

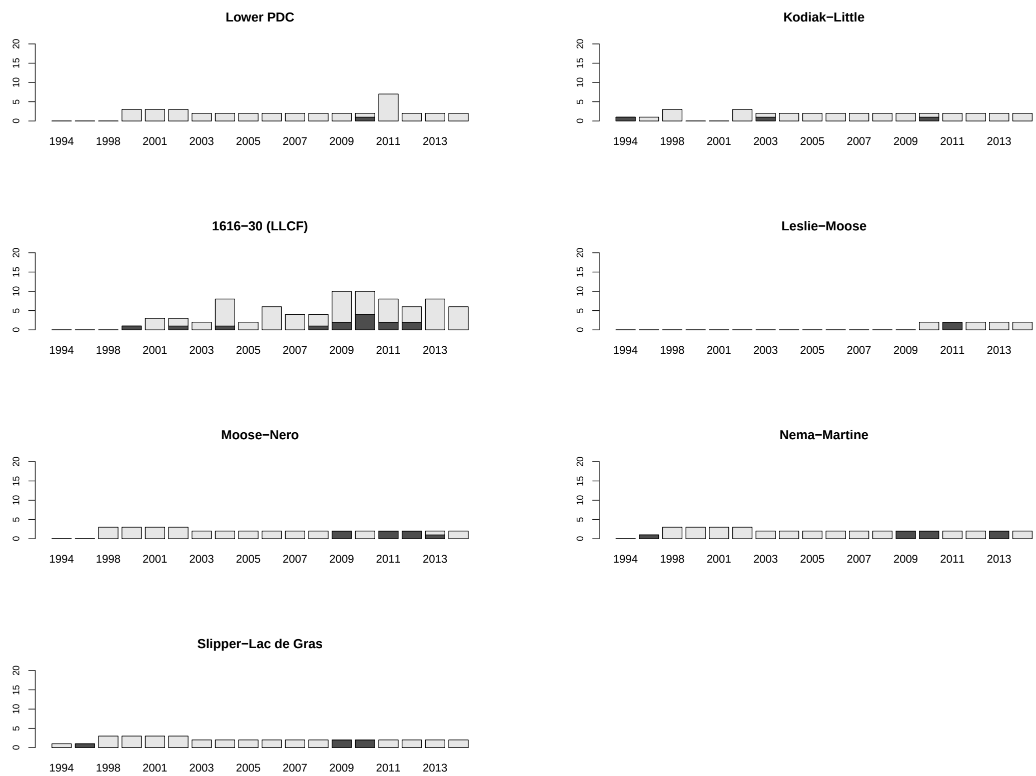
Analysis of August Total Cadmium in Koala Watershed Streams

November 13, 2014

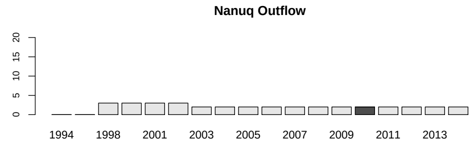
1 Censored Values:

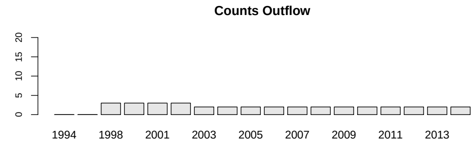
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

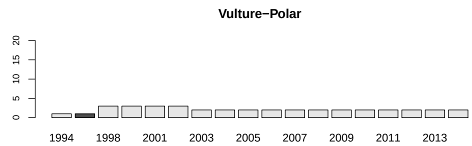
1.1 Monitored



1.2 Reference

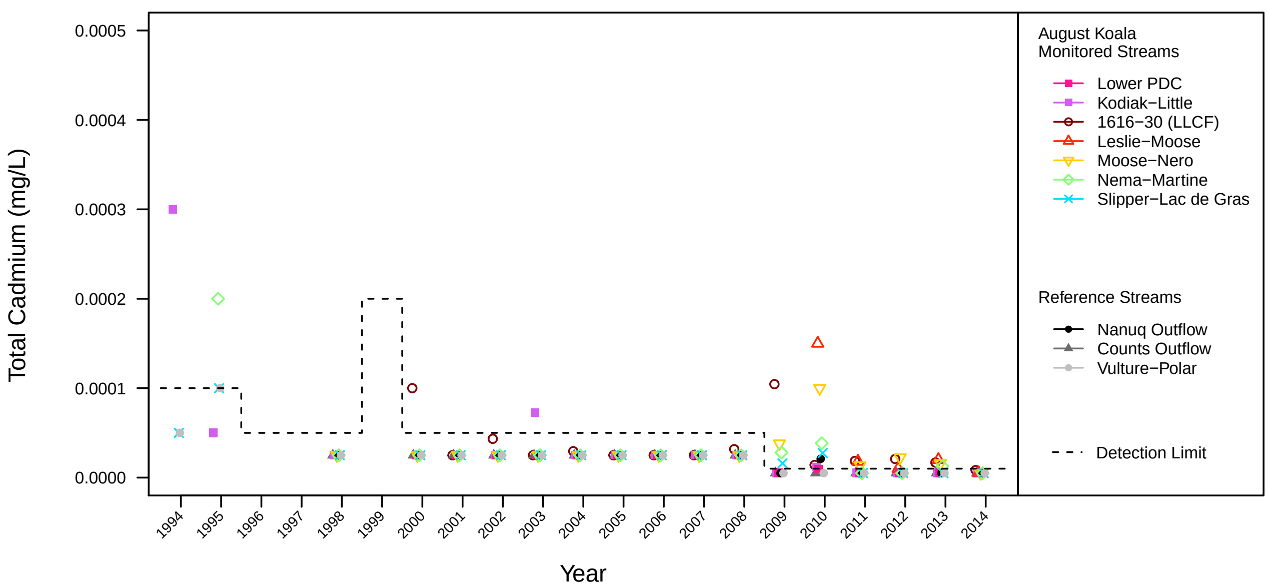






Comment:
Greater than 60% of data in all monitored and reference streams was less than the detection limit. All streams were excluded from further analyses. Statistical tests not perfomed.

2 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor- mation	Model Type	Reference Model	Bench- mark	Significant Monitored Con- trasts*
Cadmium	August	Koala	Stream	Water	ALL	NA	NA	NA	hardness- dependent	NA

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

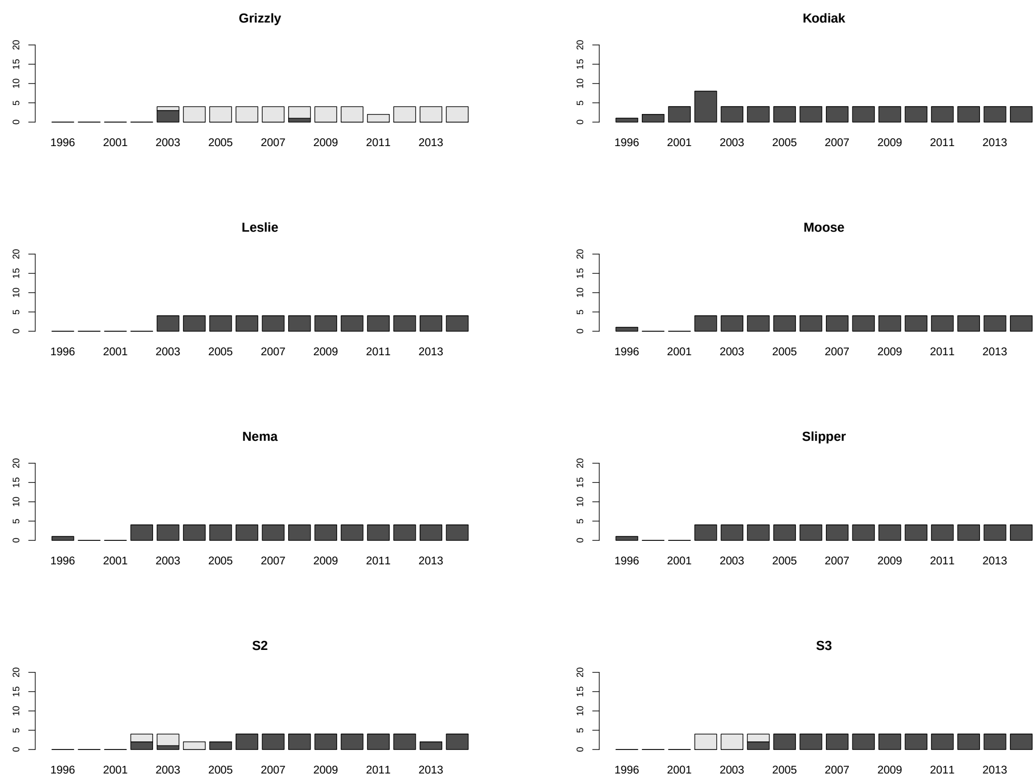
Analysis of April Total Molybdenum in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

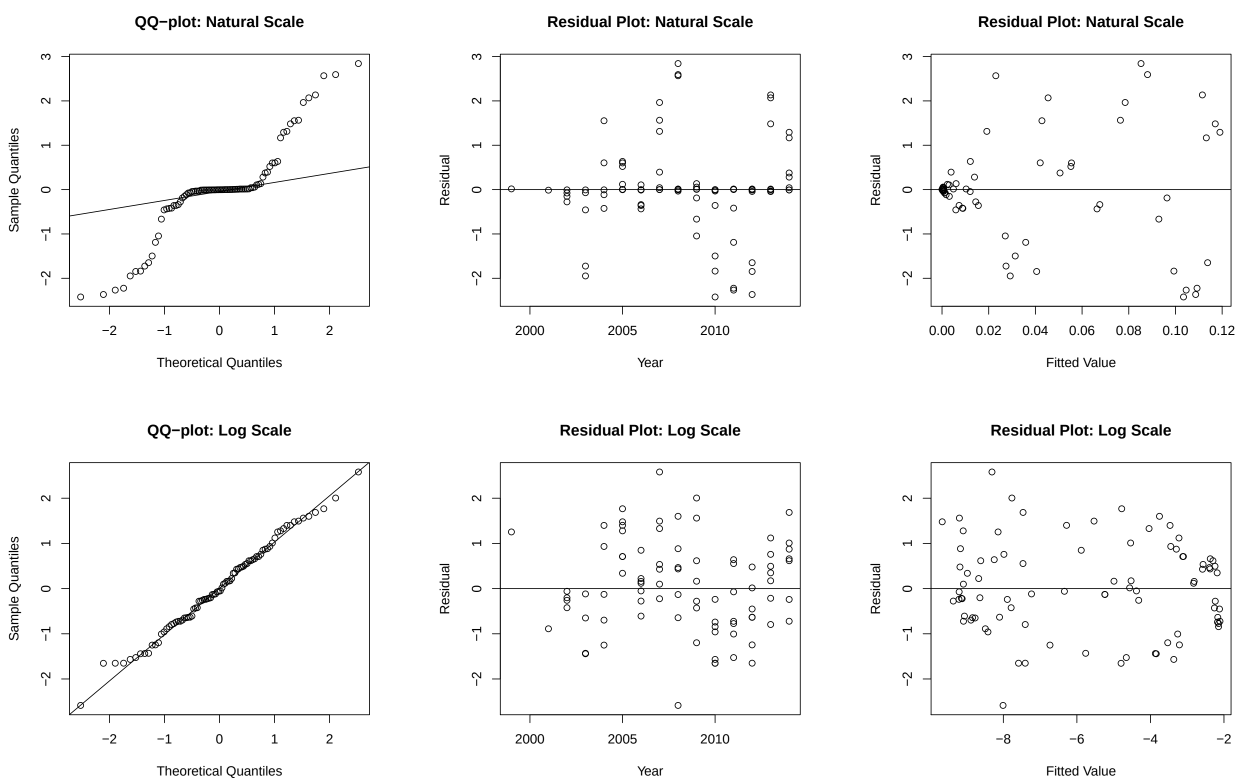
1.1 Monitored



1.2 Reference

Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and Grizzly lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in S2 and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.27E-127	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	7.4135	2	0.0246
Leslie	19.6748	2	0.0001
Moose	33.1031	2	0.0000
Nema	72.0204	2	0.0000
Slipper	78.5131	2	0.0000
S2	27.1193	2	0.0000
S3	38.3694	2	0.0000

- Conclusions:
  All monitored lakes show significant deviation from a slope of zero.

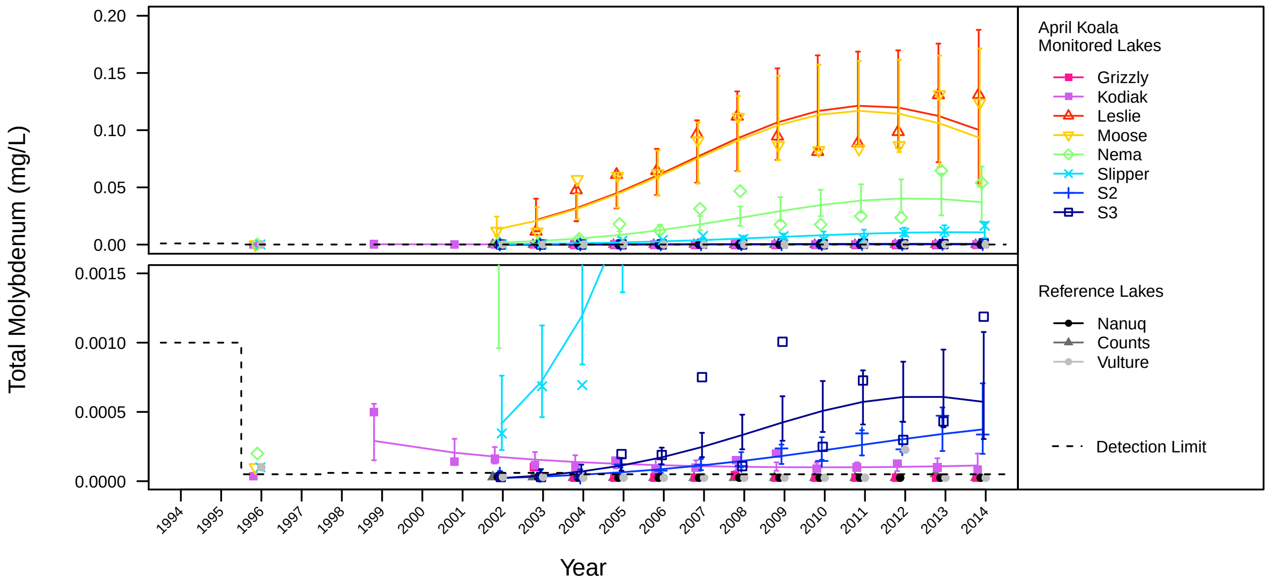
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Kodiak	0.4830
Monitored Lake	Leslie	0.7670
Monitored Lake	Moose	0.8170
Monitored Lake	Nema	0.8000
Monitored Lake	S2	0.8240
Monitored Lake	S3	0.7230
Monitored Lake	Slipper	0.8600

- Conclusions:
  Model fit for Kodiak Lake is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total molybdenum for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	8.30e-05	1.13e-04	3.27e-05	6.44e-05	2.00e-04	9.58e-05
Leslie	1.31e-01	1.00e-01	3.21e-02	5.36e-02	1.88e-01	9.38e-02
Moose	1.24e-01	9.32e-02	2.90e-02	5.07e-02	1.71e-01	8.48e-02
Nema	5.40e-02	3.70e-02	1.15e-02	2.02e-02	6.81e-02	3.37e-02
Slipper	1.65e-02	1.07e-02	3.32e-03	5.81e-03	1.96e-02	9.71e-03
S2	3.37e-04	3.73e-04	1.21e-04	1.97e-04	7.06e-04	3.55e-04
S3	1.19e-03	5.73e-04	1.84e-04	3.05e-04	1.08e-03	5.40e-04
Nanuq	2.50e-05	NA	NA	NA	NA	NA
Counts	2.50e-05	NA	NA	NA	NA	NA
Vulture	2.50e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Molybdenum	April	Koala	Lake	Water	Counts Nanuq Vulture Grizzly	log e	Tobit regression	#1a slope of zero	19.38	Kodiak Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

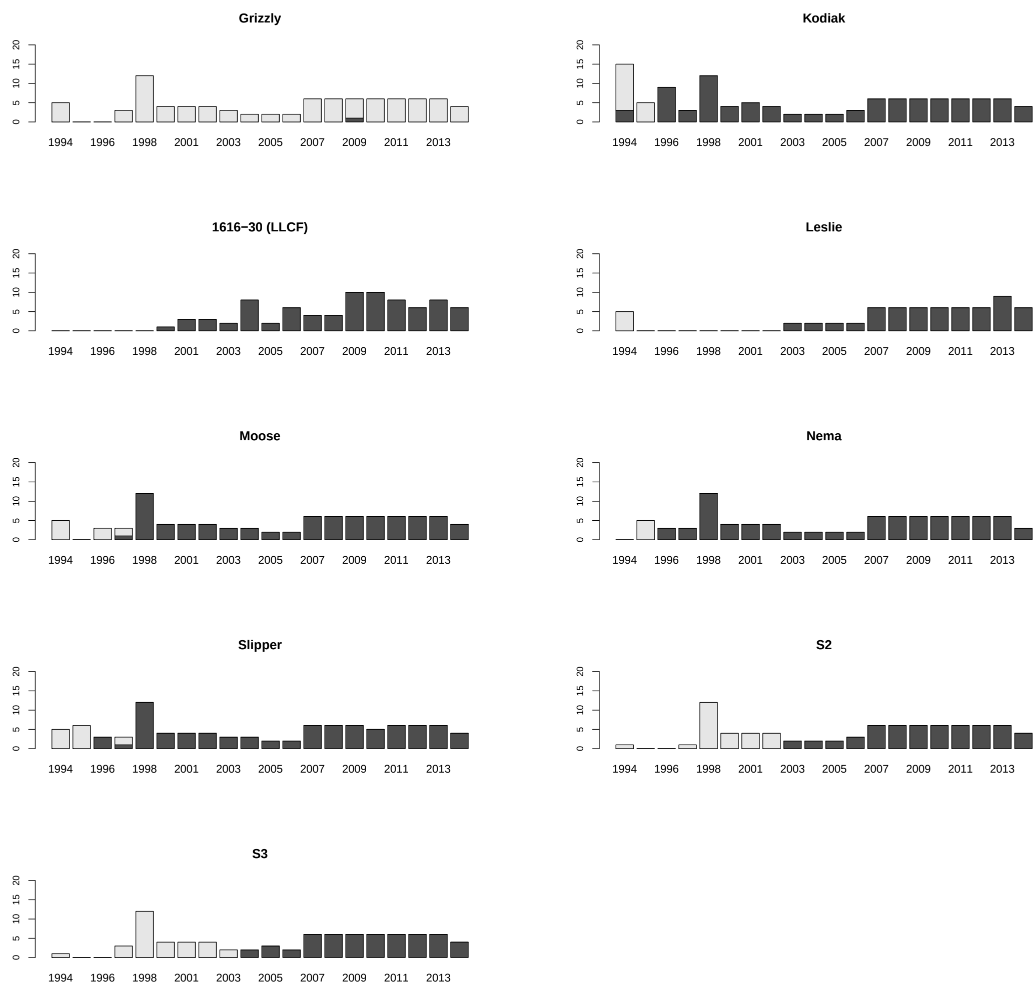
Analysis of August Total Molybdenum in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

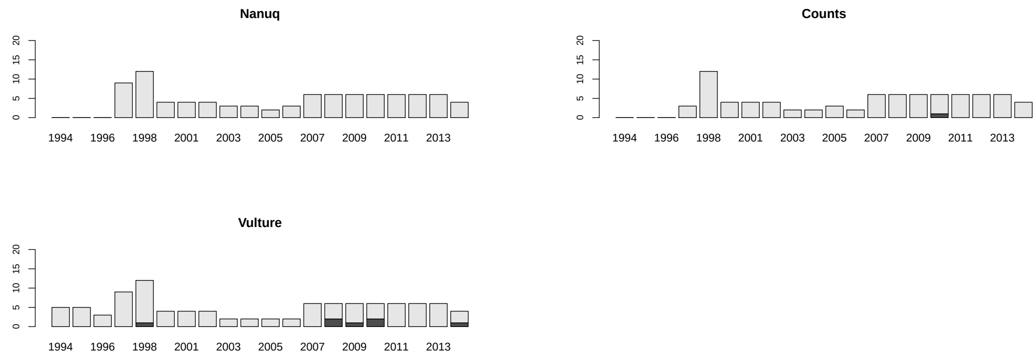
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

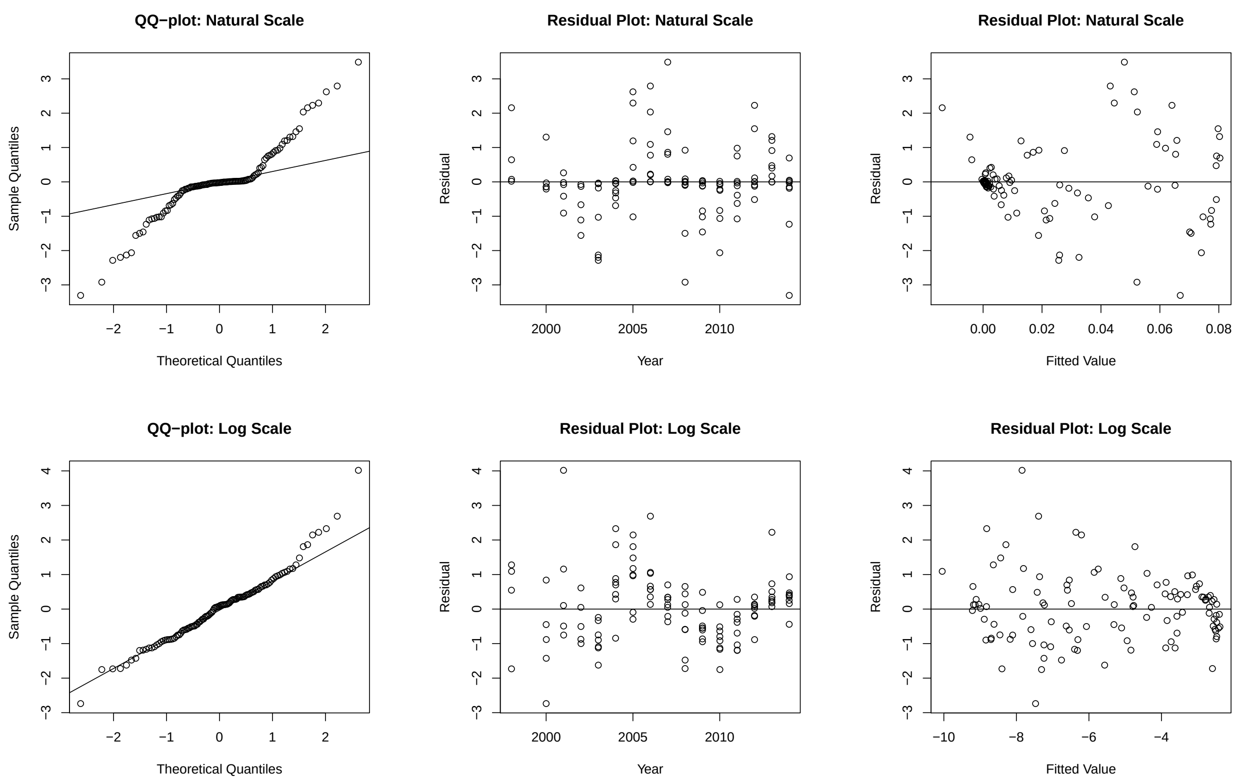


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and Grizzly lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in S2 and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
119	Moose	2007	0.07	0.05	3.49
126	Moose	2014	0.05	0.07	-3.30

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
71	Kodiak	2001	0.00	-7.84	4.02

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. However, the log-transformed model best meets the assumptions of normalty and equal variance. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	37.1070	2	0.0000
1616-30 (LLCF)	55.9056	2	0.0000
Leslie	10.8568	2	0.0044
Moose	202.1080	2	0.0000
Nema	161.4232	2	0.0000
Slipper	177.6733	2	0.0000
S2	72.7397	2	0.0000
S3	41.0750	2	0.0000

- Conclusions:
  All monitored lakes show significant deviation from a slope of zero.

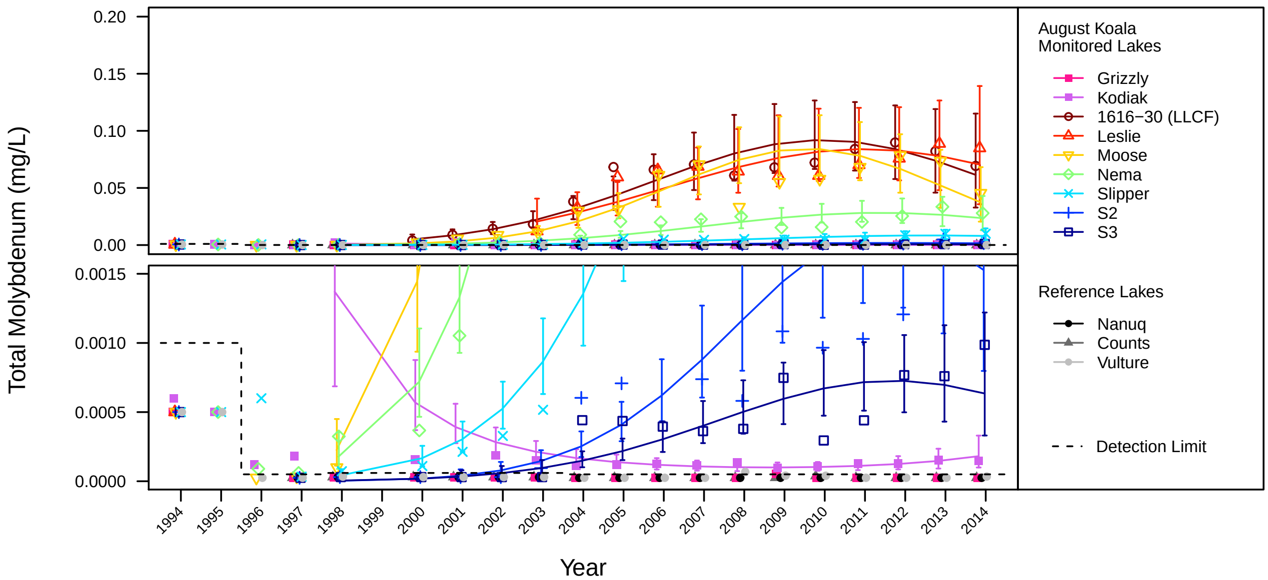
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-30 (LLCF)	0.9540
Monitored Lake	Kodiak	0.5810
Monitored Lake	Leslie	0.7350
Monitored Lake	Moose	0.9450
Monitored Lake	Nema	0.9110
Monitored Lake	S2	0.8310
Monitored Lake	S3	0.8080
Monitored Lake	Slipper	0.9270

- Conclusions:
  Models provide a good fit for all monitored lakes.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total molybdenum for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	1.47e-04	1.81e-04	5.55e-05	9.93e-05	3.30e-04	1.62e-04
Leslie	8.49e-02	7.05e-02	2.45e-02	3.57e-02	1.39e-01	7.16e-02
1616-30 (LLCF)	6.93e-02	6.15e-02	1.97e-02	3.28e-02	1.15e-01	5.76e-02
Moose	4.55e-02	3.74e-02	1.15e-02	2.05e-02	6.82e-02	3.35e-02
Nema	2.79e-02	2.36e-02	7.22e-03	1.29e-02	4.29e-02	2.11e-02
Slipper	9.98e-03	8.01e-03	2.45e-03	4.39e-03	1.46e-02	7.18e-03
S2	1.65e-03	1.53e-03	5.07e-04	7.98e-04	2.93e-03	1.48e-03
S3	9.86e-04	6.35e-04	2.12e-04	3.31e-04	1.22e-03	6.19e-04
Nanuq	2.50e-05	NA	NA	NA	NA	NA
Counts	2.50e-05	NA	NA	NA	NA	NA
Vulture	3.40e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Molybdenum	August	Koala	Lake	Water	Counts Nanuq Vulture Grizzly	log e	Tobit regression	#1a slope of zero	19.38	Kodiak 1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

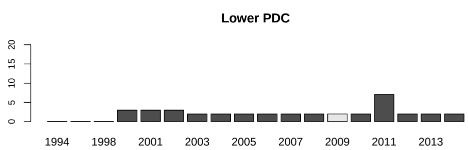
Analysis of August Total Molybdenum in Koala Watershed Streams

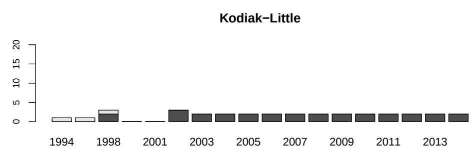
November 13, 2014

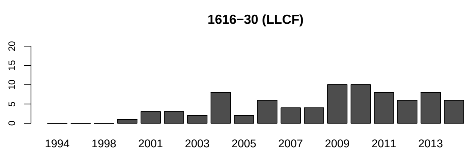
1 Censored Values:

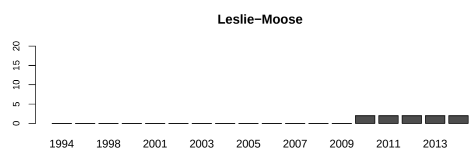
The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

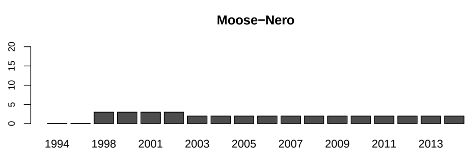
1.1 Monitored

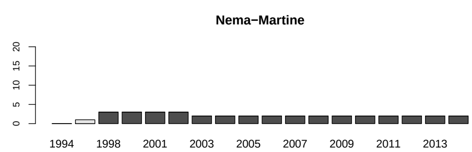


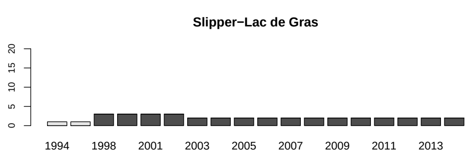




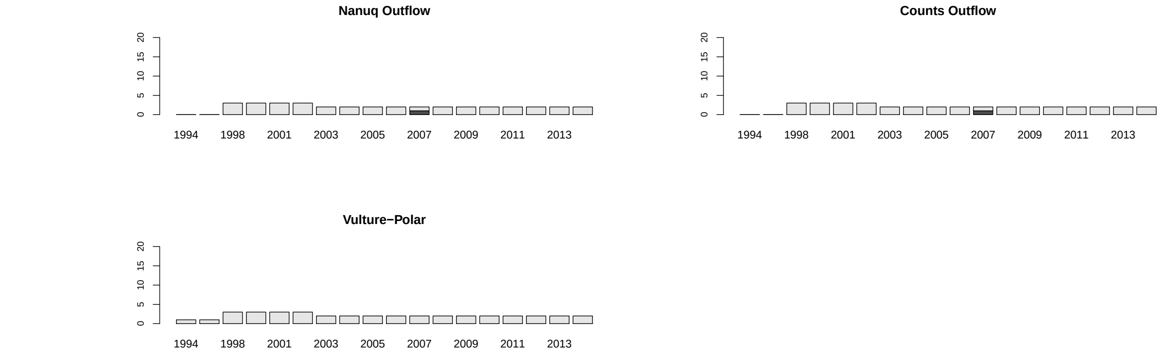






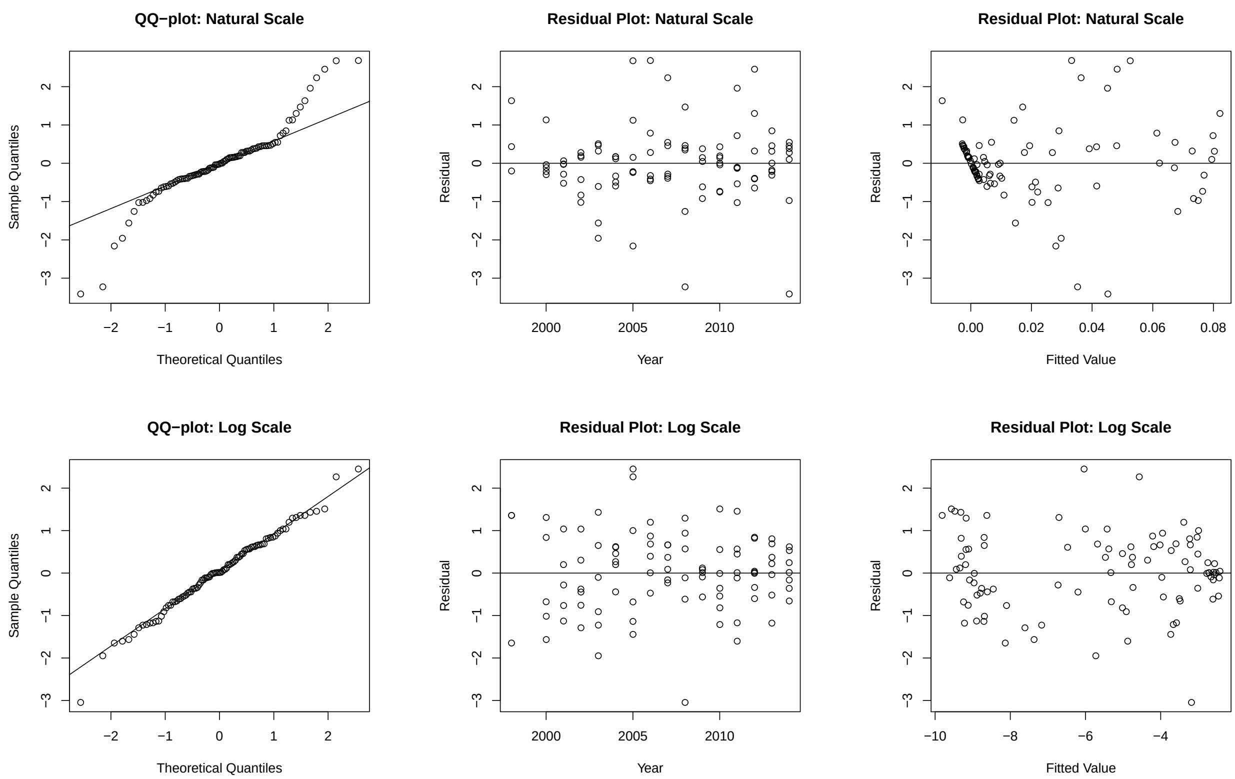


1.2 Reference



Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, and Vulture-Polar was less than the detection limit. These streams were excluded from further analyses. None of the remaining streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.02	0.04	-3.23
126	Moose-Nero	2014	0.03	0.05	-3.41

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.02	-3.18	-3.05

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	5.7604	2	0.0561
Kodiak-Little	12.3726	2	0.0021
Leslie-Moose	0.1449	2	0.9301
1616-30 (LLCF)	104.3776	2	0.0000
Moose-Nero	125.6196	2	0.0000
Nema-Martine	134.7446	2	0.0000
Slipper-Lac de Gras	140.8561	2	0.0000

- Conclusions:
  All monitored streams except Leslie-Moose show significant deviation from a slope of zero.

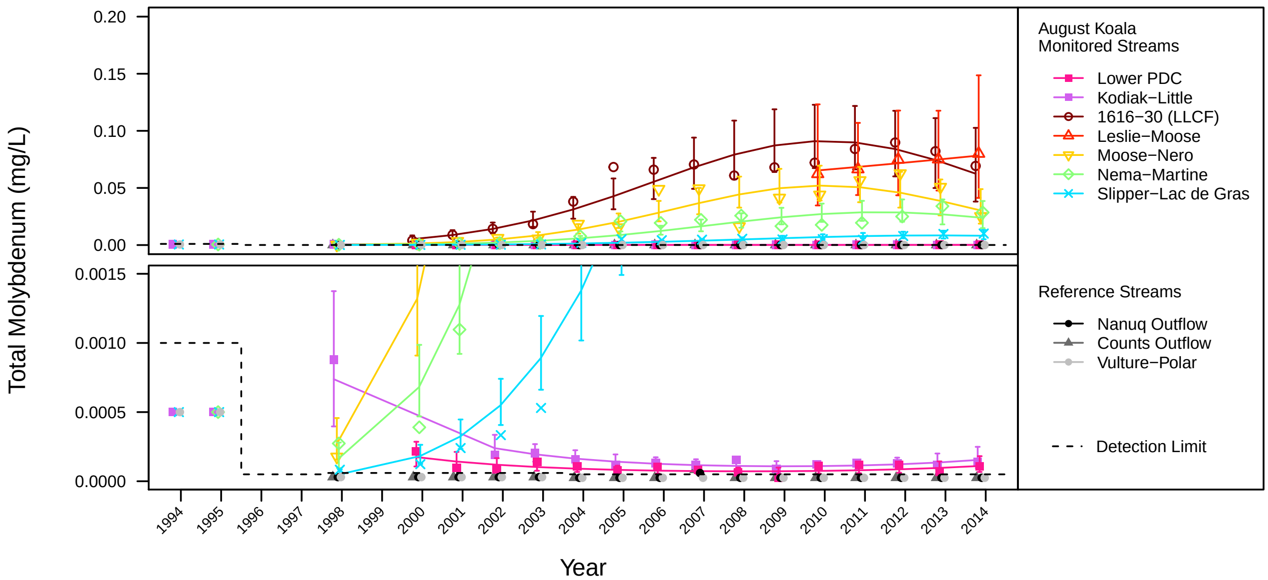
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-30 (LLCF)	0.9510
Monitored Stream	Kodiak-Little	0.9060
Monitored Stream	Leslie-Moose	0.6940
Monitored Stream	Lower PDC	0.3310
Monitored Stream	Moose-Nero	0.9370
Monitored Stream	Nema-Martine	0.9260
Monitored Stream	Slipper-Lac de Gras	0.9340

- Conclusions:
  Model fit for the Lower PDC is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total molybdenum for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	1.08e-04	1.10e-04	2.79e-05	6.73e-05	1.81e-04	8.18e-05
Kodiak-Little	1.40e-04	1.54e-04	3.77e-05	9.53e-05	2.49e-04	1.10e-04
Leslie-Moose	8.00e-02	7.83e-02	2.56e-02	4.13e-02	1.49e-01	7.49e-02
1616-30 (LLCF)	6.93e-02	6.25e-02	1.58e-02	3.81e-02	1.03e-01	4.63e-02
Moose-Nero	2.51e-02	3.03e-02	7.42e-03	1.88e-02	4.90e-02	2.17e-02
Nema-Martine	2.85e-02	2.39e-02	5.84e-03	1.48e-02	3.85e-02	1.71e-02
Slipper-Lac de Gras	1.00e-02	8.17e-03	2.00e-03	5.06e-03	1.32e-02	5.85e-03
Nanuq Outflow	2.50e-05	NA	NA	NA	NA	NA
Counts Outflow	2.50e-05	NA	NA	NA	NA	NA
Vulture-Polar	2.50e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Molybdenum	August	Koala	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar	log e	linear mixed effects regression	#1a slope of zero	19.38	Kodiak-Little 1616-30 (LLCF) Lower PDC Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

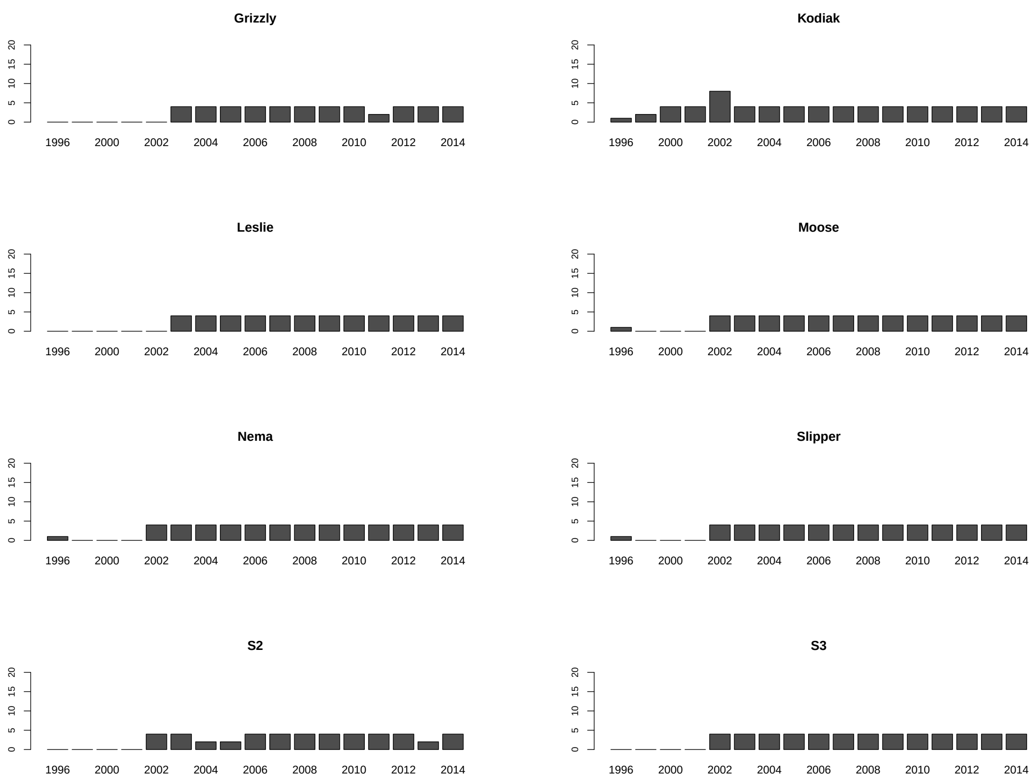
Analysis of April Total Nickel in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

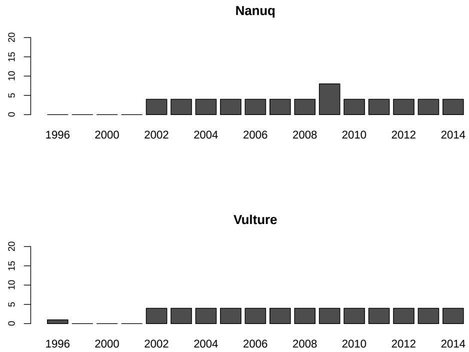
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

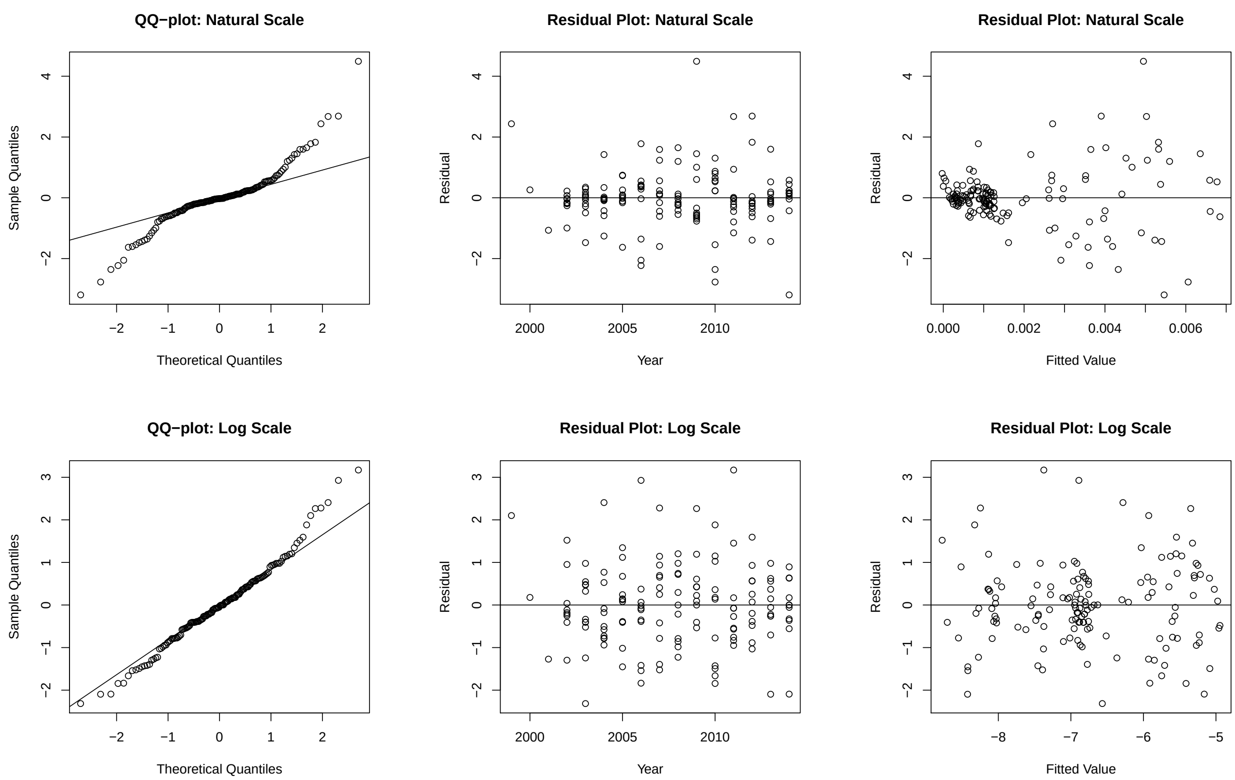


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
79	Kodiak	2009	0.01	0.00	4.49
84	Kodiak	2014	0.00	0.01	-3.20

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
39	Counts	2011	0.00	-7.37	3.17

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	0.00E+00	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
6601.67	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
6.39	4.00	0.17

- Conclusions:
  The slopes do not differ significantly among reference lakes.

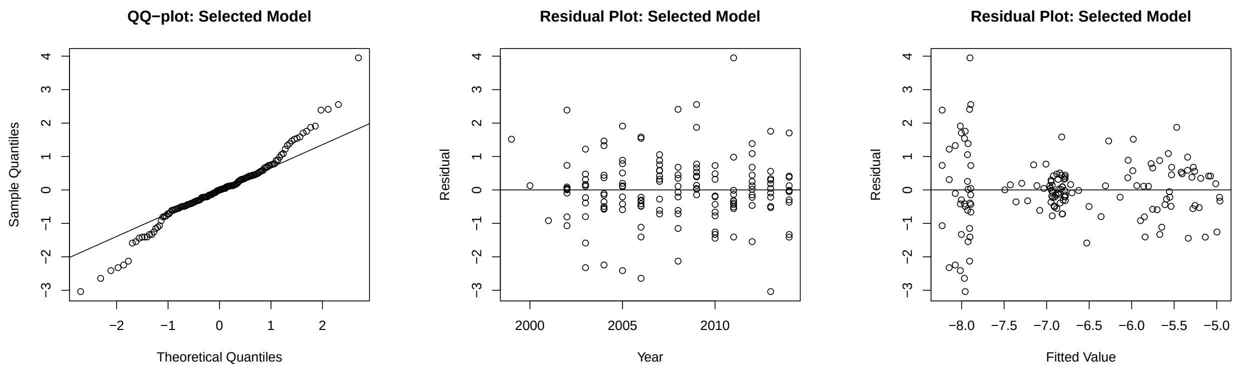
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
39	Counts	2011	0.00	-7.90	3.95
146	Nanuq	2013	0.00	-7.96	-3.04

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.82	2.00	0.66
Kodiak	2.39	2.00	0.30
Leslie	13.03	2.00	0.00
Moose	13.50	2.00	0.00
Nema	10.63	2.00	0.00
Slipper	3.58	2.00	0.17
S2	0.47	2.00	0.79
S3	1.19	2.00	0.55

- Conclusions:
  Leslie, Moose, and Nema lakes show significant deviation from the common slope of reference lakes.

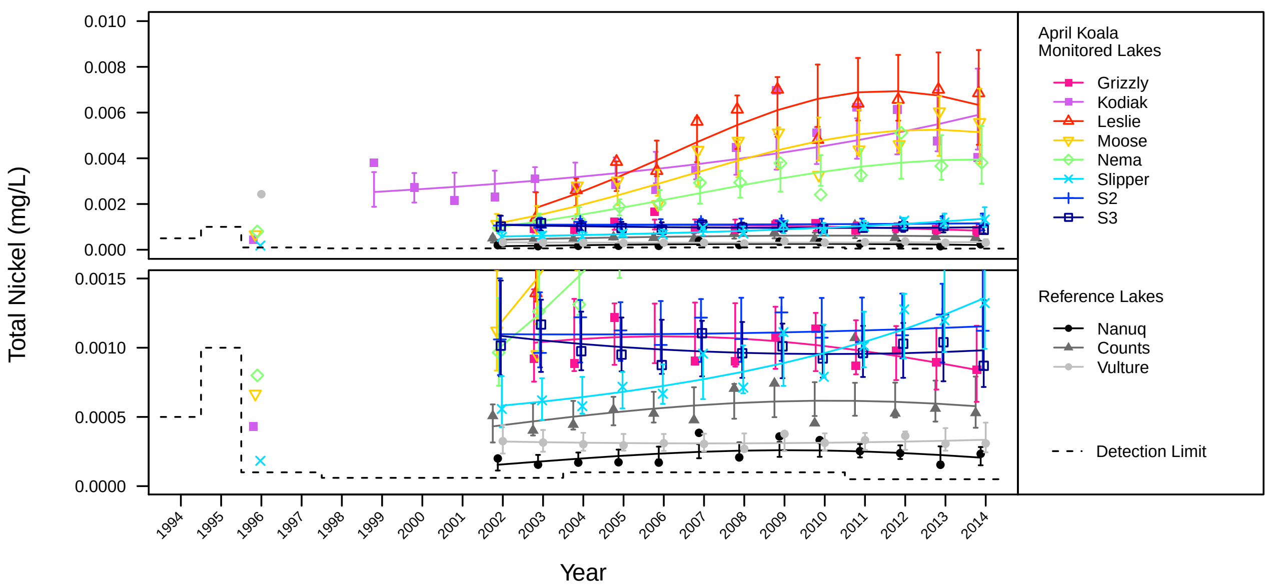
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0520
Monitored Lake	Grizzly	0.2280
Monitored Lake	Kodiak	0.5280
Monitored Lake	Leslie	0.8880
Monitored Lake	Moose	0.7940
Monitored Lake	Nema	0.8970
Monitored Lake	S2	0.0930
Monitored Lake	S3	0.1070
Monitored Lake	Slipper	0.8320

- Conclusions:
  Model fit for Grizzly Lake is weak. Model fit for pooled reference lakes, S2 and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nickel for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	8.41e-04	8.40e-04	1.38e-04	6.09e-04	1.16e-03	4.03e-04
Kodiak	4.03e-03	5.89e-03	8.90e-04	4.38e-03	7.92e-03	2.60e-03
Leslie	6.85e-03	6.33e-03	1.04e-03	4.59e-03	8.73e-03	3.04e-03
Moose	5.58e-03	5.15e-03	8.26e-04	3.76e-03	7.05e-03	2.42e-03
Nema	3.81e-03	3.95e-03	6.34e-04	2.89e-03	5.41e-03	1.86e-03
Slipper	1.32e-03	1.36e-03	2.18e-04	9.92e-04	1.86e-03	6.38e-04
S2	1.12e-03	1.15e-03	1.85e-04	8.43e-04	1.58e-03	5.42e-04
S3	8.70e-04	9.81e-04	1.57e-04	7.16e-04	1.34e-03	4.61e-04
Nanuq	2.33e-04	2.06e-04	3.31e-05	1.51e-04	2.83e-04	NA
Counts	5.29e-04	5.78e-04	9.27e-05	4.22e-04	7.91e-04	NA
Vulture	3.08e-04	3.35e-04	5.38e-05	2.45e-04	4.59e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Nickel	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	hardness-dependent	Leslie Moose Nema

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

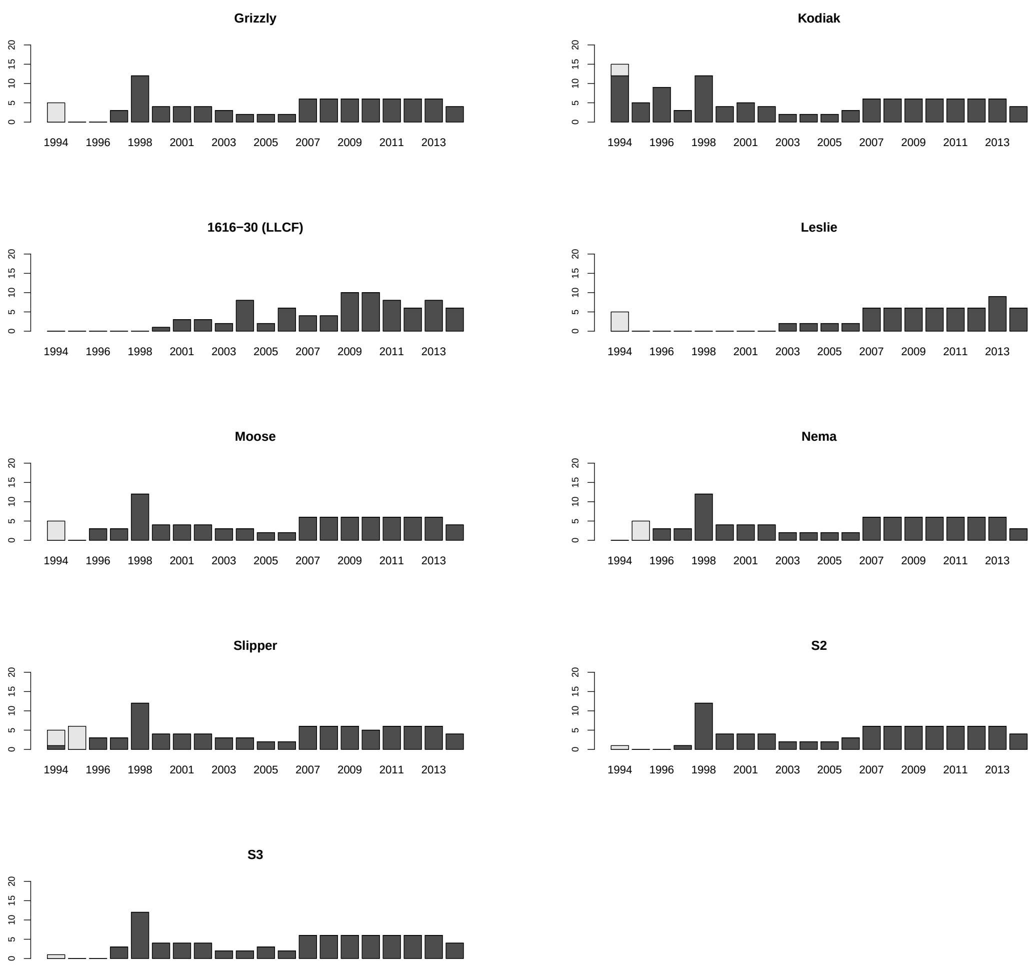
Analysis of August Total Nickel in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

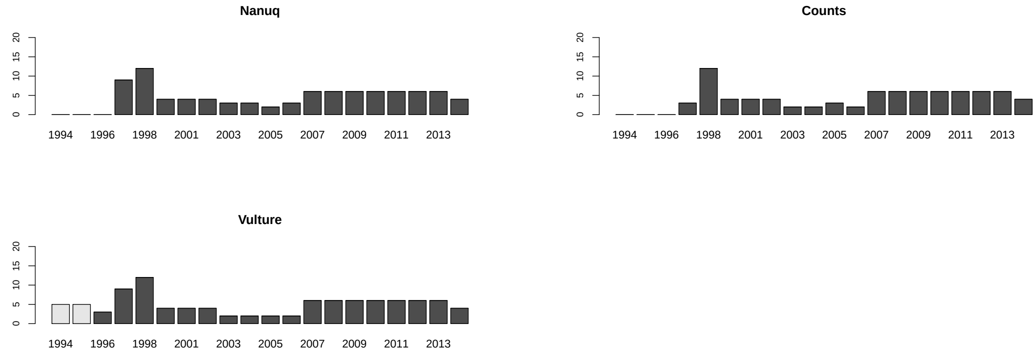
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

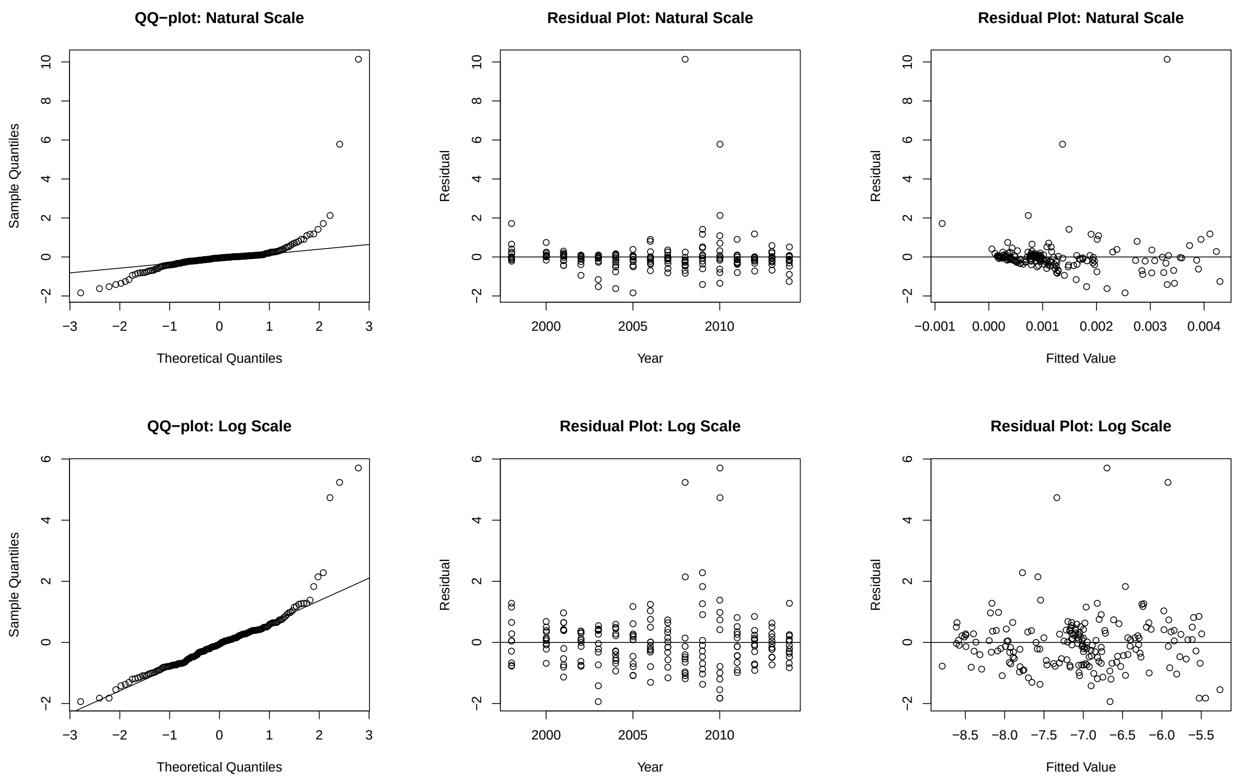


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	0.01	0.00	10.13
227	Slipper	2010	0.01	0.00	5.78

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	0.01	-5.92	5.24
227	Slipper	2010	0.01	-6.70	5.71
248	Vulture	2010	0.00	-7.34	4.74

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
54.36	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

- Conclusions:
  The slopes do not differ significantly among reference lakes.

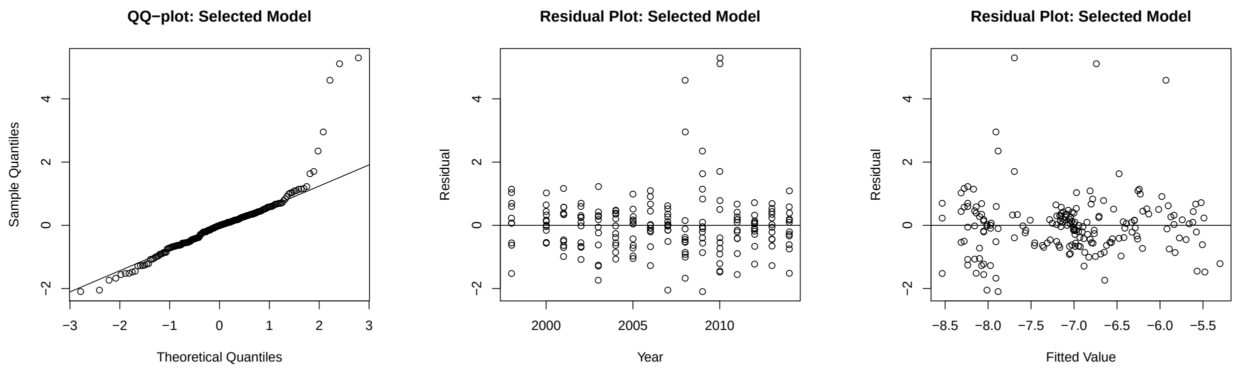
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
120	Moose	2008	0.01	-5.93	4.59
227	Slipper	2010	0.01	-6.74	5.11
248	Vulture	2010	0.00	-7.69	5.30

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.8836	2	0.6429
Kodiak	1.5050	2	0.4712
1616-30 (LLCF)	8.3051	2	0.0157
Leslie	17.7749	2	0.0001
Moose	39.8778	2	0.0000
Nema	16.6196	2	0.0002
Slipper	4.6805	2	0.0963
S2	0.3287	2	0.8484
S3	1.0205	2	0.6003

- Conclusions:
  1616-30 (LLCF), Leslie, Moose, and Nema show significant deviation from the common slope of reference lakes.

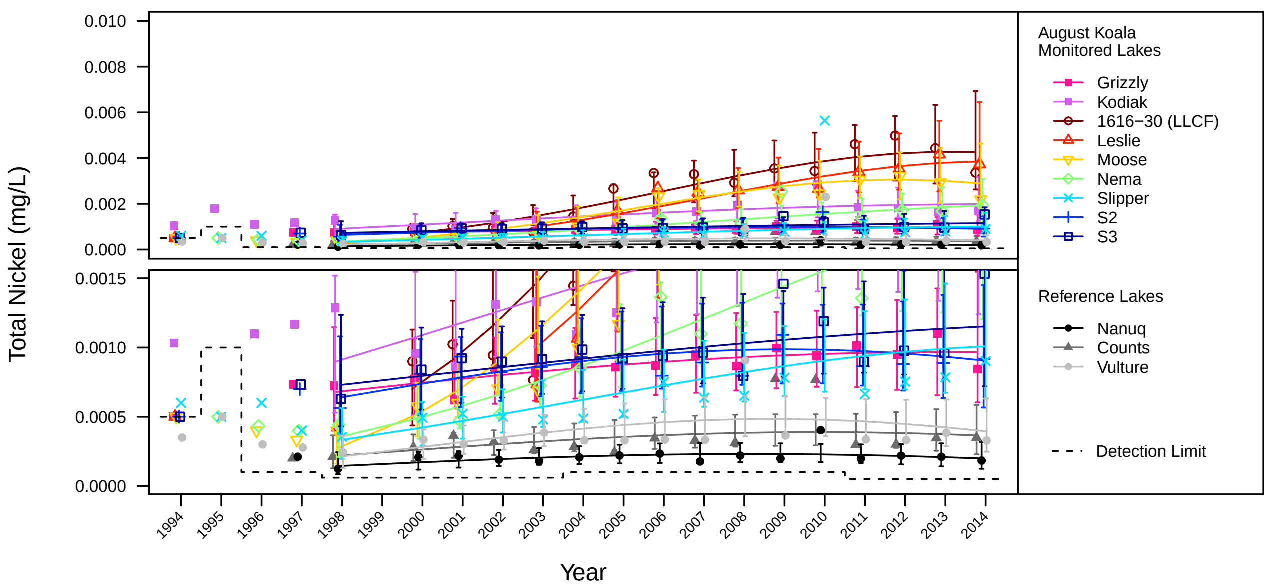
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1290
Monitored Lake	1616-30 (LLCF)	0.8570
Monitored Lake	Grizzly	0.6310
Monitored Lake	Kodiak	0.5350
Monitored Lake	Leslie	0.8830
Monitored Lake	Moose	0.7310
Monitored Lake	Nema	0.8680
Monitored Lake	S2	0.3470
Monitored Lake	S3	0.4170
Monitored Lake	Slipper	0.3050

- Conclusions:
  Model fit for Slipper, S2, and S3 is weak. Model fit for pooled reference lakes is poor.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nickel for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	8.44e-04	9.67e-04	2.32e-04	6.04e-04	1.55e-03	6.78e-04
Kodiak	1.71e-03	1.99e-03	4.76e-04	1.24e-03	3.18e-03	1.39e-03
Leslie	3.74e-03	3.85e-03	1.01e-03	2.30e-03	6.44e-03	2.96e-03
1616-30 (LLCF)	3.36e-03	4.27e-03	1.06e-03	2.63e-03	6.93e-03	3.09e-03
Moose	2.19e-03	2.90e-03	6.94e-04	1.81e-03	4.63e-03	2.03e-03
Nema	1.93e-03	1.93e-03	4.63e-04	1.21e-03	3.09e-03	1.35e-03
Slipper	9.02e-04	1.01e-03	2.42e-04	6.30e-04	1.61e-03	7.08e-04
S2	9.18e-04	9.07e-04	2.17e-04	5.67e-04	1.45e-03	6.36e-04
S3	1.53e-03	1.15e-03	2.76e-04	7.20e-04	1.84e-03	8.09e-04
Nanuq	1.84e-04	1.99e-04	4.77e-05	1.24e-04	3.18e-04	NA
Counts	3.49e-04	3.65e-04	8.76e-05	2.28e-04	5.85e-04	NA
Vulture	3.29e-04	3.95e-04	9.47e-05	2.47e-04	6.32e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Nickel	August	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	hardness-dependent	1616-30 (LLCF) Leslie Moose Nema

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

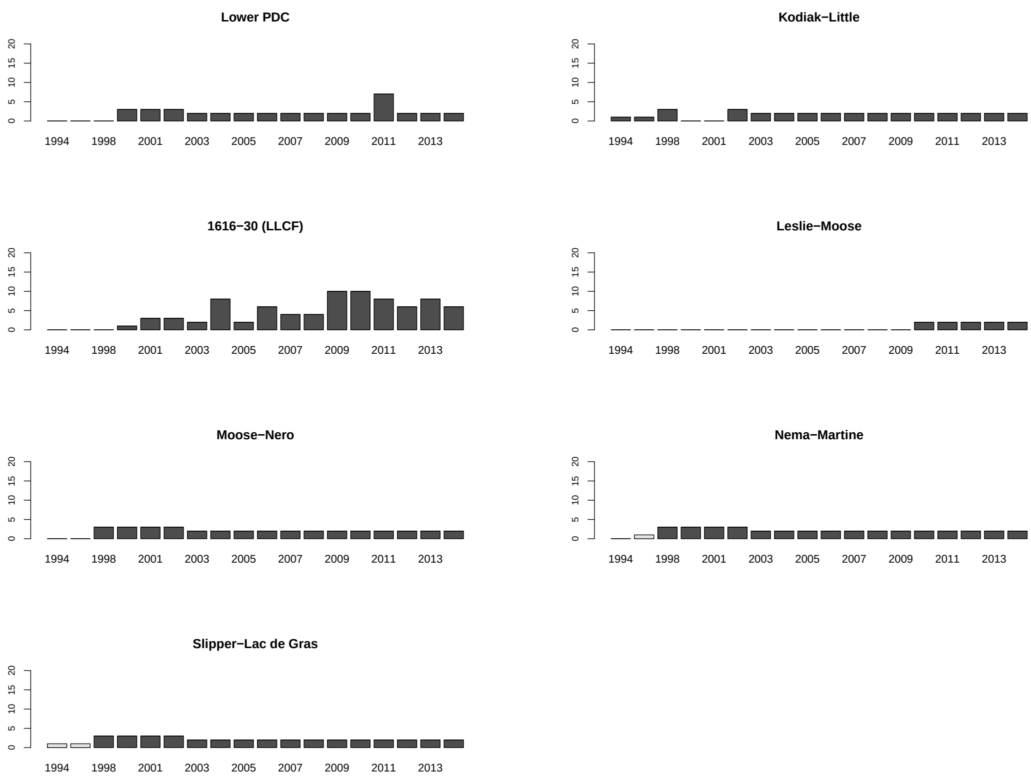
Analysis of August Total Nickel in Koala Watershed Streams

November 13, 2014

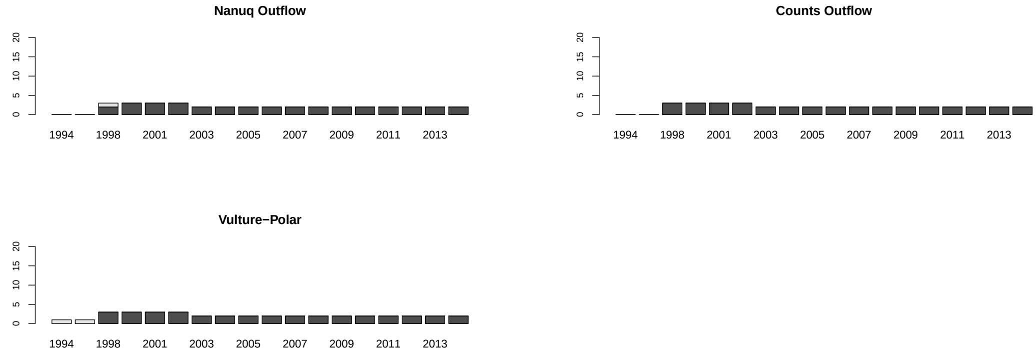
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

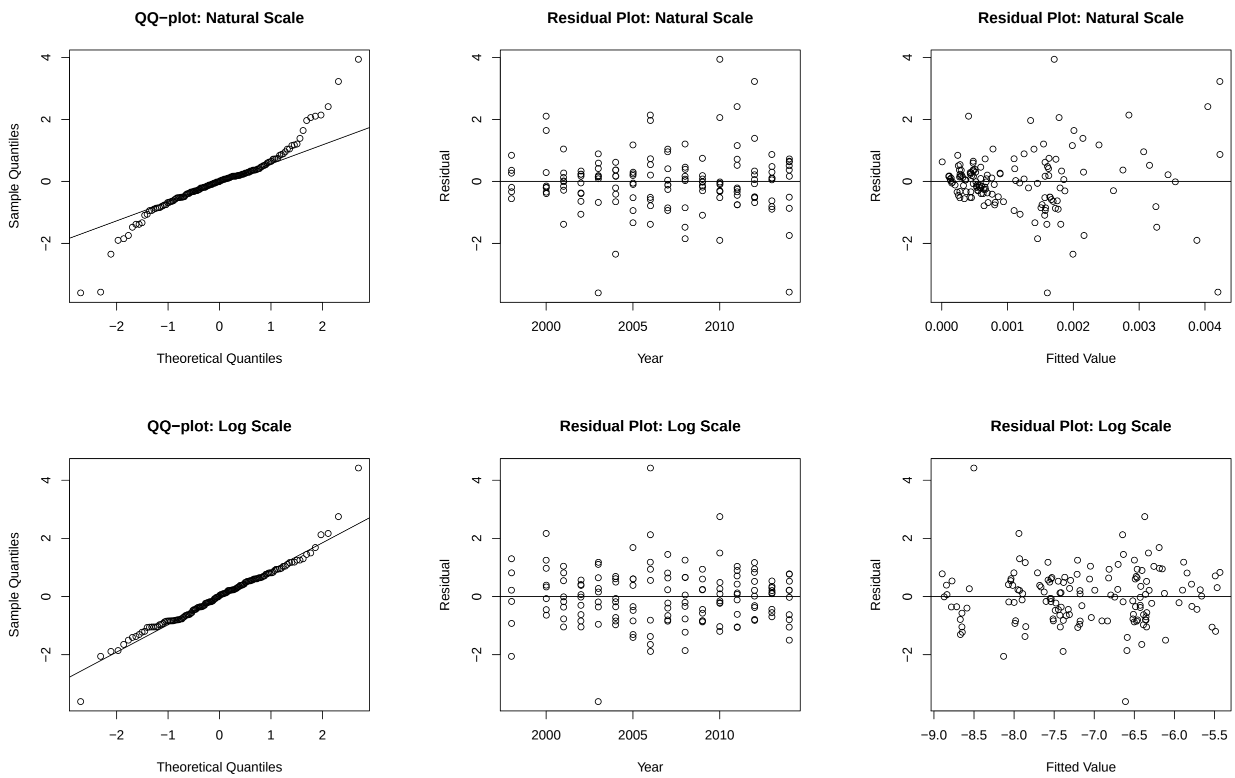


1.2 Reference



Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
10	1616-30 (LLCF)	2003	0.00	0.00	-3.60
19	1616-30 (LLCF)	2012	0.00	0.00	3.23
21	1616-30 (LLCF)	2014	0.00	0.00	-3.57
101	Lower PDC	2010	0.00	0.00	3.94

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
10	1616-30 (LLCF)	2003	0.00	-6.61	-3.61
139	Nanuq Outflow	2006	0.00	-8.50	4.42

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
566.15	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
46.41	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	0.8417	2	0.6565
Kodiak-Little	7.1122	2	0.0285
Leslie-Moose	2.2800	2	0.3198
1616-30 (LLCF)	189.8483	2	0.0000
Moose-Nero	74.6504	2	0.0000
Nema-Martine	55.0698	2	0.0000
Slipper-Lac de Gras	13.3014	2	0.0013

- Conclusions:
  All monitored streams except the Lower PDC and Leslie-Moose show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Kodiak-Little-vs-Nanuq Outflow	1469.0289	3	0.0000
Kodiak-Little-vs-Counts Outflow	630.3165	3	0.0000
Kodiak-Little-vs-Vulture-Polar	282.5230	3	0.0000
1616-30 (LLCF)-vs-Nanuq Outflow	103.4212	3	0.0000
1616-30 (LLCF)-vs-Counts Outflow	38.5061	3	0.0000
1616-30 (LLCF)-vs-Vulture-Polar	42.9616	3	0.0000
Moose-Nero-vs-Nanuq Outflow	1325.6207	3	0.0000
Moose-Nero-vs-Counts Outflow	537.0137	3	0.0000
Moose-Nero-vs-Vulture-Polar	241.0041	3	0.0000
Nema-Martine-vs-Nanuq Outflow	1080.1252	3	0.0000
Nema-Martine-vs-Counts Outflow	384.1937	3	0.0000
Nema-Martine-vs-Vulture-Polar	146.0700	3	0.0000
Slipper-Lac de Gras-vs-Nanuq Outflow	567.9930	3	0.0000
Slipper-Lac de Gras-vs-Counts Outflow	103.4126	3	0.0000
Slipper-Lac de Gras-vs-Vulture-Polar	12.1455	3	0.0069

- Conclusions:
  All remaining monitored streams show significant deviation from the common slope of reference streams.

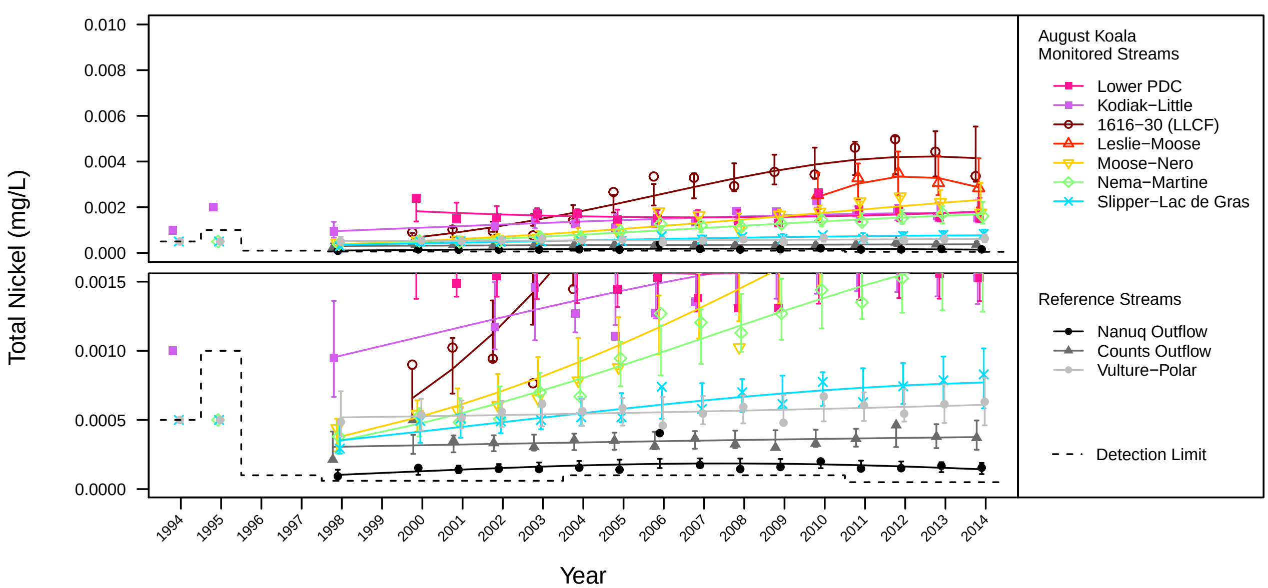
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.1130
Reference Stream	Nanuq Outflow	0.3070
Reference Stream	Vulture-Polar	0.2210
Monitored Stream	1616-30 (LLCF)	0.8640
Monitored Stream	Kodiak-Little	0.5840
Monitored Stream	Leslie-Moose	0.8160
Monitored Stream	Lower PDC	0.0720
Monitored Stream	Moose-Nero	0.8750
Monitored Stream	Nema-Martine	0.9450
Monitored Stream	Slipper-Lac de Gras	0.8150

- Conclusions:
  Model fit for Nanuq Outflow and Vulture-Polar is weak. Model fit for Counts Outflow and the Lower PDC is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nickel for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	1.52e-03	1.81e-03	2.65e-04	1.36e-03	2.41e-03	7.75e-04
Kodiak-Little	1.53e-03	1.77e-03	2.51e-04	1.34e-03	2.33e-03	7.33e-04
Leslie-Moose	2.84e-03	2.87e-03	5.37e-04	1.99e-03	4.14e-03	1.57e-03
1616-30 (LLCF)	3.36e-03	4.15e-03	6.07e-04	3.12e-03	5.53e-03	1.78e-03
Moose-Nero	1.76e-03	2.32e-03	3.29e-04	1.76e-03	3.07e-03	9.64e-04
Nema-Martine	1.61e-03	1.69e-03	2.40e-04	1.28e-03	2.24e-03	7.02e-04
Slipper-Lac de Gras	8.29e-04	7.71e-04	1.09e-04	5.84e-04	1.02e-03	3.20e-04
Nanuq Outflow	1.55e-04	1.43e-04	2.03e-05	1.09e-04	1.89e-04	NA
Counts Outflow	3.71e-04	3.76e-04	5.33e-05	2.85e-04	4.96e-04	NA
Vulture-Polar	6.32e-04	6.09e-04	8.63e-05	4.61e-04	8.04e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Nickel	August	Koala	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	hardness-dependent	Kodiak-Little 1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

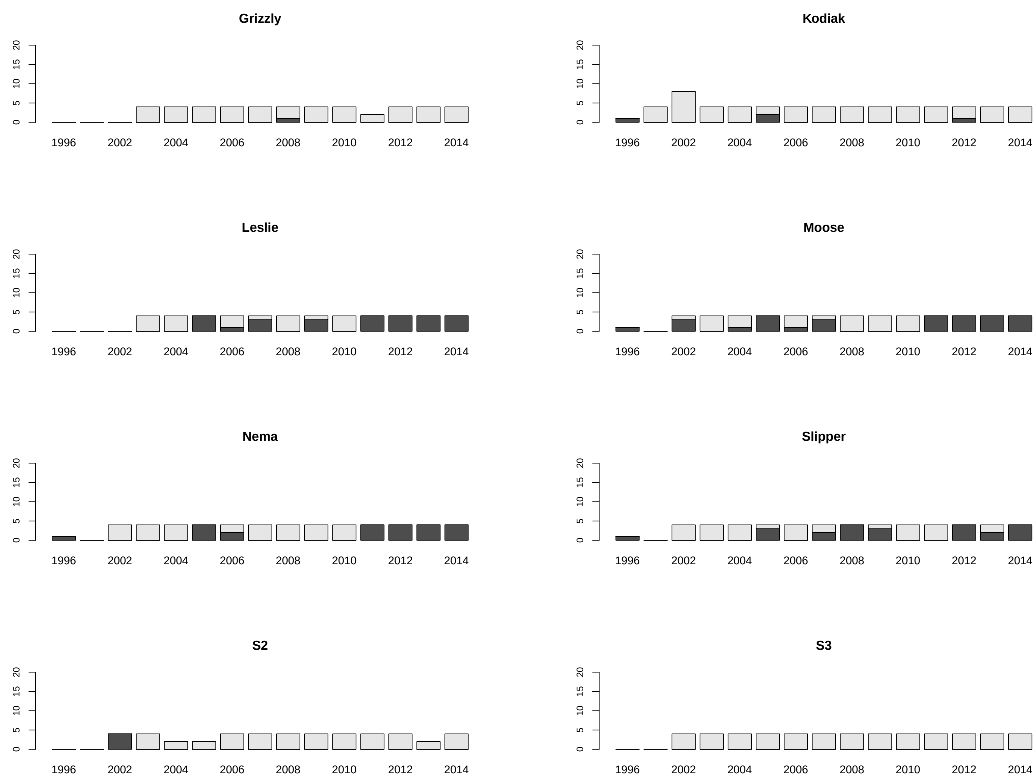
Analysis of April Total Selenium in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

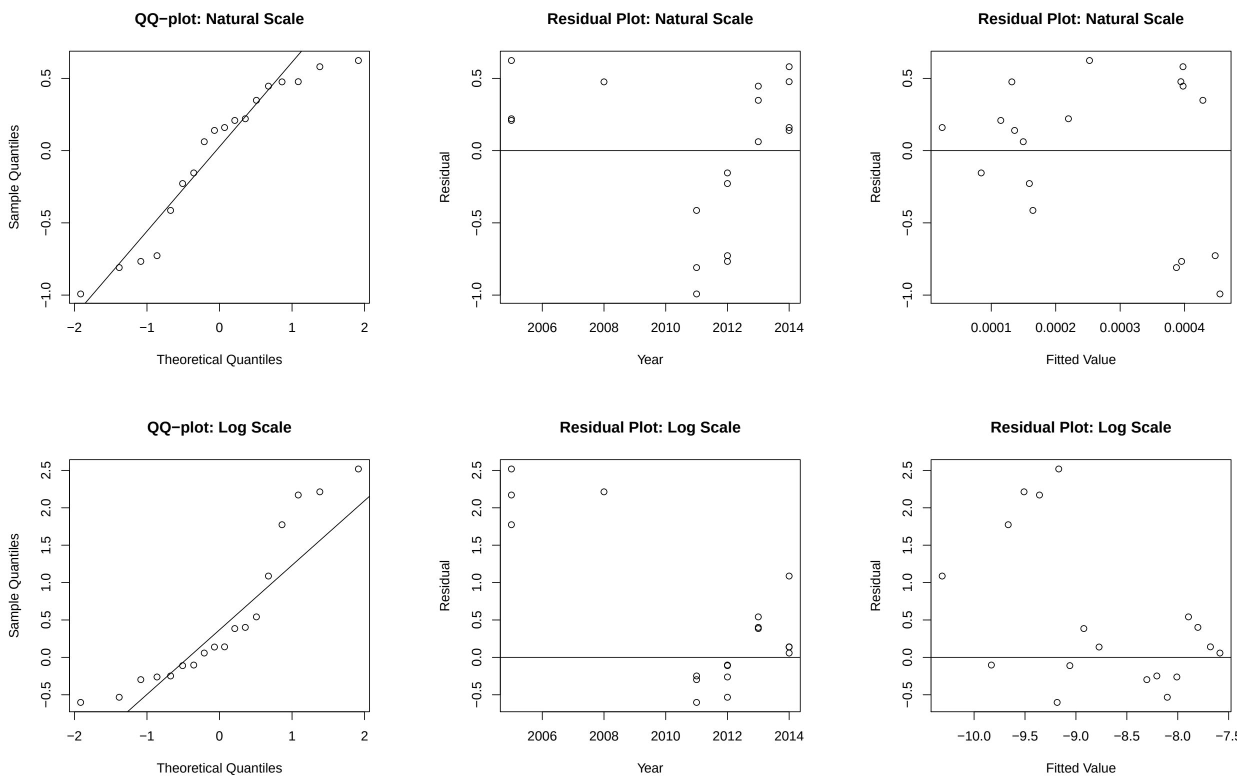
1.1 Monitored



1.2 Reference

Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Grizzly, Kodiak, S2, and S3 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Leslie, Moose, Nema, and Slipper lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.50E-40	natural model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Leslie	3.0992	2	0.2123
Moose	3.1835	2	0.2036
Nema	0.3979	2	0.8196
Slipper	0.3915	2	0.8222

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

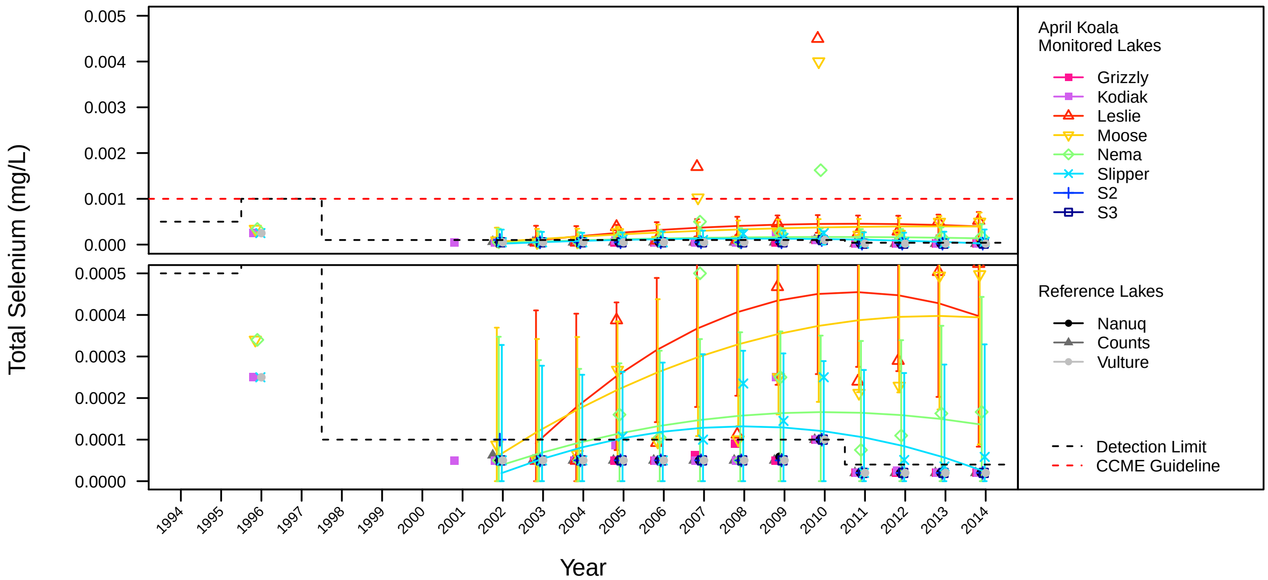
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Leslie	0.0980
Monitored Lake	Moose	0.0770
Monitored Lake	Nema	0.0930
Monitored Lake	Slipper	0.2960

- Conclusions:
  Model fit for Slipper Lake Lake is weak. Model fit for Leslie, Moose, and Nema lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total selenium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie	5.23e-04	3.97e-04	1.60e-04	8.30e-05	7.12e-04	4.70e-04
Moose	4.98e-04	3.94e-04	1.56e-04	8.85e-05	7.00e-04	4.56e-04
Nema	1.67e-04	1.36e-04	1.57e-04	0.00e+00	4.43e-04	4.59e-04
Slipper	5.85e-05	2.39e-05	1.56e-04	0.00e+00	3.29e-04	4.56e-04
Nanuq	2.00e-05	NA	NA	NA	NA	NA
Counts	2.00e-05	NA	NA	NA	NA	NA
Vulture	2.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Selenium	April	Koala	Lake	Water	Counts Nanuq Vulture Grizzly Kodiak S2 S3	none	Tobit regression	#1a slope of zero	0.001	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

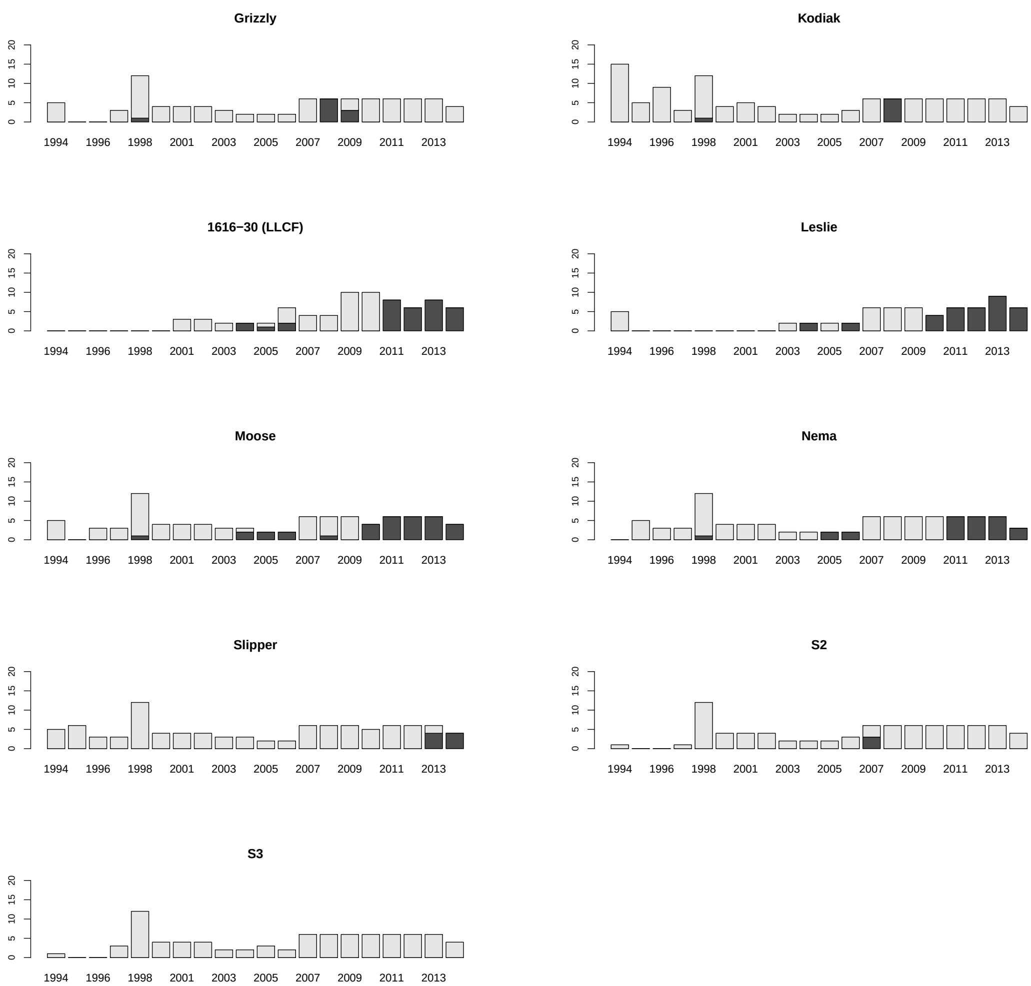
Analysis of August Total Selenium in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

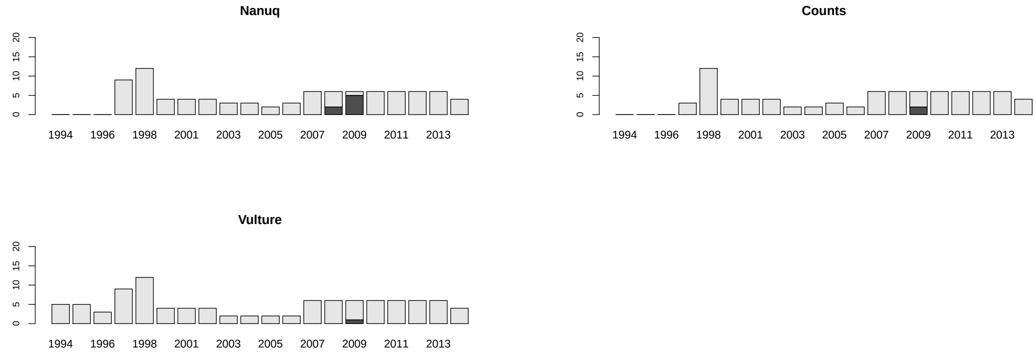
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

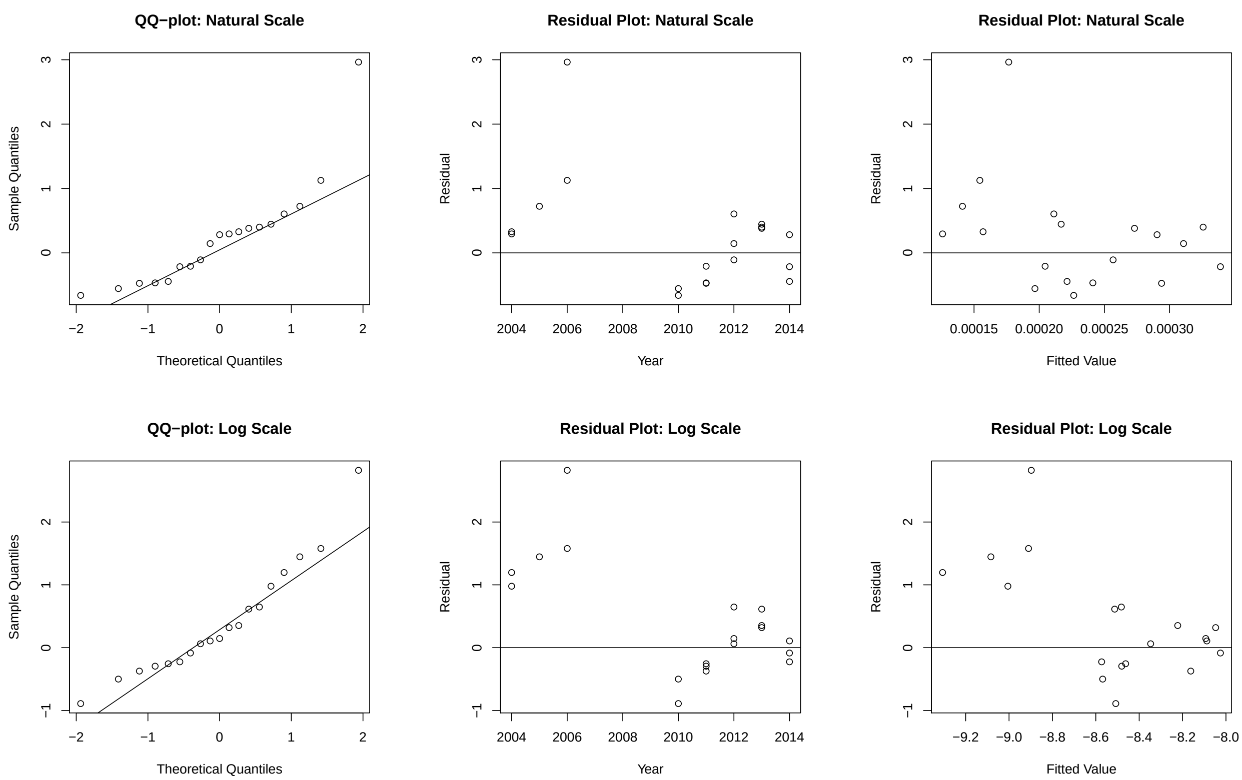


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Grizzly, Kodiak, Nema, Slipper, S2, and S3 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in 1616-30 (LLCF), Leslie, and Moose was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-30 (LLCF)	9.0567	2	0.0108
Leslie	1.7290	2	0.4213
Moose	4.0279	2	0.1335

- Conclusions:
  1616-30 (LLCF) shows significant deviation from a slope of zero.

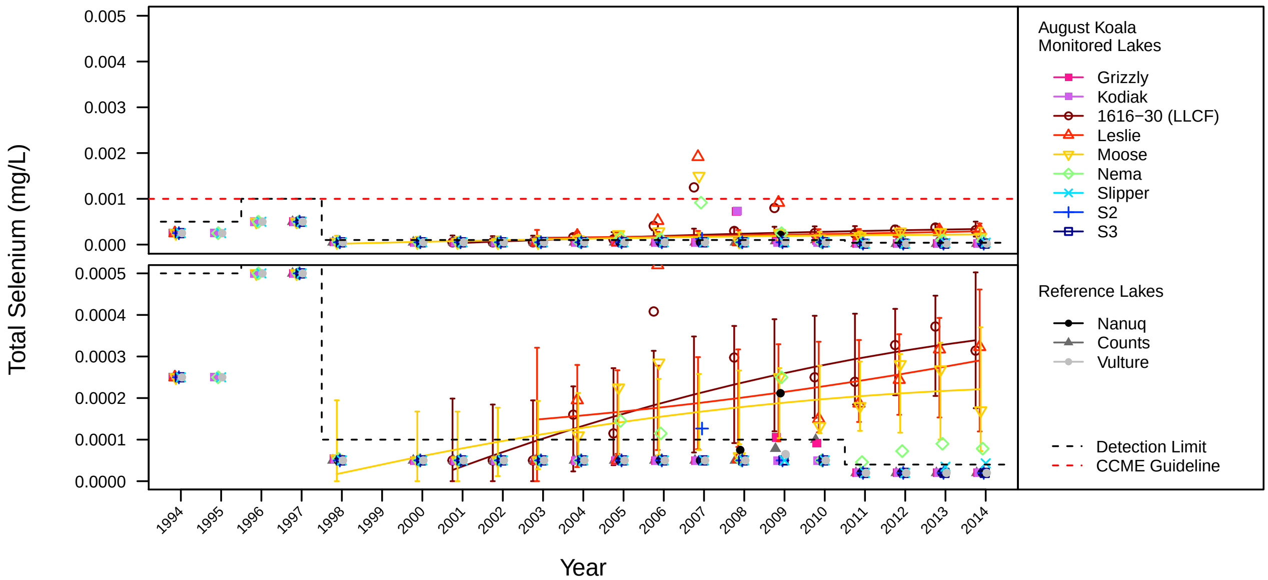
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-30 (LLCF)	0.2010
Monitored Lake	Leslie	0.1200
Monitored Lake	Moose	0.0850

- Conclusions:
  Model fit for 1616-30 (LLCF) is weak. Model fit for Leslie and Moose lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total selenium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie	3.23e-04	2.90e-04	8.71e-05	1.20e-04	4.61e-04	2.55e-04
1616-30 (LLCF)	3.14e-04	3.39e-04	8.34e-05	1.76e-04	5.02e-04	2.44e-04
Moose	1.70e-04	2.21e-04	7.59e-05	7.25e-05	3.70e-04	2.22e-04
Nanuq	2.00e-05	NA	NA	NA	NA	NA
Counts	2.00e-05	NA	NA	NA	NA	NA
Vulture	2.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Selenium	August	Koala	Lake	Water	Counts Nanuq Vulture Grizzly Kodiak Nema Slipper S2 S3	none	Tobit regression	#1a slope of zero	0.001	1616-30 (LLCF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

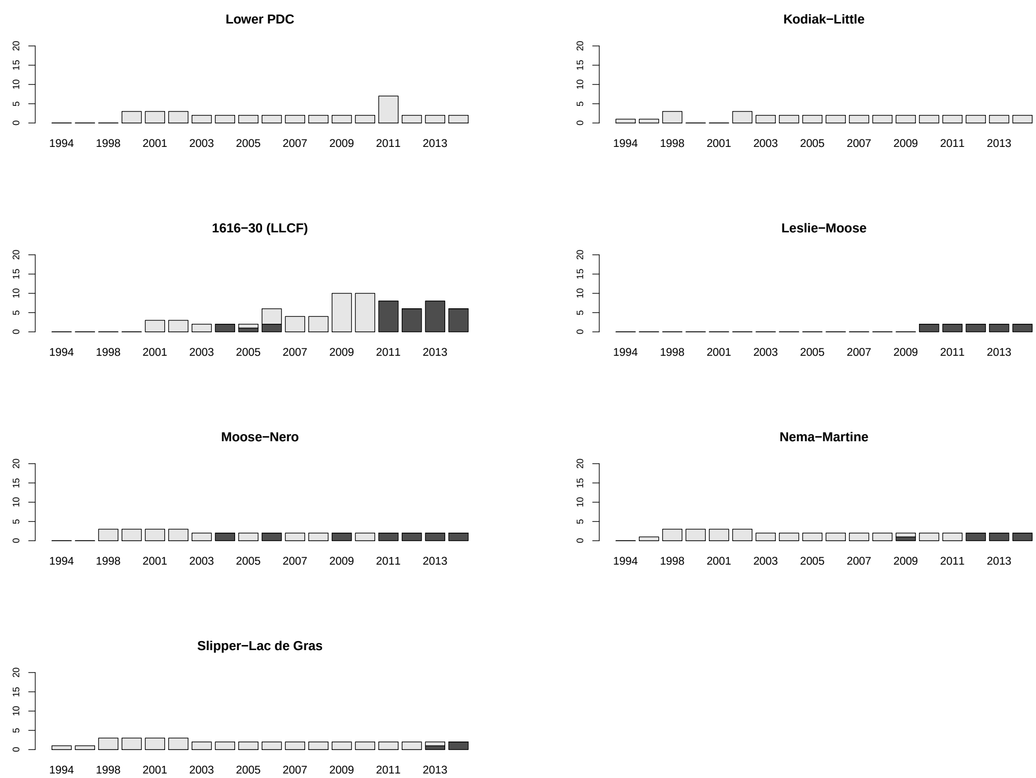
Analysis of August Total Selenium in Koala Watershed Streams

November 13, 2014

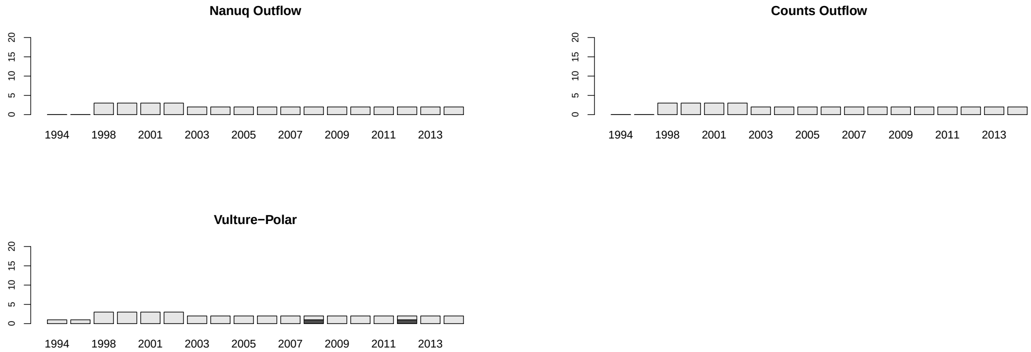
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

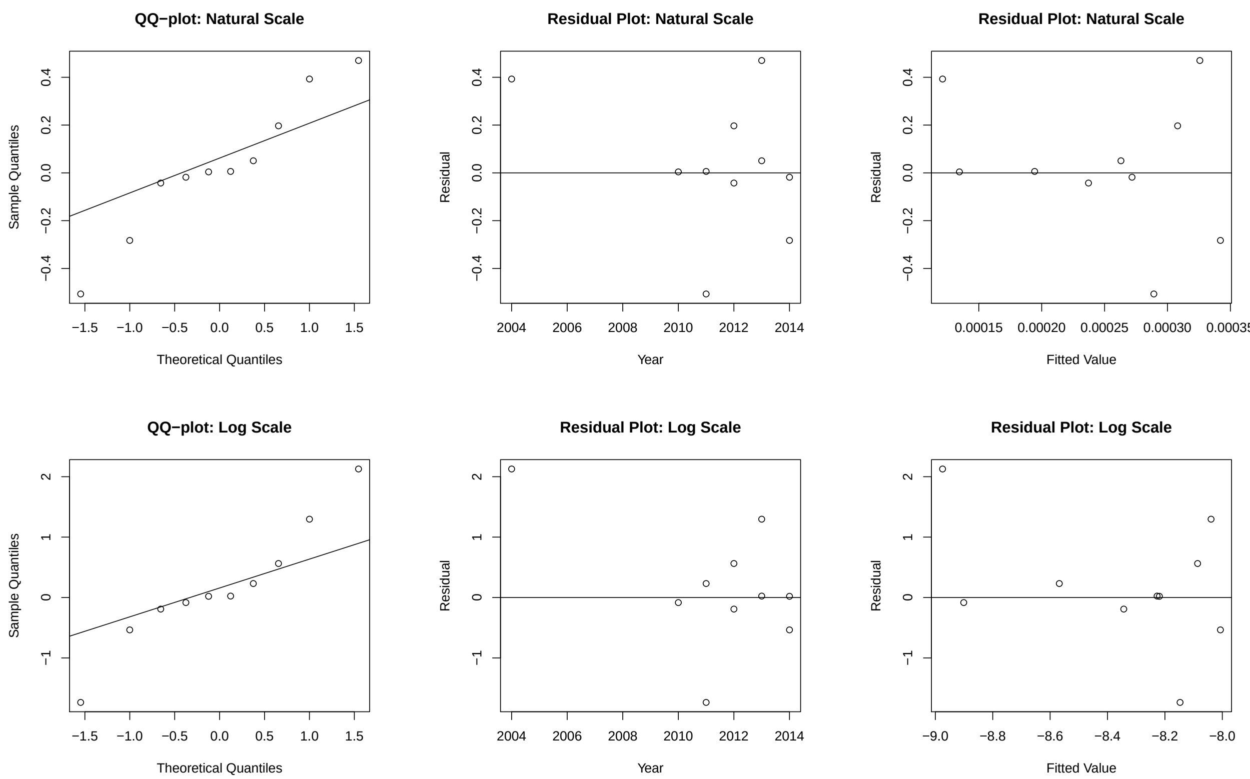


1.2 Reference



Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar, Kodiak-Little, the Lower PDC, Moose-Nero, Nema-Martine, and Slipper-Lac de Gras was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in 1616-30 (LLCF) was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Leslie-Moose	1.3108	2	0.5192
1616-30 (LLCF)	12.2559	2	0.0022

- Conclusions:
  1616-30 (LLCF) shows significant deviation from a slope of zero.

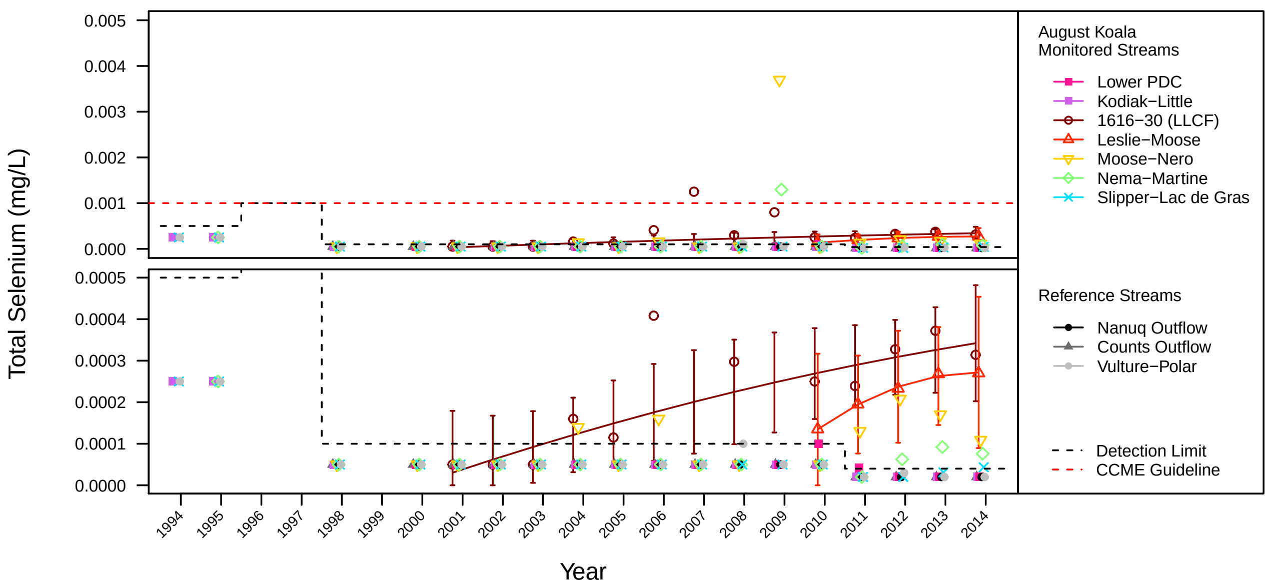
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-30 (LLCF)	0.2030
Monitored Stream	Leslie-Moose	0.9960

- Conclusions:
  Model fit for 1616-30 (LLCF) is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total selenium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie-Moose	2.70e-04	2.72e-04	9.29e-05	8.97e-05	4.54e-04	2.72e-04
1616-30 (LLCF)	3.14e-04	3.42e-04	7.13e-05	2.02e-04	4.82e-04	2.09e-04
Nanuq Outflow	2.00e-05	NA	NA	NA	NA	NA
Counts Outflow	2.00e-05	NA	NA	NA	NA	NA
Vulture-Polar	2.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Selenium	August	Koala	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar Kodiak-Little Lower PDC Moose-Nero Nema-Martine Slipper-Lac de Gras	none	Tobit regression	#1a slope of zero	0.001	1616-30 (LLCF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

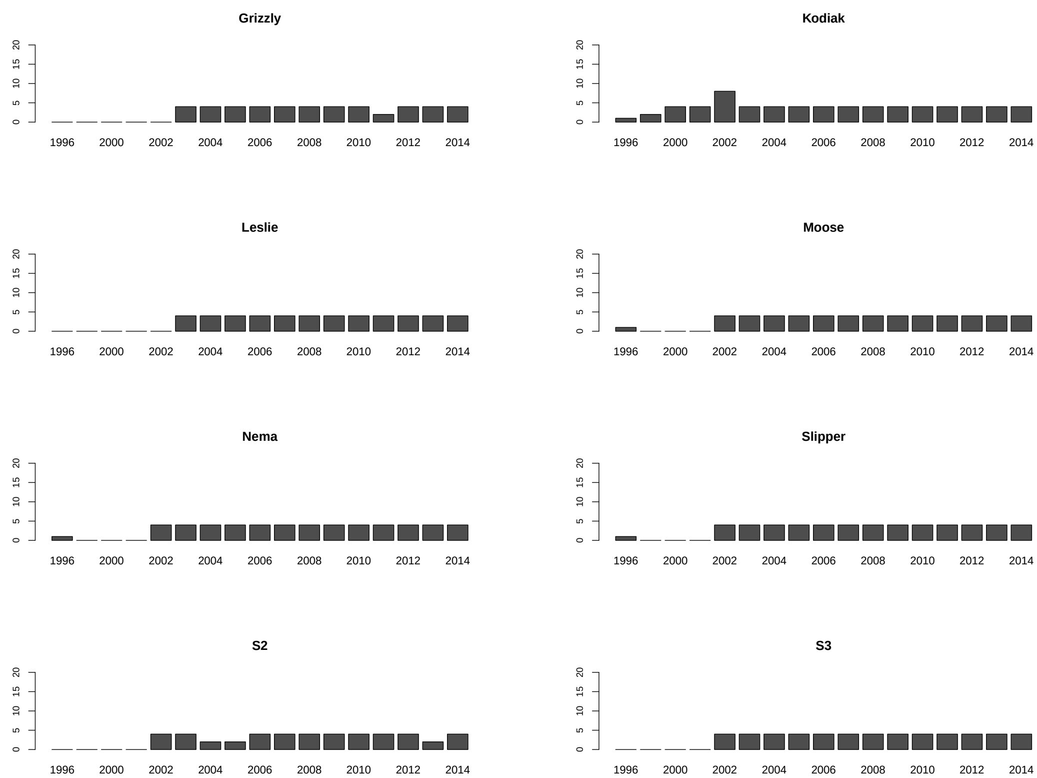
Analysis of April Total Strontium in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

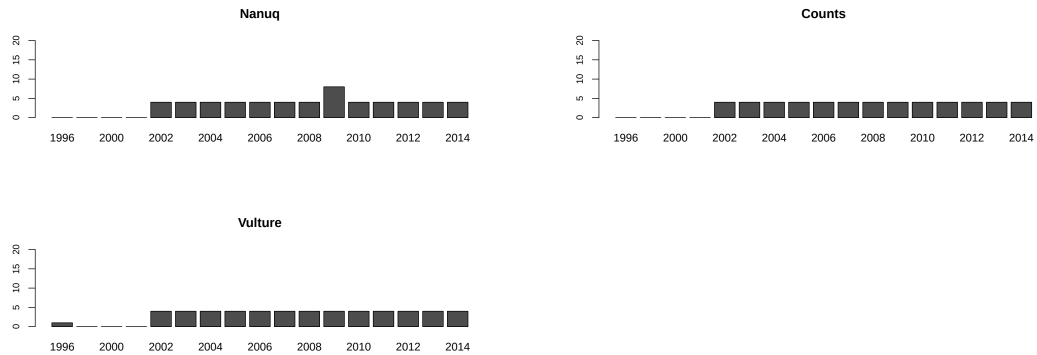
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

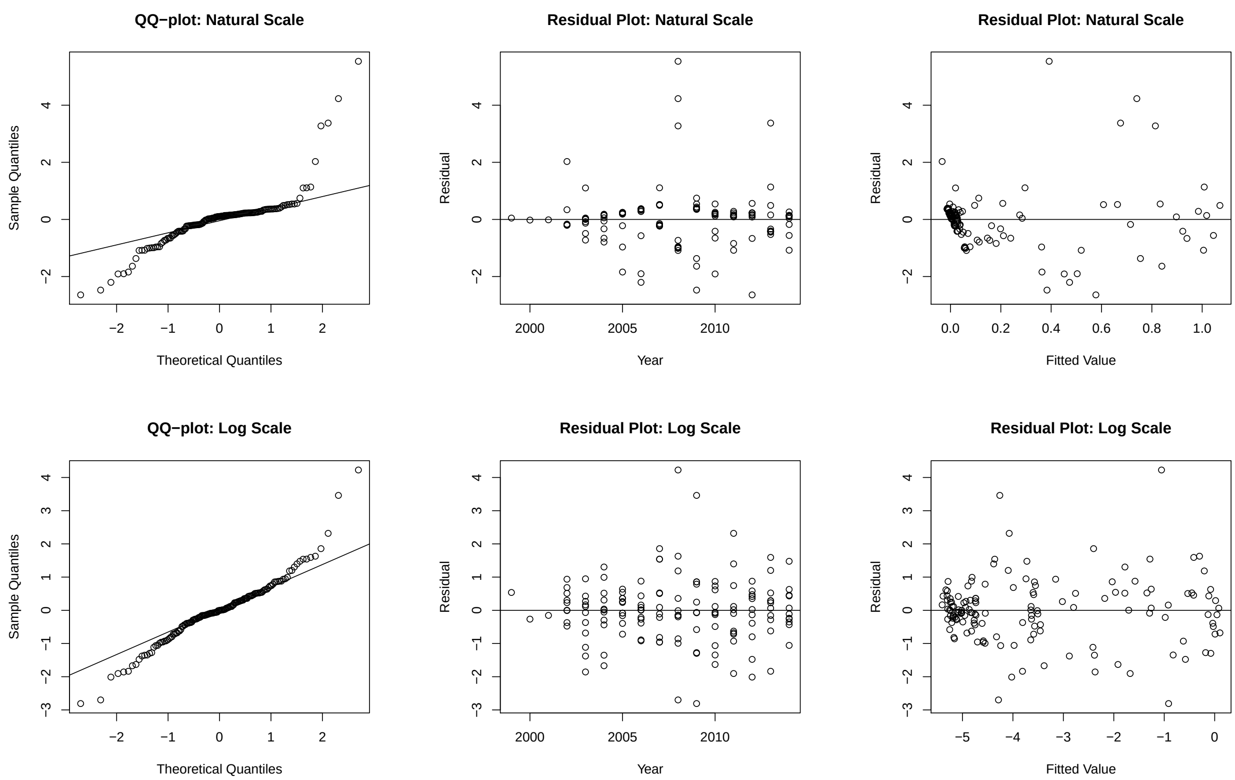


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
99	Leslie	2008	0.98	0.81	3.28
120	Moose	2008	0.95	0.74	4.23
162	Nema	2008	0.67	0.39	5.54
167	Nema	2013	0.84	0.68	3.37

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	0.67	-1.05	4.23
205	S3	2009	0.02	-4.26	3.46

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.87E-71	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
2864.31	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.29	4.00	0.99

- Conclusions:
  The slopes do not differ significantly among reference lakes.

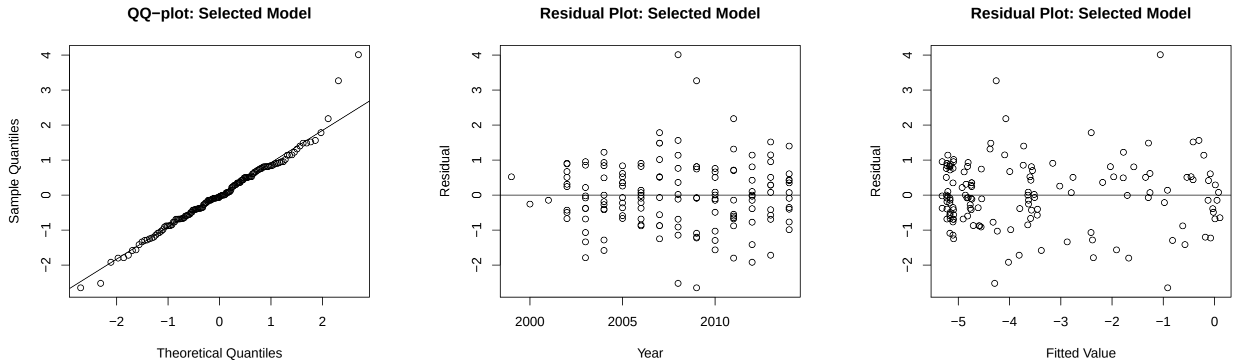
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.825	0.000	0.175	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
162	Nema	2008	0.67	-1.06	4.01
205	S3	2009	0.02	-4.26	3.27

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.48	2.00	0.78
Kodiak	0.10	2.00	0.95
Leslie	132.43	2.00	0.00
Moose	155.15	2.00	0.00
Nema	147.32	2.00	0.00
Slipper	139.64	2.00	0.00
S2	10.55	2.00	0.01
S3	21.56	2.00	0.00

- Conclusions:
  All monitored lakes except Grizzly and Kodiak show significant deviation from the common slope of reference lakes.

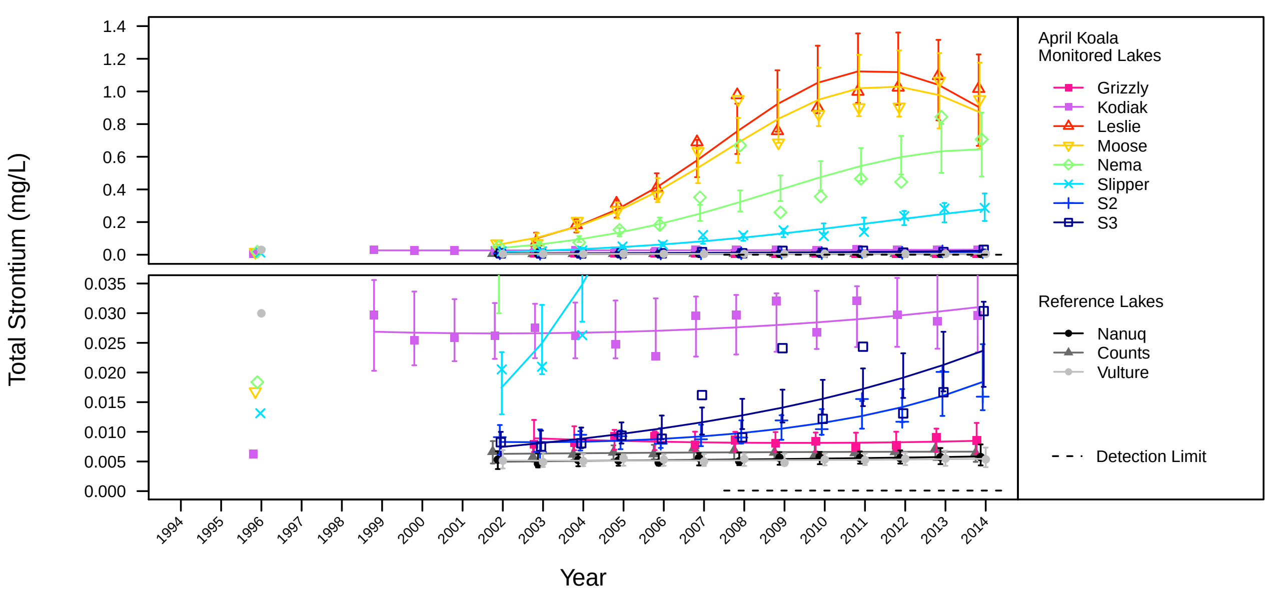
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0620
Monitored Lake	Grizzly	0.1140
Monitored Lake	Kodiak	0.2720
Monitored Lake	Leslie	0.9610
Monitored Lake	Moose	0.9610
Monitored Lake	Nema	0.8880
Monitored Lake	S2	0.7640
Monitored Lake	S3	0.6260
Monitored Lake	Slipper	0.9480

- Conclusions:
  Model fit for Kodiak Lake is weak. Model fit for pooled reference lakes and Grizzly Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total strontium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	8.50e-03	8.48e-03	1.32e-03	6.25e-03	1.15e-02	3.85e-03
Kodiak	2.96e-02	3.10e-02	4.44e-03	2.34e-02	4.11e-02	1.30e-02
Leslie	1.02e+00	9.05e-01	1.41e-01	6.67e-01	1.23e+00	4.11e-01
Moose	9.52e-01	8.73e-01	1.33e-01	6.48e-01	1.18e+00	3.89e-01
Nema	7.06e-01	6.46e-01	9.83e-02	4.79e-01	8.70e-01	2.88e-01
Slipper	2.87e-01	2.79e-01	4.24e-02	2.07e-01	3.75e-01	1.24e-01
S2	1.59e-02	1.84e-02	2.80e-03	1.36e-02	2.48e-02	8.19e-03
S3	3.03e-02	2.37e-02	3.61e-03	1.76e-02	3.19e-02	1.06e-02
Nanuq	5.73e-03	5.85e-03	8.90e-04	4.34e-03	7.88e-03	NA
Counts	6.43e-03	6.65e-03	1.01e-03	4.94e-03	8.97e-03	NA
Vulture	5.36e-03	5.45e-03	8.29e-04	4.04e-03	7.34e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Strontium	April	Koala	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	6.242	Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

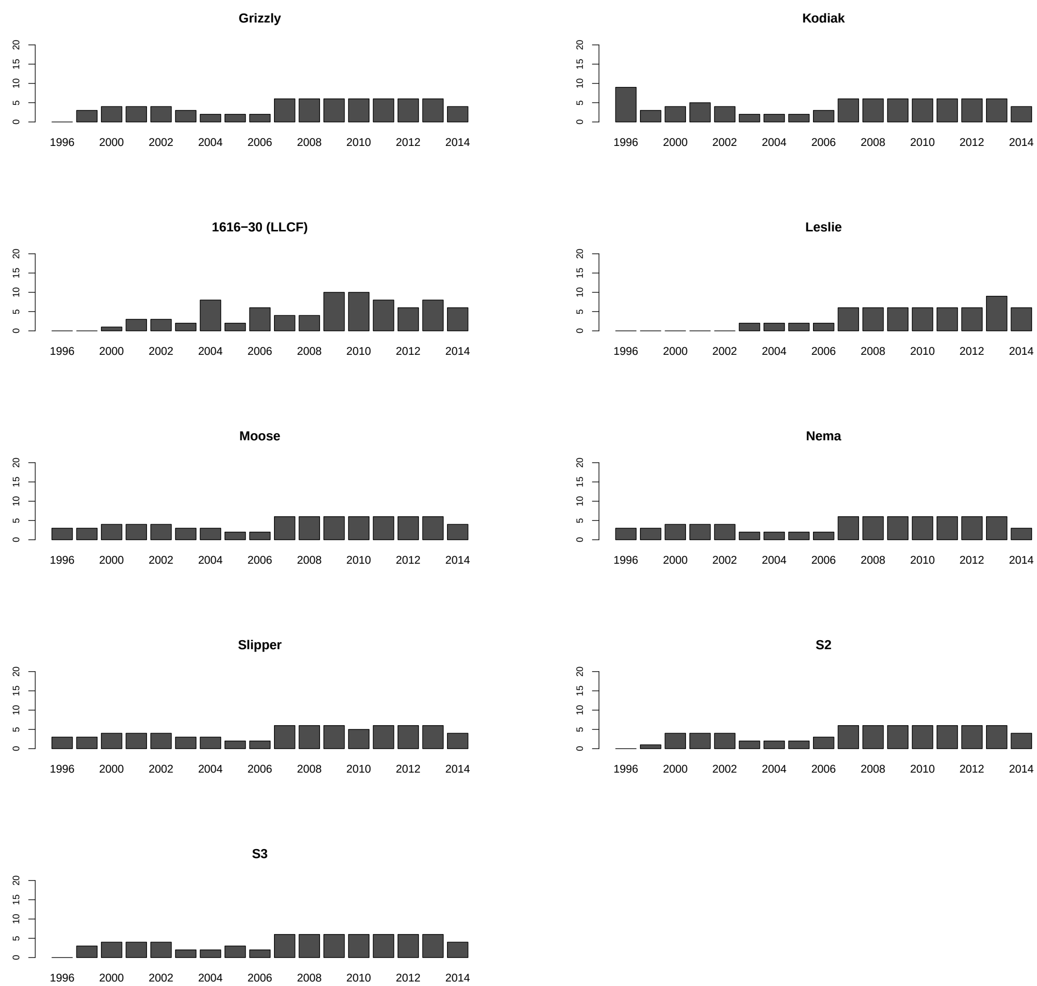
Analysis of August Total Strontium in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

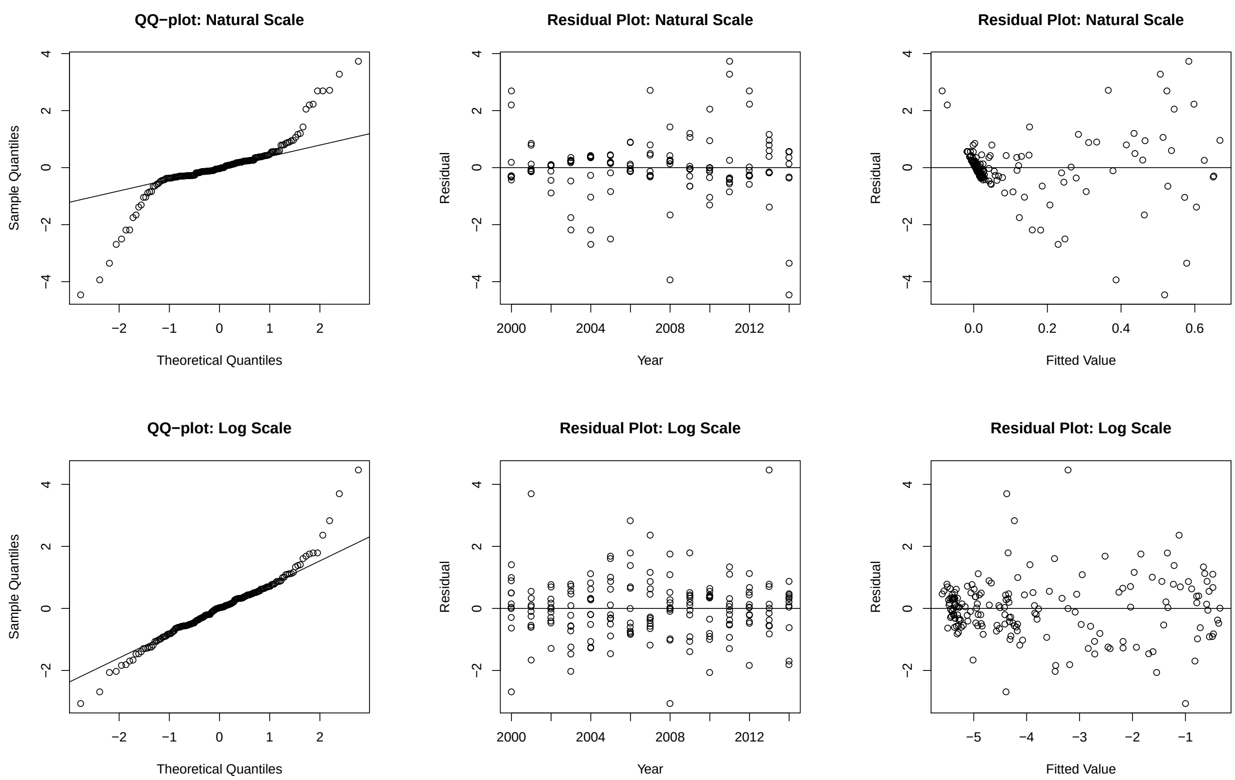
1.1 Monitored



1.2 Reference

Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
18	1616-30 (LLCF)	2011	0.74	0.58	3.73
21	1616-30 (LLCF)	2014	0.44	0.58	-3.35
120	Moose	2008	0.23	0.39	-3.94
123	Moose	2011	0.64	0.51	3.28
126	Moose	2014	0.34	0.52	-4.46

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
71	Kodiak	2001	0.02	-4.38	3.70
120	Moose	2008	0.23	-1.00	-3.07
188	S2	2013	0.08	-3.22	4.46

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
2.31	6.00	0.89

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

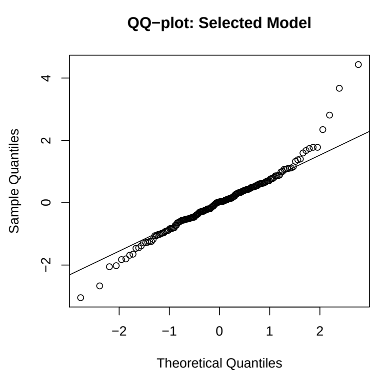
3.2 Compare Reference Models using AIC Weights

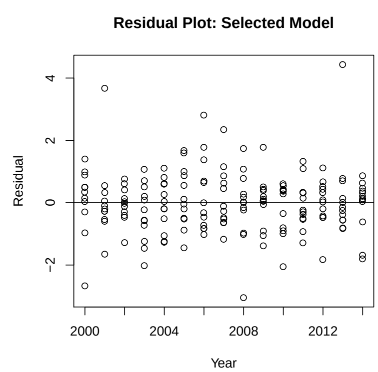
- Results:

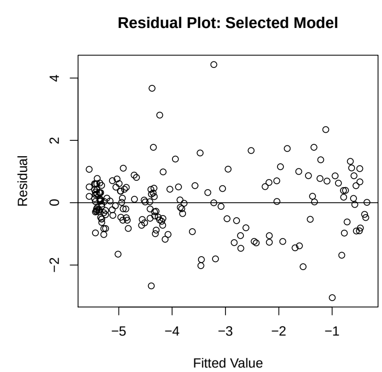
	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.008	0.000	0.992	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model







Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
71	Kodiak	2001	0.02	-4.38	3.67
120	Moose	2008	0.23	-1.00	-3.05
188	S2	2013	0.08	-3.22	4.43

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
Grizzly	81.2901	3	0.0000
Kodiak	455.0959	3	0.0000
1616-30 (LLCF)	147.5094	3	0.0000
Leslie	6758.9584	3	0.0000
Moose	6499.3981	3	0.0000
Nema	4332.7626	3	0.0000
Slipper	2317.0654	3	0.0000
S2	774.2091	3	0.0000
S3	363.6614	3	0.0000

- Conclusions:
  All monitored lakes show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.2789	2	0.8698
Kodiak	0.0508	2	0.9749
1616-30 (LLCF)	147.5055	2	0.0000
Leslie	199.6489	2	0.0000
Moose	526.1900	2	0.0000
Nema	490.1688	2	0.0000
Slipper	316.6868	2	0.0000
S2	158.3281	2	0.0000
S3	74.1631	2	0.0000

- Conclusions:
  When allowing for differences in intercept, all monitored lakes except Grizzly and Kodiak show significant deviation from the common slope of reference lakes.

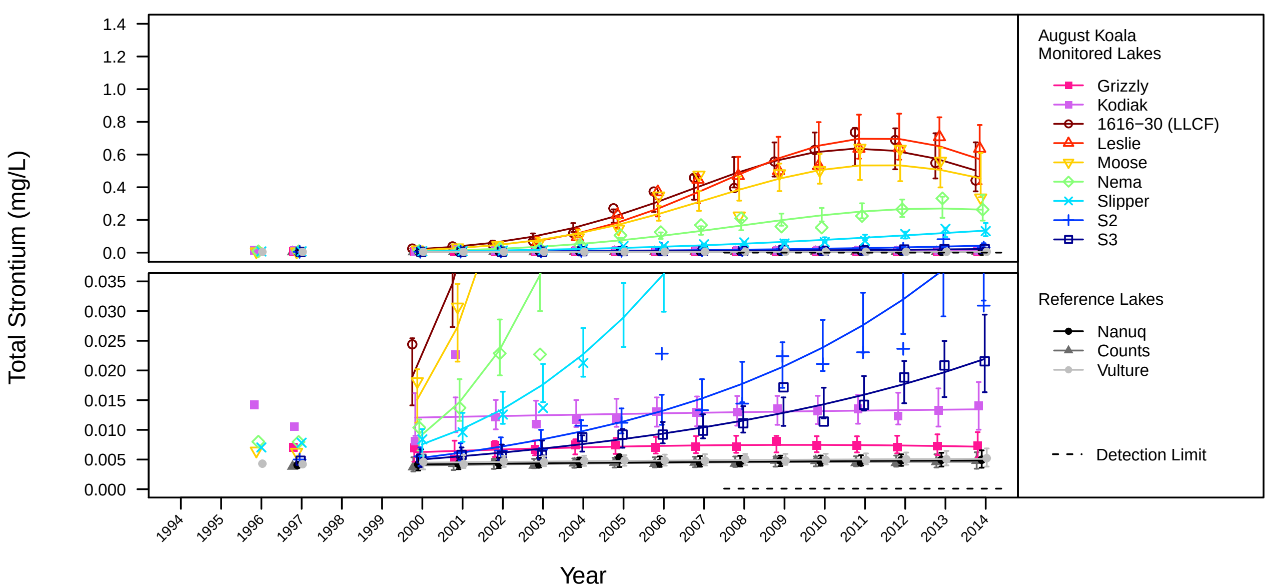
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3770
Monitored Lake	1616-30 (LLCF)	0.9740
Monitored Lake	Grizzly	0.3280
Monitored Lake	Kodiak	0.0290
Monitored Lake	Leslie	0.9450
Monitored Lake	Moose	0.9490
Monitored Lake	Nema	0.9590
Monitored Lake	S2	0.8260
Monitored Lake	S3	0.9320
Monitored Lake	Slipper	0.9680

- Conclusions:
  Model fit for pooled reference lakes and Grizzly Lake is weak. Model fit for Kodiak Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total strontium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	7.38e-03	7.17e-03	1.08e-03	5.34e-03	9.62e-03	3.15e-03
Kodiak	1.40e-02	1.35e-02	2.02e-03	1.00e-02	1.81e-02	5.91e-03
Leslie	6.37e-01	5.72e-01	9.09e-02	4.19e-01	7.81e-01	2.66e-01
1616-30 (LLCF)	4.41e-01	5.03e-01	7.54e-02	3.75e-01	6.75e-01	2.21e-01
Moose	3.36e-01	4.55e-01	6.82e-02	3.39e-01	6.10e-01	2.00e-01
Nema	2.63e-01	2.63e-01	3.94e-02	1.96e-01	3.53e-01	1.15e-01
Slipper	1.32e-01	1.35e-01	2.02e-02	1.00e-01	1.81e-01	5.92e-02
S2	3.09e-02	4.26e-02	6.40e-03	3.18e-02	5.72e-02	1.87e-02
S3	2.15e-02	2.19e-02	3.29e-03	1.63e-02	2.94e-02	9.62e-03
Nanuq	4.96e-03	4.87e-03	7.31e-04	3.63e-03	6.54e-03	NA
Counts	4.82e-03	4.64e-03	6.96e-04	3.46e-03	6.22e-03	NA
Vulture	5.23e-03	5.12e-03	7.67e-04	3.81e-03	6.86e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Strontium	August	Koala	Lake	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	6.242	Grizzly Kodiak 1616-30 (LLCF) Leslie Moose Nema Slipper S2 S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

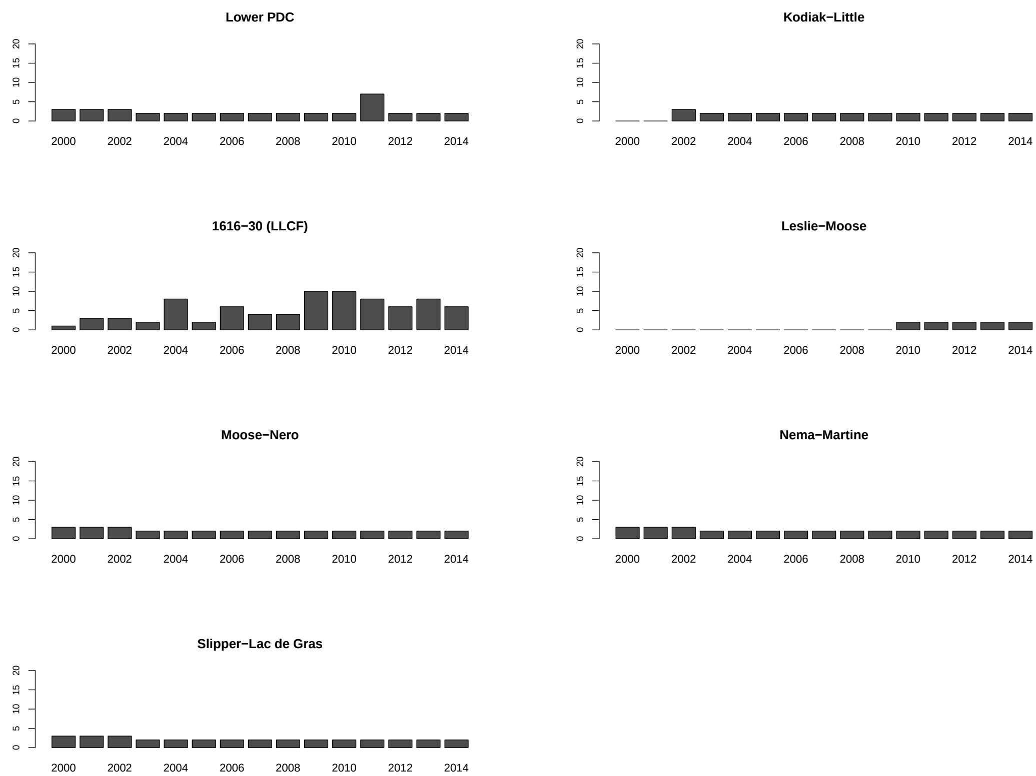
Analysis of August Total Strontium in Koala Watershed Streams

November 13, 2014

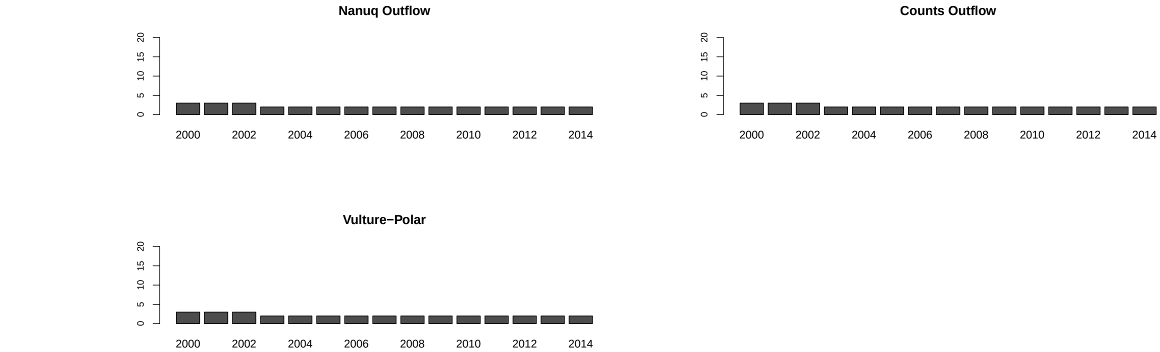
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

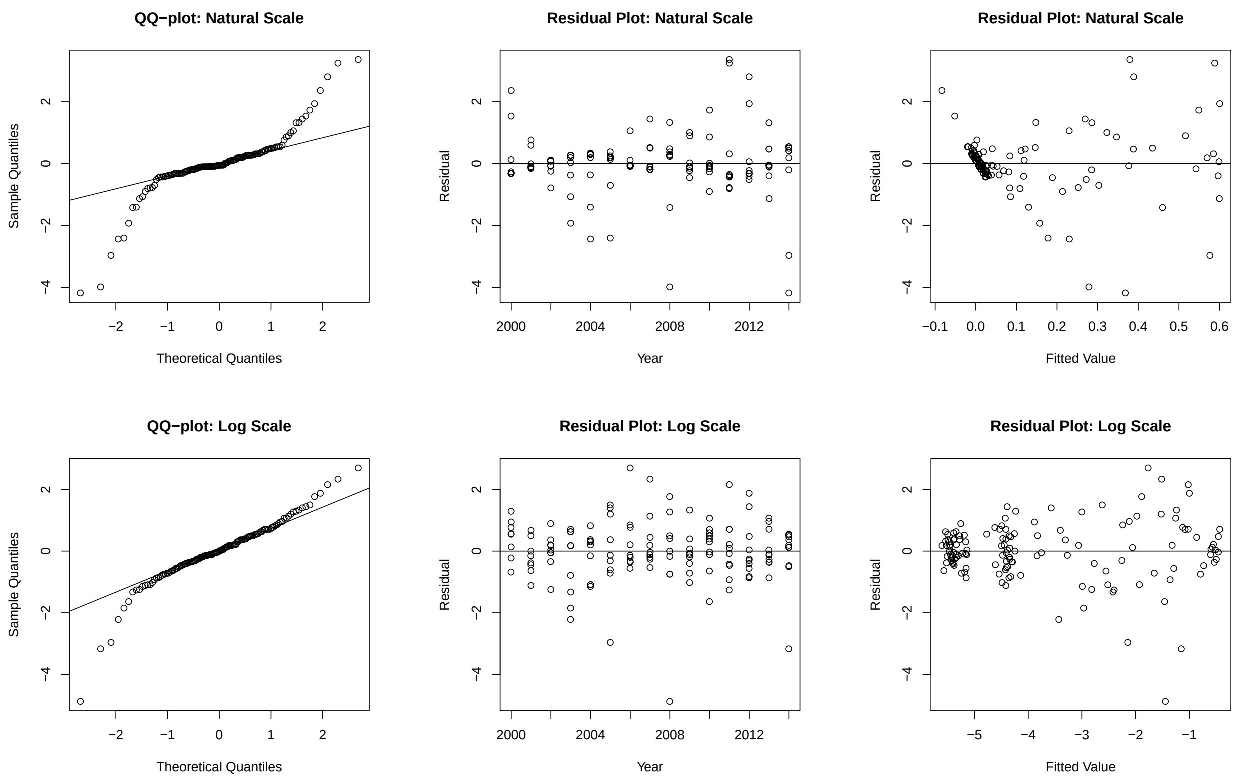


1.2 Reference



Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
18	1616-30 (LLCF)	2011	0.74	0.59	3.25
120	Moose-Nero	2008	0.10	0.28	-3.99
123	Moose-Nero	2011	0.53	0.38	3.36
126	Moose-Nero	2014	0.18	0.37	-4.18

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.10	-1.45	-4.88
126	Moose-Nero	2014	0.18	-1.15	-3.17

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
129.54	6.00	0.00

- Conclusions:
  he slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
117.00	4.00	0.00

- Conclusions:

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.861	0.000	0.139	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	0.5269	2	0.7684
Kodiak-Little	0.3570	2	0.8365
Leslie-Moose	0.2302	2	0.8913
1616-30 (LLCF)	501.3449	2	0.0000
Moose-Nero	257.0675	2	0.0000
Nema-Martine	278.7780	2	0.0000
Slipper-Lac de Gras	178.3214	2	0.0000

- Conclusions:
  1616-30 (LLCF), Moose-Nero, Nema-Martine, and Slipper-Lac de Gras show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-30 (LLCF)-vs-Nanuq Outflow	111.6024	3	0.0000
1616-30 (LLCF)-vs-Counts Outflow	105.4548	3	0.0000
1616-30 (LLCF)-vs-Vulture-Polar	106.2592	3	0.0000
Moose-Nero-vs-Nanuq Outflow	2913.1739	3	0.0000
Moose-Nero-vs-Counts Outflow	2929.6052	3	0.0000
Moose-Nero-vs-Vulture-Polar	2579.5005	3	0.0000
Nema-Martine-vs-Nanuq Outflow	2358.8854	3	0.0000
Nema-Martine-vs-Counts Outflow	2369.5833	3	0.0000
Nema-Martine-vs-Vulture-Polar	2062.7890	3	0.0000
Slipper-Lac de Gras-vs-Nanuq Outflow	1260.7721	3	0.0000
Slipper-Lac de Gras-vs-Counts Outflow	1264.5195	3	0.0000
Slipper-Lac de Gras-vs-Vulture-Polar	1047.2075	3	0.0000

- Conclusions:
  All remaining monitored streams show significant deviation from the common slope of reference streams.

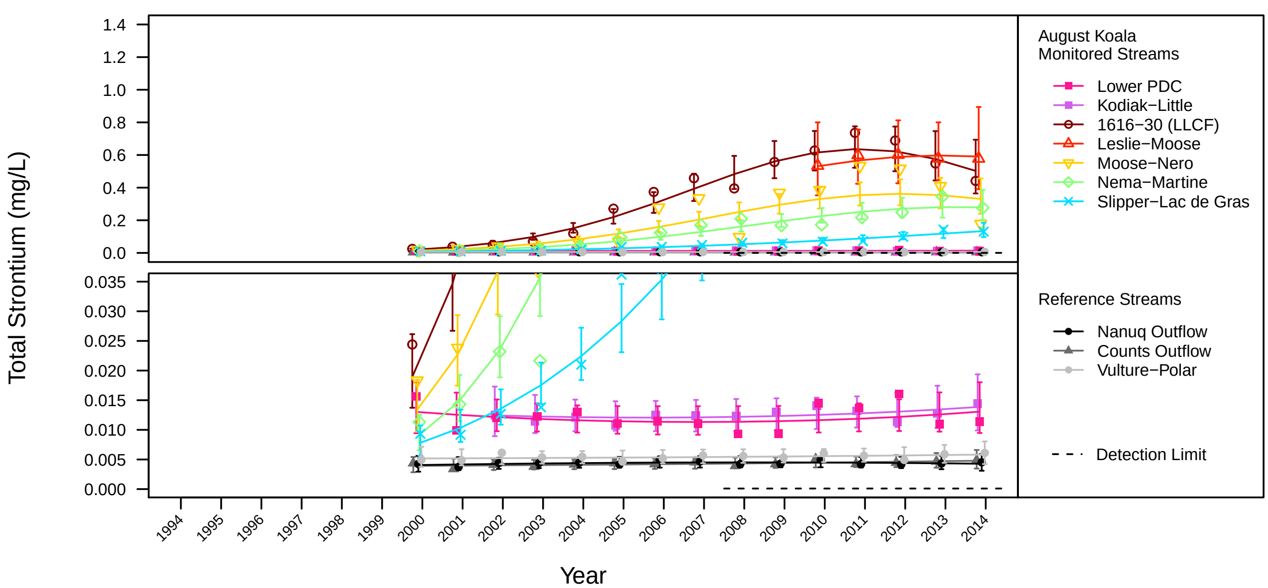
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.4060
Reference Stream	Nanuq Outflow	0.1900
Reference Stream	Vulture-Polar	0.1910
Monitored Stream	1616-30 (LLCF)	0.9740
Monitored Stream	Kodiak-Little	0.2820
Monitored Stream	Leslie-Moose	0.6420
Monitored Stream	Lower PDC	0.0850
Monitored Stream	Moose-Nero	0.8550
Monitored Stream	Nema-Martine	0.9590
Monitored Stream	Slipper-Lac de Gras	0.9740

- Conclusions:
  Model fit for Counts Outflow and Kodiak-Little is weak. Model fit for Vulture-Polar and the Lower PDC is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total strontium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	1.14e-02	1.31e-02	2.15e-03	9.47e-03	1.80e-02	6.28e-03
Kodiak-Little	1.44e-02	1.38e-02	2.37e-03	9.90e-03	1.94e-02	6.93e-03
Leslie-Moose	5.78e-01	5.91e-01	1.25e-01	3.90e-01	8.94e-01	3.66e-01
1616-30 (LLCF)	4.41e-01	5.03e-01	8.26e-02	3.64e-01	6.94e-01	2.42e-01
Moose-Nero	1.78e-01	3.31e-01	5.43e-02	2.40e-01	4.56e-01	1.59e-01
Nema-Martine	2.76e-01	2.79e-01	4.58e-02	2.02e-01	3.85e-01	1.34e-01
Slipper-Lac de Gras	1.30e-01	1.34e-01	2.20e-02	9.69e-02	1.85e-01	6.43e-02
Nanuq Outflow	4.52e-03	4.28e-03	7.04e-04	3.10e-03	5.91e-03	NA
Counts Outflow	4.89e-03	4.78e-03	7.86e-04	3.47e-03	6.60e-03	NA
Vulture-Polar	6.11e-03	5.83e-03	9.57e-04	4.22e-03	8.04e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Strontium	August	Koala	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	6.242	1616-30 (LLCF) Moose-Nero Nema-Martine Slipper-Lac de Gras

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

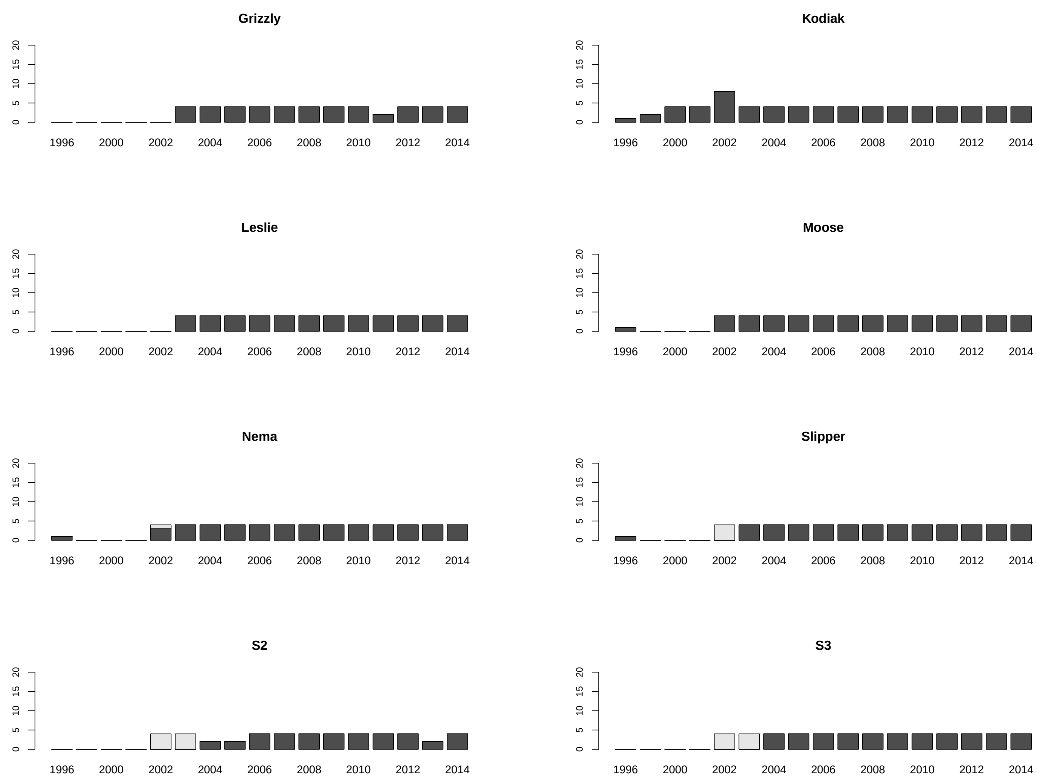
Analysis of April Total Uranium in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

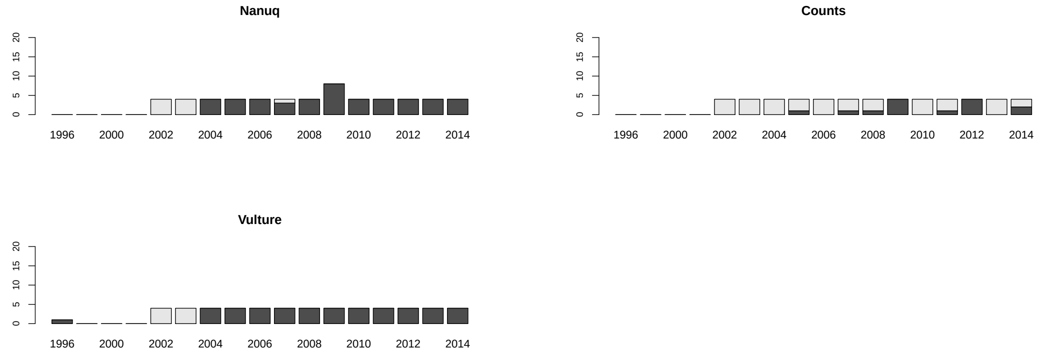
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

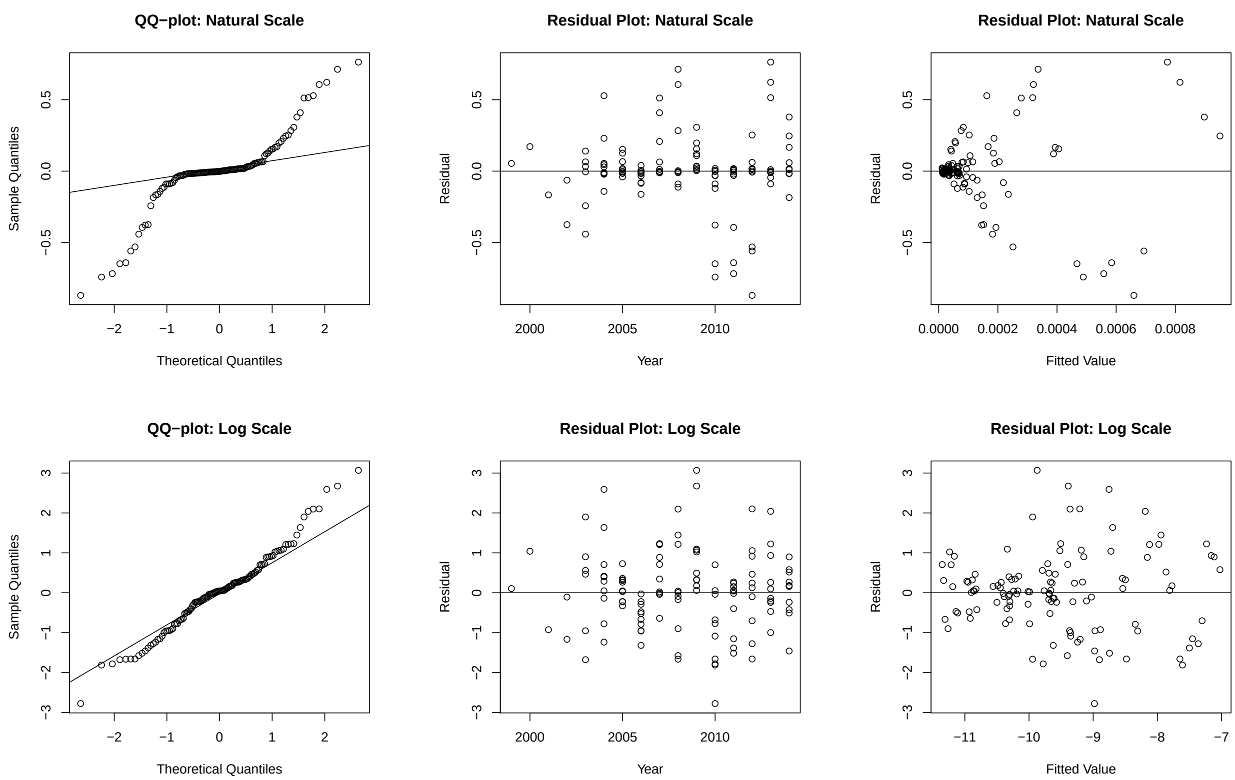


1.2 Reference



Comment:
Greater than 60% of data in Counts was less than the detection limit. This lakes was excluded from further analyses. 10-60% of data in Nanuq, Vulture, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
226	Slipper	2009	0.00	-9.87	3.07

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	0.00E+00	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
16.93	3.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.11	2.00	0.95

- Conclusions:
  The slopes do not differ significantly among reference lakes.

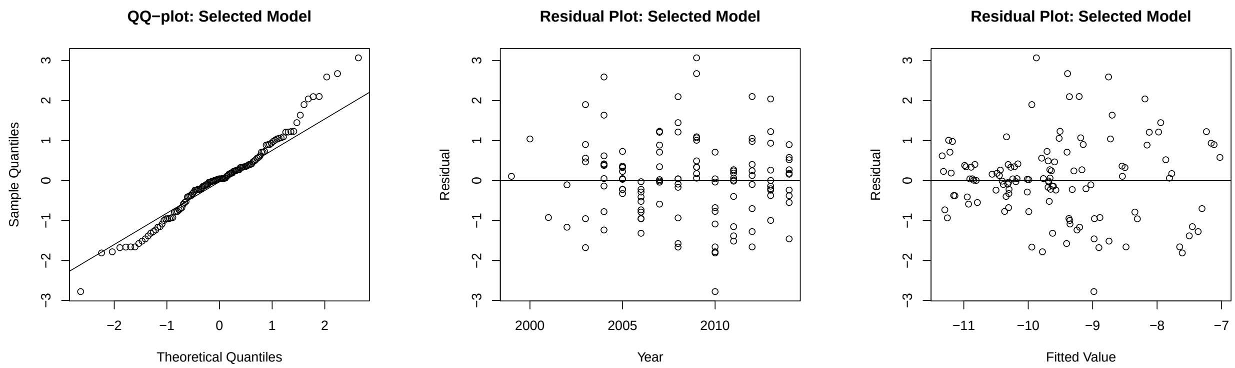
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.279	0.719	0.002	Indistinguishable support for 2 & 1; choose Model 2.

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
226	Slipper	2009	0.00	-9.87	3.07

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	0.8403	2	0.6570
Kodiak	4.2814	2	0.1176
Leslie	47.9153	2	0.0000
Moose	50.9433	2	0.0000
Nema	60.7726	2	0.0000
Slipper	9.3793	2	0.0092
S2	5.4803	2	0.0646
S3	3.9693	2	0.1374

- Conclusions:
  Leslie, Moose, Nema, and Slipper lakes show significant deviation from the common slope of reference lakes.

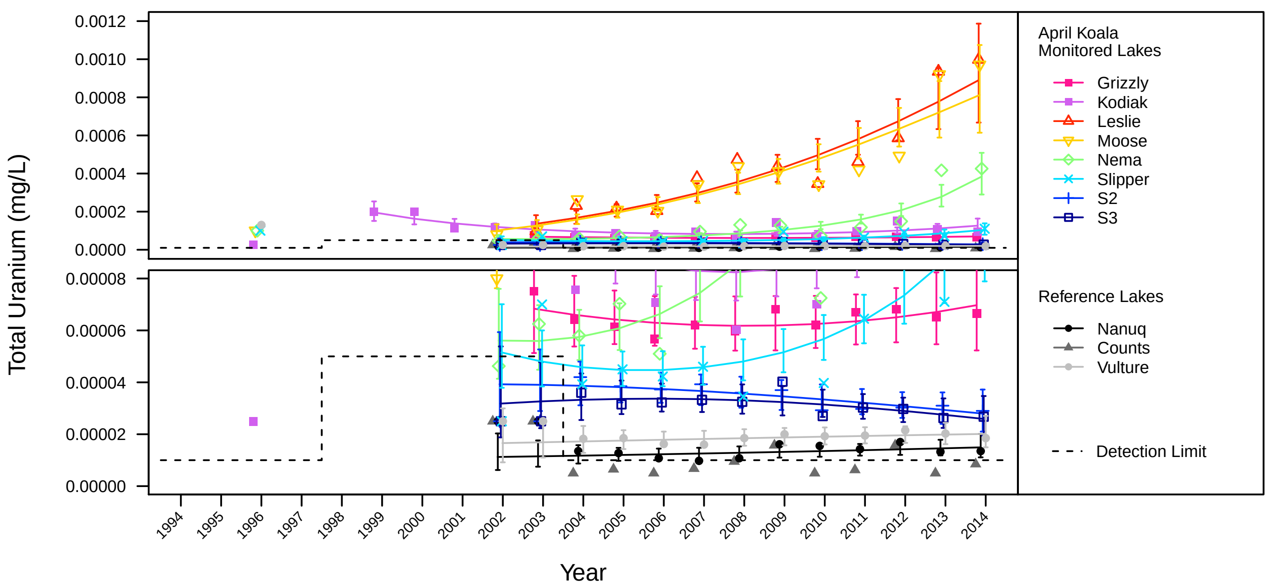
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3850
Monitored Lake	Grizzly	0.3110
Monitored Lake	Kodiak	0.5230
Monitored Lake	Leslie	0.8660
Monitored Lake	Moose	0.8720
Monitored Lake	Nema	0.8240
Monitored Lake	S2	0.3140
Monitored Lake	S3	0.3220
Monitored Lake	Slipper	0.4030

- Conclusions:
  Model fit for pooled reference lakes, Grizzly, Slipper, S2, and S3 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total uranium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	6.65e-05	6.97e-05	1.02e-05	5.23e-05	9.30e-05	2.99e-05
Kodiak	9.45e-05	1.26e-04	1.67e-05	9.75e-05	1.64e-04	4.88e-05
Leslie	9.98e-04	8.90e-04	1.31e-04	6.68e-04	1.19e-03	3.82e-04
Moose	9.71e-04	8.12e-04	1.16e-04	6.14e-04	1.07e-03	3.39e-04
Nema	4.26e-04	3.84e-04	5.51e-05	2.90e-04	5.09e-04	1.61e-04
Slipper	1.10e-04	1.05e-04	1.50e-05	7.89e-05	1.38e-04	4.39e-05
S2	2.90e-05	2.80e-05	4.08e-06	2.10e-05	3.72e-05	1.19e-05
S3	2.67e-05	2.59e-05	3.86e-06	1.94e-05	3.47e-05	1.13e-05
Nanuq	1.35e-05	1.49e-05	2.26e-06	1.11e-05	2.01e-05	NA
Counts	8.50e-06	NA	NA	NA	NA	NA
Vulture	1.85e-05	2.01e-05	3.04e-06	1.50e-05	2.71e-05	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Uranium	April	Koala	Lake	Water	Counts	log e	Tobit regression	#2 shared slopes	0.015	Leslie Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

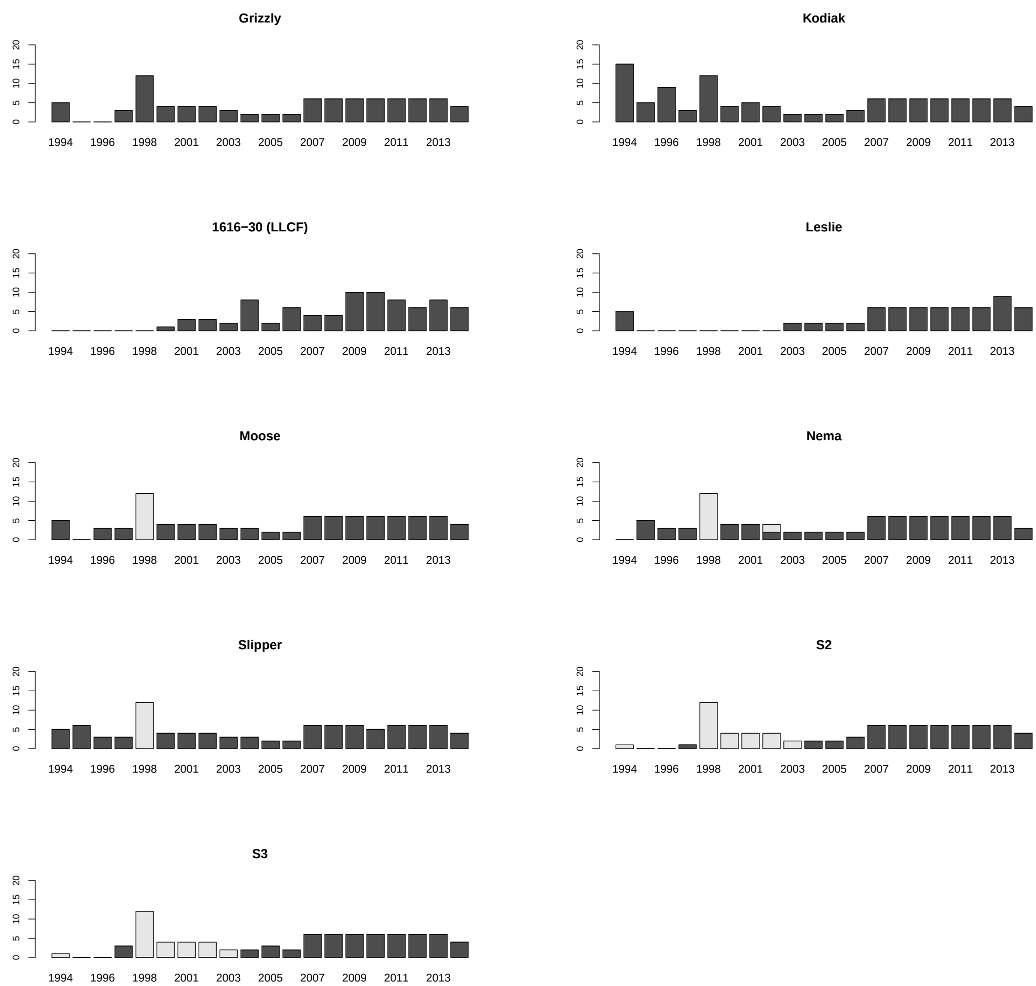
Analysis of August Total Uranium in Lakes of the Koala Watershed and Lac de Gras

November 13, 2014

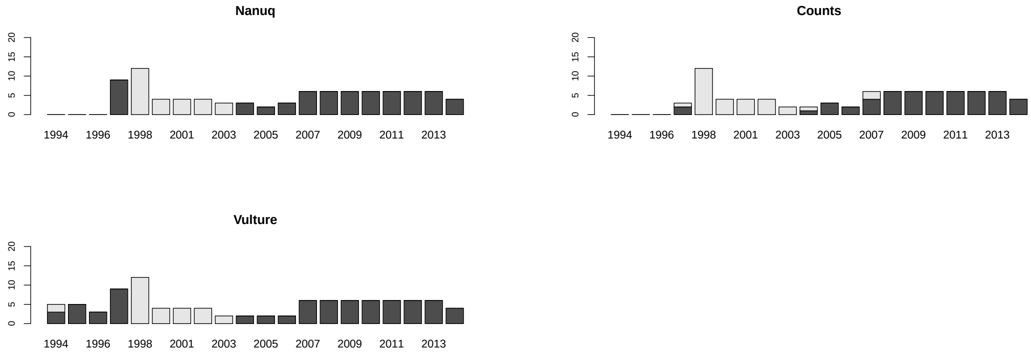
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

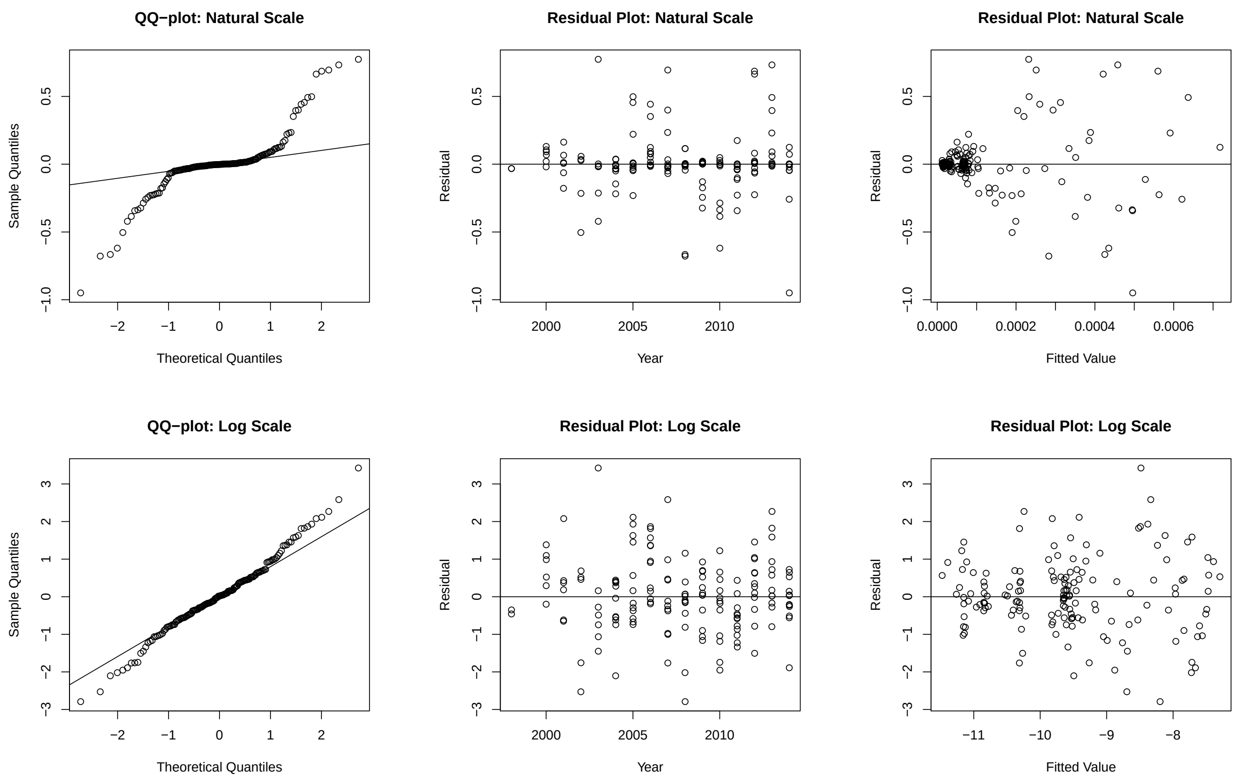


1.2 Reference



Comment:
10-60% of data in Counts, Nanuq, Vulture, Moose, Nema, Slipper, S2, and S3 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
10	1616-30 (LLCF)	2003	0.00	-8.48	3.42

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
15.15	6.00	0.02

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
3.92	4.00	0.42

- Conclusions:
  The slopes do not differ significantly among reference lakes.

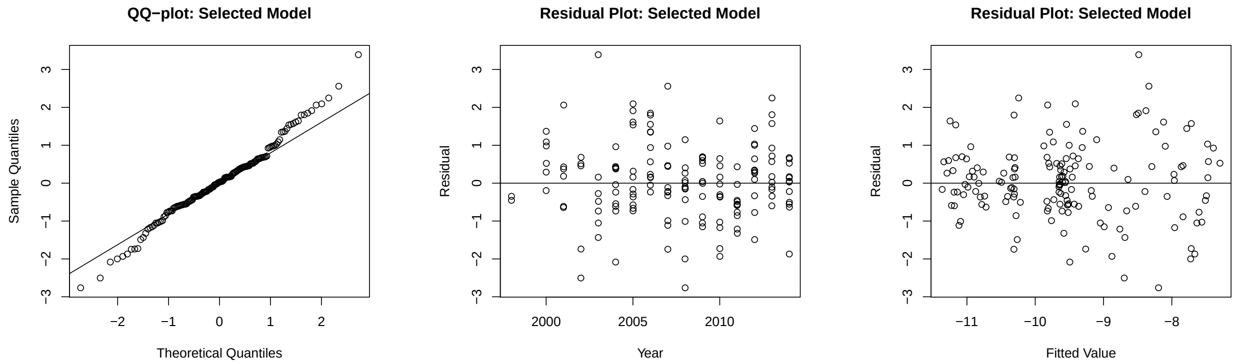
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.121	0.879	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
10	1616-30 (LLCF)	2003	0.00	-8.48	3.39

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Grizzly	2.1747	2	0.3371
Kodiak	3.3737	2	0.1851
1616-30 (LLCF)	31.1771	2	0.0000
Leslie	42.6562	2	0.0000
Moose	55.0979	2	0.0000
Nema	34.4572	2	0.0000
Slipper	2.5160	2	0.2842
S2	1.3222	2	0.5163
S3	7.1374	2	0.0282

- Conclusions:
  All monitored lakes except Grizzly, Kodiak, Slipper, and S2 show significant deviation from the common slope of reference lakes.

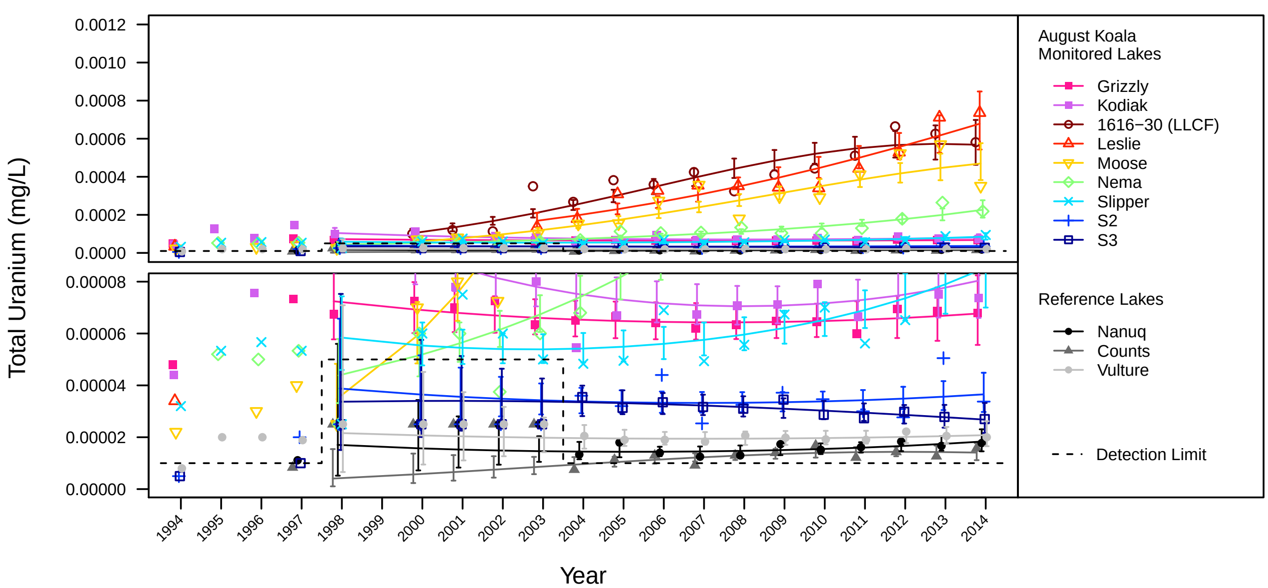
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3500
Monitored Lake	1616-30 (LLCF)	0.8670
Monitored Lake	Grizzly	0.3520
Monitored Lake	Kodiak	0.3830
Monitored Lake	Leslie	0.8680
Monitored Lake	Moose	0.9110
Monitored Lake	Nema	0.7930
Monitored Lake	S2	0.1780
Monitored Lake	S3	0.3220
Monitored Lake	Slipper	0.2520

- Conclusions:
  Model fit for pooled reference lakes, Grizzly, Kodiak, Slipper, and S3 is weak. Model fit for S2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total uranium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Grizzly	6.80e-05	6.77e-05	6.79e-06	5.56e-05	8.24e-05	1.99e-05
Kodiak	7.38e-05	8.04e-05	8.07e-06	6.60e-05	9.78e-05	2.36e-05
Leslie	7.36e-04	6.79e-04	7.72e-05	5.43e-04	8.48e-04	2.26e-04
1616-30 (LLCF)	5.81e-04	5.69e-04	5.96e-05	4.63e-04	6.98e-04	1.75e-04
Moose	3.51e-04	4.70e-04	4.90e-05	3.83e-04	5.76e-04	1.43e-04
Nema	2.19e-04	2.26e-04	2.31e-05	1.85e-04	2.77e-04	6.77e-05
Slipper	9.42e-05	8.53e-05	8.60e-06	7.00e-05	1.04e-04	2.52e-05
S2	3.38e-05	3.65e-05	3.83e-06	2.97e-05	4.49e-05	1.12e-05
S3	2.70e-05	2.68e-05	2.94e-06	2.16e-05	3.32e-05	8.60e-06
Nanuq	1.78e-05	1.83e-05	2.15e-06	1.46e-05	2.31e-05	NA
Counts	1.57e-05	1.41e-05	1.67e-06	1.12e-05	1.78e-05	NA
Vulture	2.00e-05	2.08e-05	2.44e-06	1.65e-05	2.62e-05	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Uranium	August	Koala	Lake	Water	none	log e	Tobit regression	#2 shared slopes	0.015	1616-30 (LLCF) Leslie Moose Nema S3

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

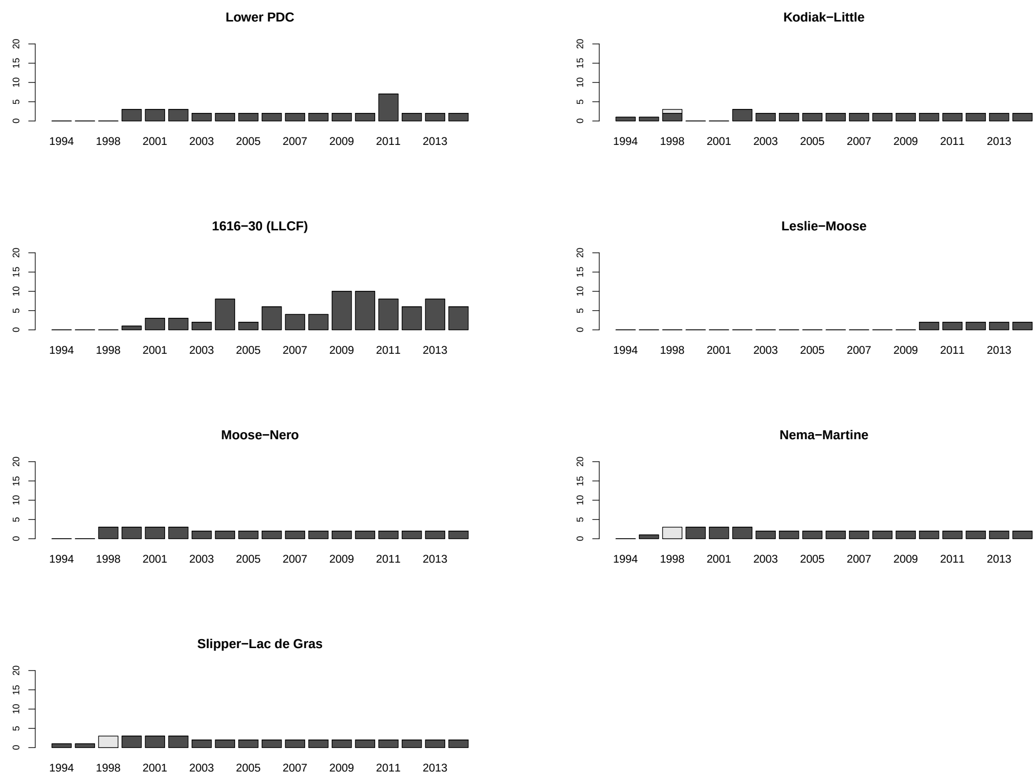
Analysis of August Total Uranium in Koala Watershed Streams

November 13, 2014

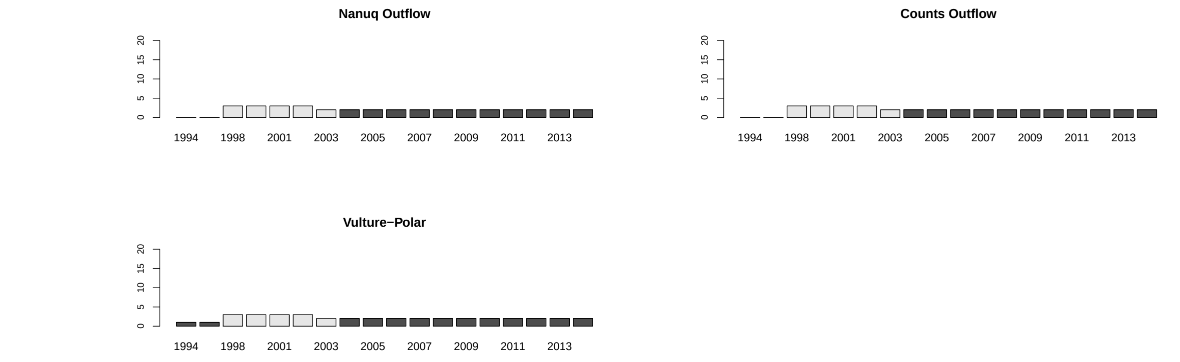
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

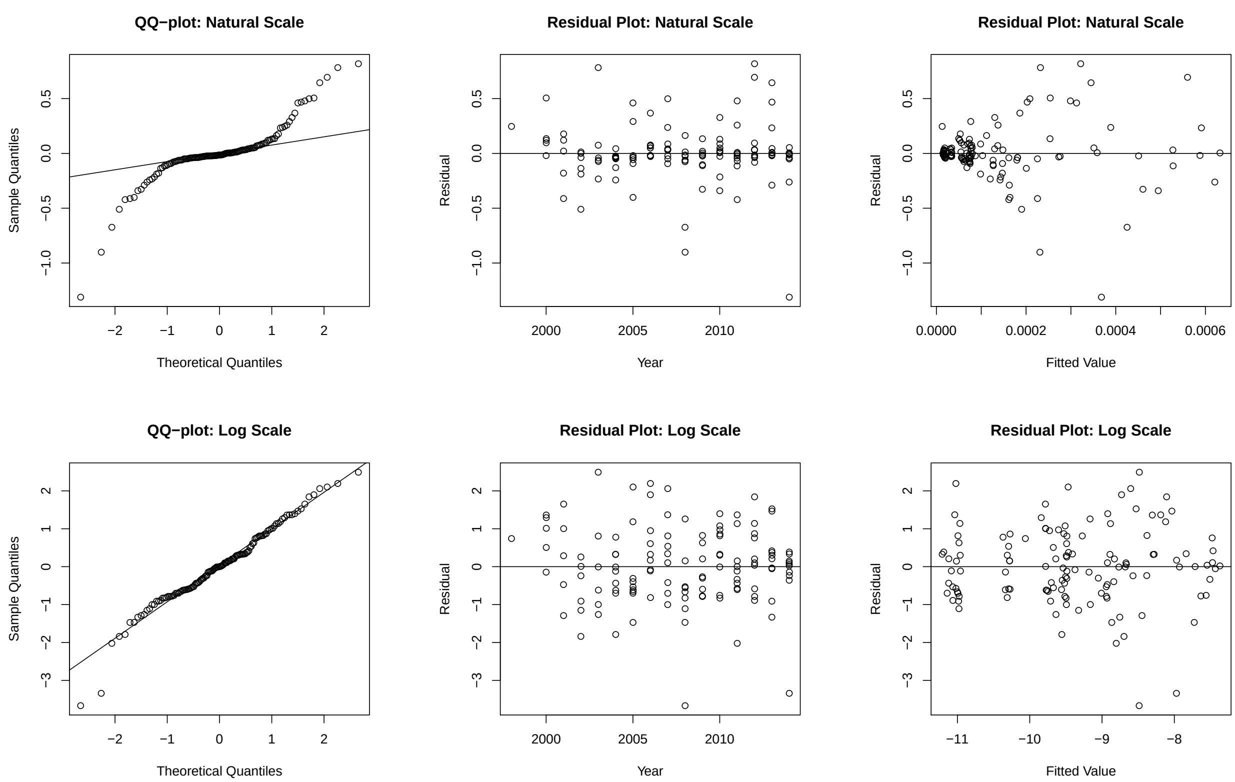


1.2 Reference



Comment:
10-60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.00	-8.49	-3.67
126	Moose-Nero	2014	0.00	-7.97	-3.34

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
28.61	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
1.05	4.00	0.90

- Conclusions:
  The slopes do not differ significantly among reference streams.

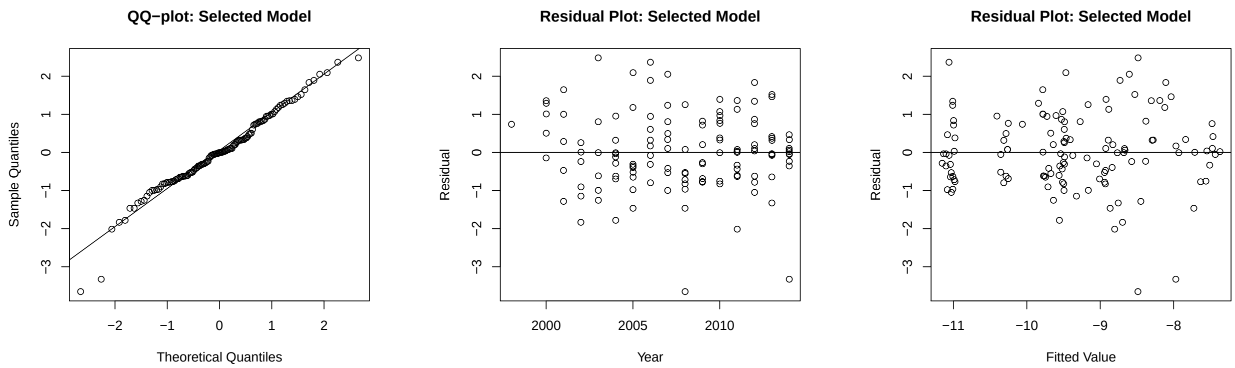
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.030	0.970	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
120	Moose-Nero	2008	0.00	-8.49	-3.65
126	Moose-Nero	2014	0.00	-7.97	-3.33

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference stream slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
Lower PDC	7.8670	2	0.0196
Kodiak-Little	1.4858	2	0.4757
Leslie-Moose	5.3734	2	0.0681
1616-30 (LLCF)	18.5541	2	0.0001
Moose-Nero	23.7078	2	0.0000
Nema-Martine	27.3858	2	0.0000
Slipper-Lac de Gras	3.0905	2	0.2133

- Conclusions:
  All monitored streams except Kodiak-Little, Leslie-Moose, and Slipper-Lac de Gras show significant deviation from the common slope of reference streams.

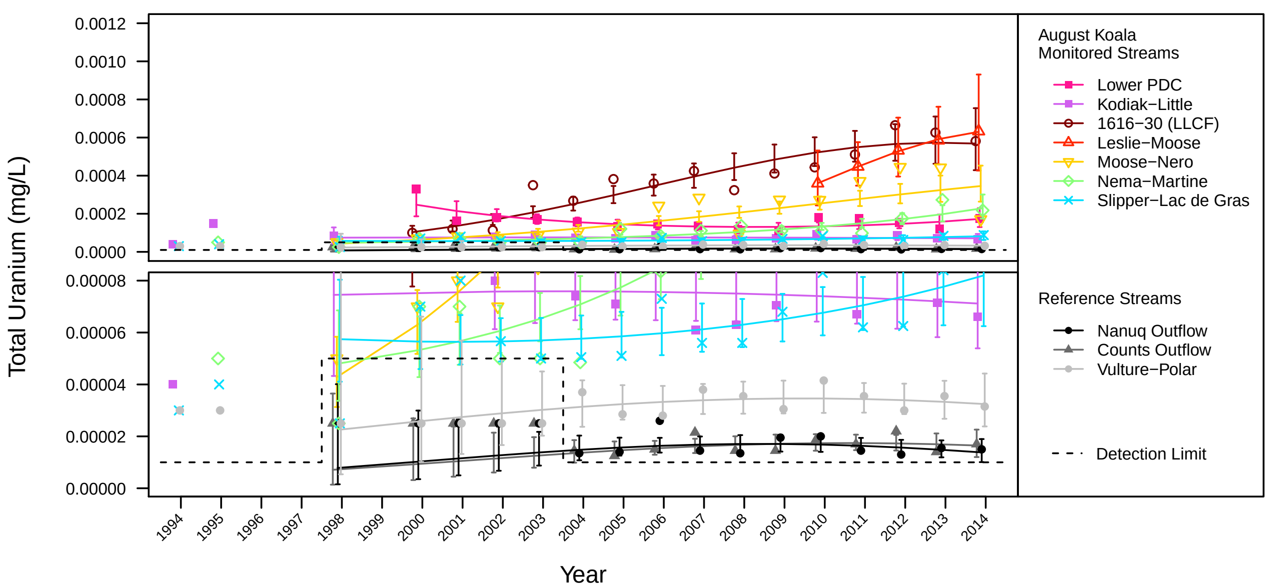
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.5400
Monitored Stream	1616-30 (LLCF)	0.8670
Monitored Stream	Kodiak-Little	0.0320
Monitored Stream	Leslie-Moose	0.9990
Monitored Stream	Lower PDC	0.5420
Monitored Stream	Moose-Nero	0.7430
Monitored Stream	Nema-Martine	0.7170
Monitored Stream	Slipper-Lac de Gras	0.1870

- Conclusions:
  Model fit for Kodiak-Little and Slipper-Lac de Gras is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total uranium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	1.75e-04	1.73e-04	2.49e-05	1.30e-04	2.29e-04	7.29e-05
Kodiak-Little	6.60e-05	7.12e-05	1.01e-05	5.39e-05	9.40e-05	2.95e-05
Leslie-Moose	6.33e-04	6.30e-04	1.25e-04	4.27e-04	9.31e-04	3.67e-04
1616-30 (LLCF)	5.81e-04	5.69e-04	8.19e-05	4.29e-04	7.54e-04	2.40e-04
Moose-Nero	1.70e-04	3.45e-04	4.76e-05	2.64e-04	4.53e-04	1.39e-04
Nema-Martine	2.18e-04	2.29e-04	3.19e-05	1.74e-04	3.01e-04	9.34e-05
Slipper-Lac de Gras	8.80e-05	8.20e-05	1.14e-05	6.25e-05	1.08e-04	3.33e-05
Nanuq Outflow	1.50e-05	1.38e-05	2.23e-06	1.01e-05	1.90e-05	NA
Counts Outflow	1.70e-05	1.65e-05	2.65e-06	1.20e-05	2.26e-05	NA
Vulture-Polar	3.15e-05	3.25e-05	5.12e-06	2.38e-05	4.42e-05	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Uranium	August	Koala	Stream	Water	none	log e	Tobit regression	#2 shared slopes	0.015	Lower PDC 1616-30 (LLCF) Moose-Nero Nema-Martine

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

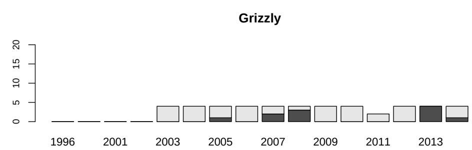
Analysis of April Total Vanadium in Lakes of the Koala Watershed and Lac de Gras

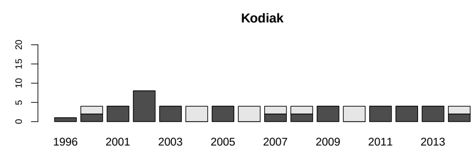
November 13, 2014

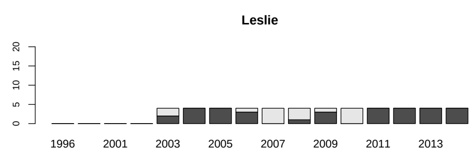
1 Censored Values:

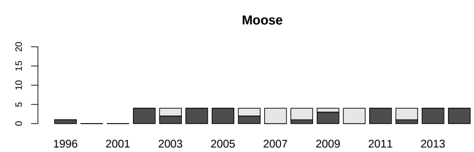
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

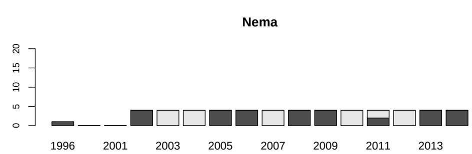
1.1 Monitored

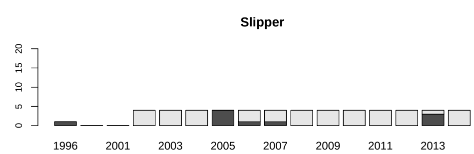








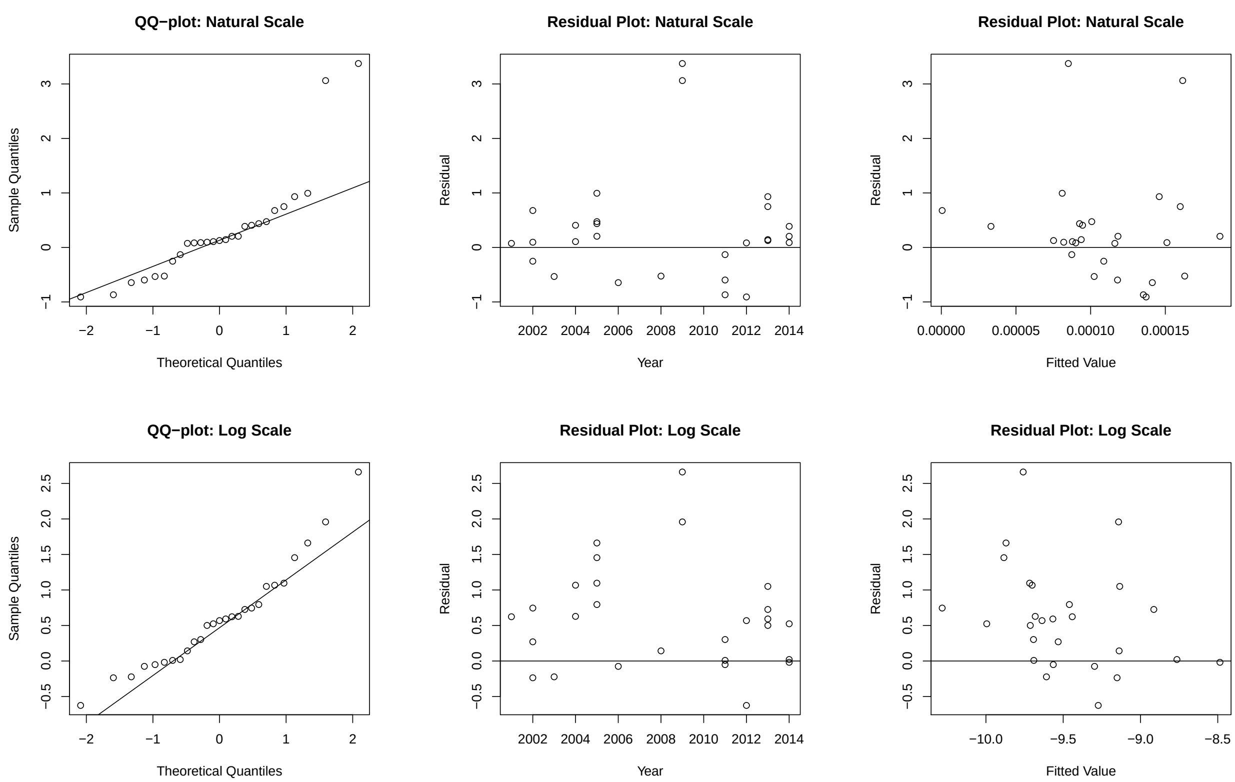




1.2 Reference

Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Grizzly, Slipper, S2, and S3 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Kodiak, Leslie, Moose, and Nema was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-30 (LLCF) was not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
79	Kodiak	2009	0.00	0.00	3.37
163	Nema	2009	0.00	0.00	3.06

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	2.86E-92	natural model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	0.2748	2	0.8716
Leslie	1.8808	2	0.3905
Moose	0.8339	2	0.6590
Nema	4.3848	2	0.1116

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

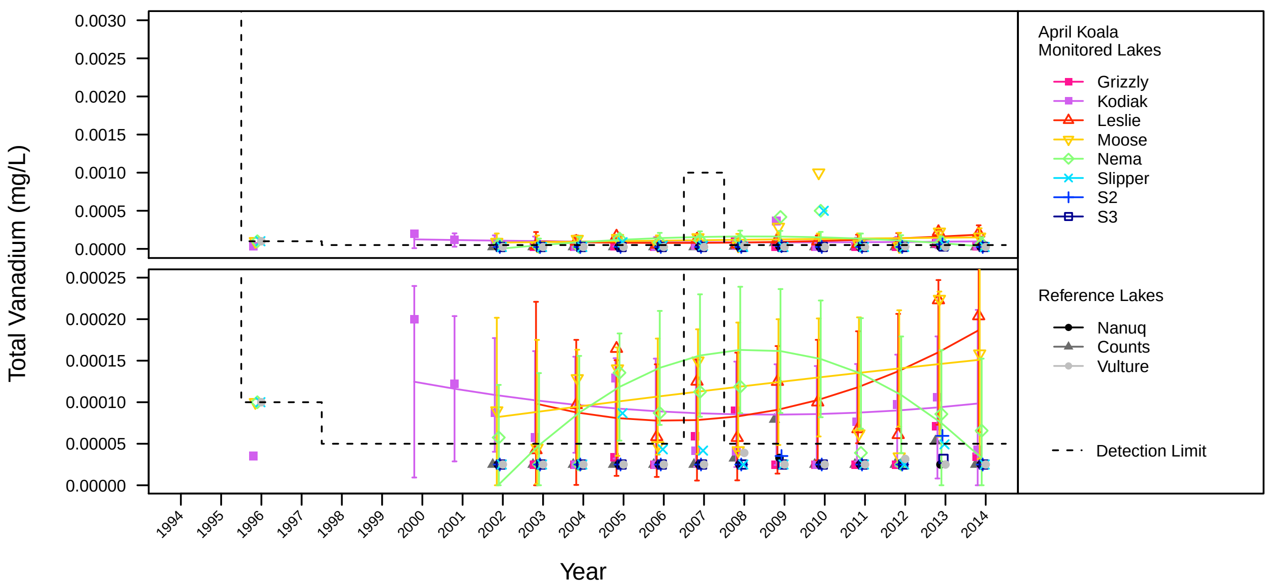
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Kodiak	0.0180
Monitored Lake	Leslie	0.3380
Monitored Lake	Moose	0.0740
Monitored Lake	Nema	0.1610

- Conclusions:
  Model fit for Leslie Lake is weak. Model fit for Kodiak, Moose, and Nema lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total vanadium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	4.28e-05	9.84e-05	5.75e-05	0.00e+00	2.11e-04	1.68e-04
Leslie	2.04e-04	1.87e-04	6.25e-05	6.40e-05	3.09e-04	1.83e-04
Moose	1.58e-04	1.51e-04	6.09e-05	3.17e-05	2.70e-04	1.78e-04
Nema	6.57e-05	3.33e-05	6.08e-05	0.00e+00	1.52e-04	1.78e-04
Nanuq	2.50e-05	NA	NA	NA	NA	NA
Counts	2.50e-05	NA	NA	NA	NA	NA
Vulture	2.50e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Vanadium	April	Koala	Lake	Water	Counts Nanuq Vulture Grizzly Slipper S2 S3	none	Tobit regression	#1a slope of zero	0.03	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

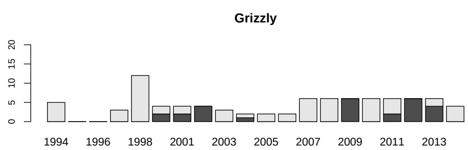
Analysis of August Total Vanadium in Lakes of the Koala Watershed and Lac de Gras

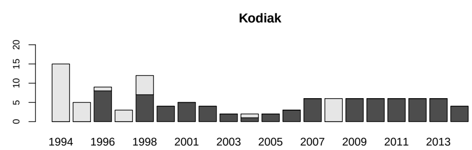
November 13, 2014

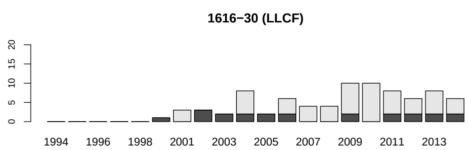
1 Censored Values:

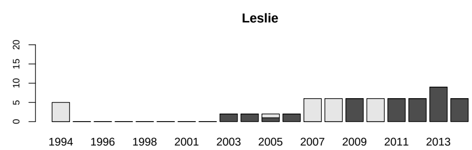
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

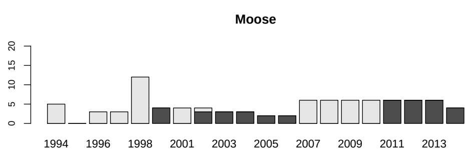
1.1 Monitored

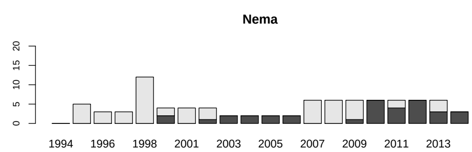


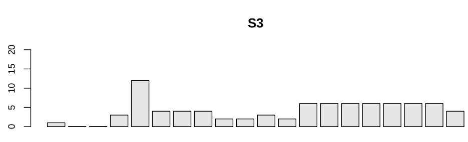




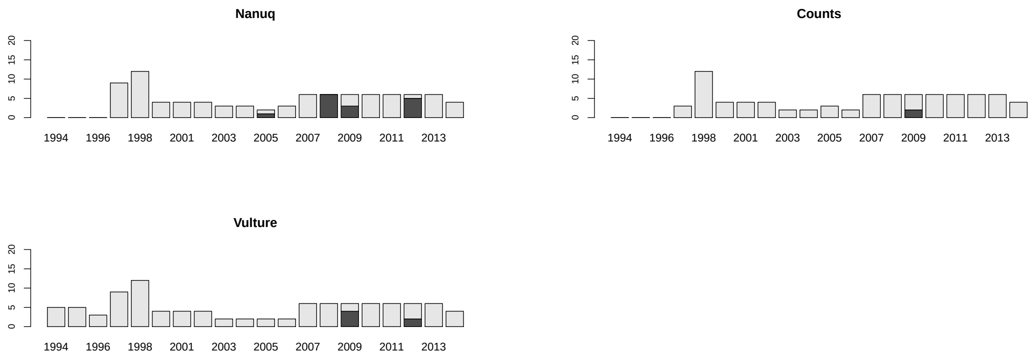






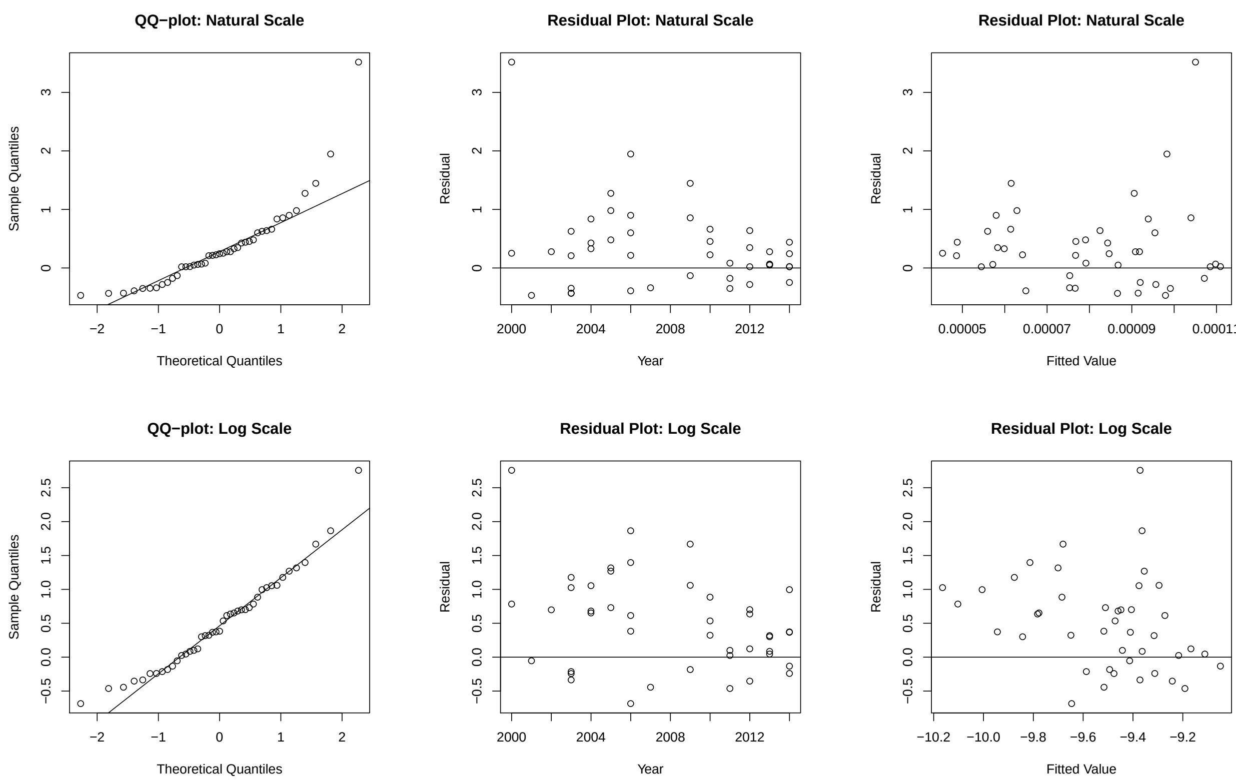


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, 1616-30 (LLCF), Grizzly, S2, and S3 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Kodiak, Leslie, Moose, Nema, and Slipper lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
70	Kodiak	2000	0.00	0.00	3.52

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	0.5843	2	0.7467
Leslie	0.9116	2	0.6339
Moose	7.4305	2	0.0243
Nema	2.7603	2	0.2515
Slipper	3.0528	2	0.2173

- Conclusions:
  Moose Lake shows significant deviation from a slope of zero.

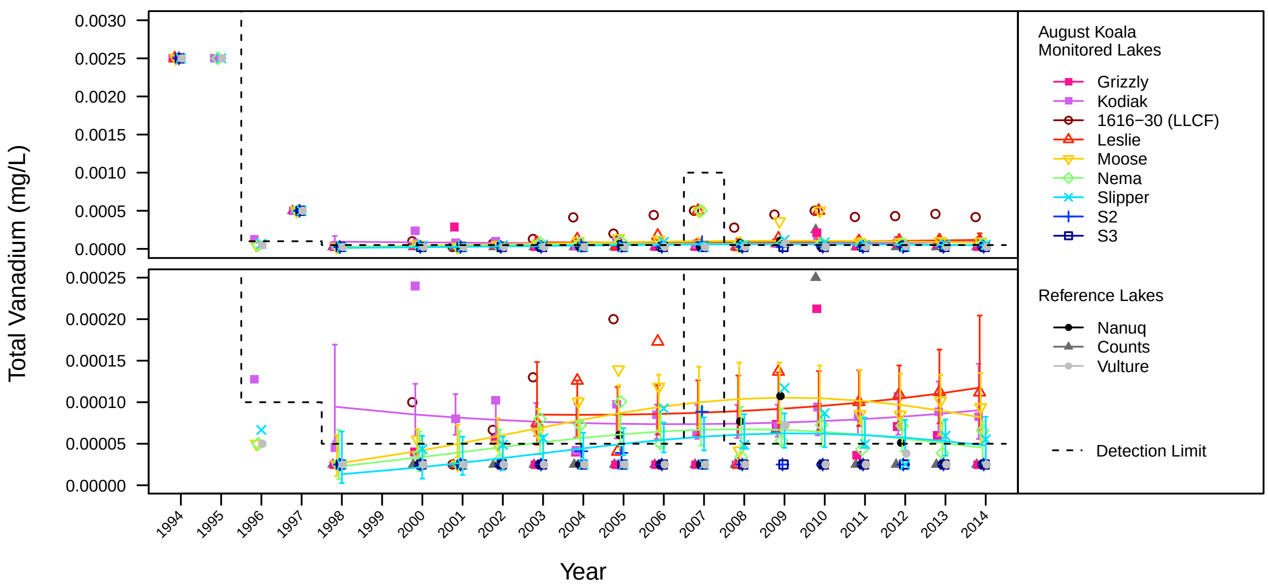
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Kodiak	0.0310
Monitored Lake	Leslie	0.0820
Monitored Lake	Moose	0.2800
Monitored Lake	Nema	0.2030
Monitored Lake	Slipper	0.4090

- Conclusions:
  Model fit for Moose, Nema, and Slipper lakes is weak. Model fit for Kodiak and Leslie lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total vanadium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	8.25e-05	9.03e-05	2.23e-05	5.57e-05	1.46e-04	6.51e-05
Leslie	1.12e-04	1.18e-04	3.32e-05	6.76e-05	2.04e-04	9.71e-05
Moose	9.40e-05	8.19e-05	2.10e-05	4.96e-05	1.35e-04	6.13e-05
Nema	6.57e-05	4.52e-05	1.24e-05	2.63e-05	7.74e-05	3.63e-05
Slipper	5.53e-05	4.80e-05	1.32e-05	2.80e-05	8.23e-05	3.87e-05
Nanuq	2.50e-05	NA	NA	NA	NA	NA
Counts	2.50e-05	NA	NA	NA	NA	NA
Vulture	2.50e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Vanadium	August	Koala	Lake	Water	Counts Nanuq Vulture 1616-30 (LLCF) Grizzly S2 S3	log e	Tobit regression	#1a slope of zero	0.03	Moose

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

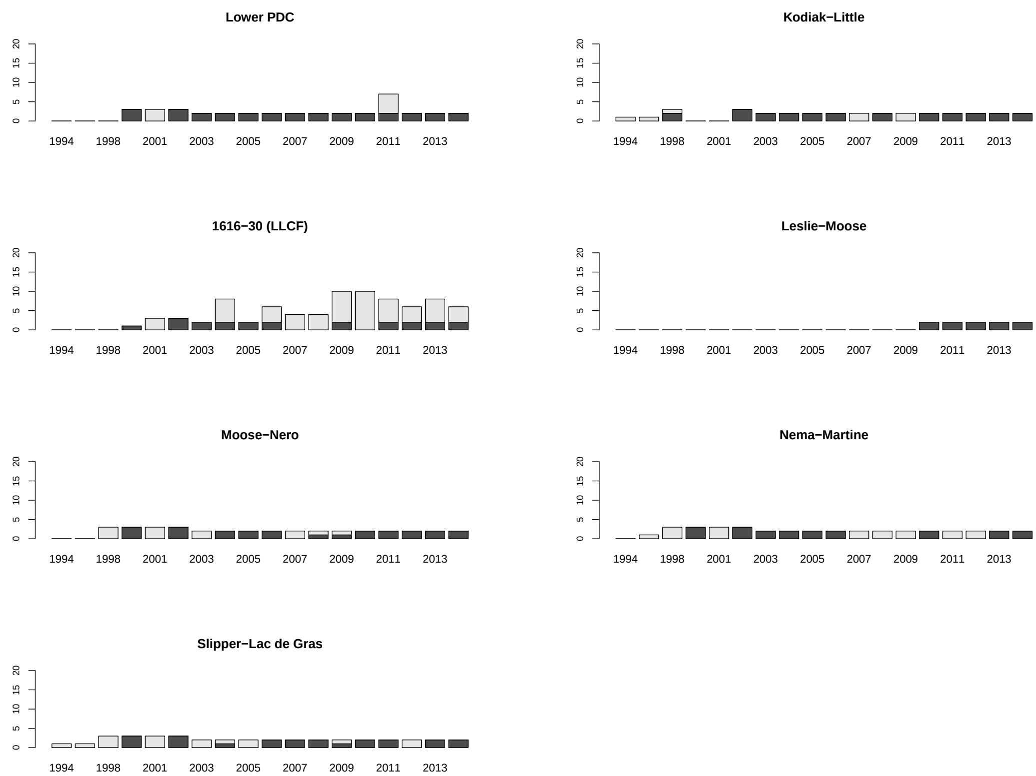
Analysis of August Total Vanadium in Koala Watershed Streams

November 13, 2014

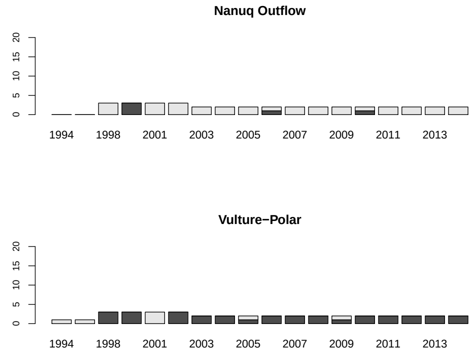
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

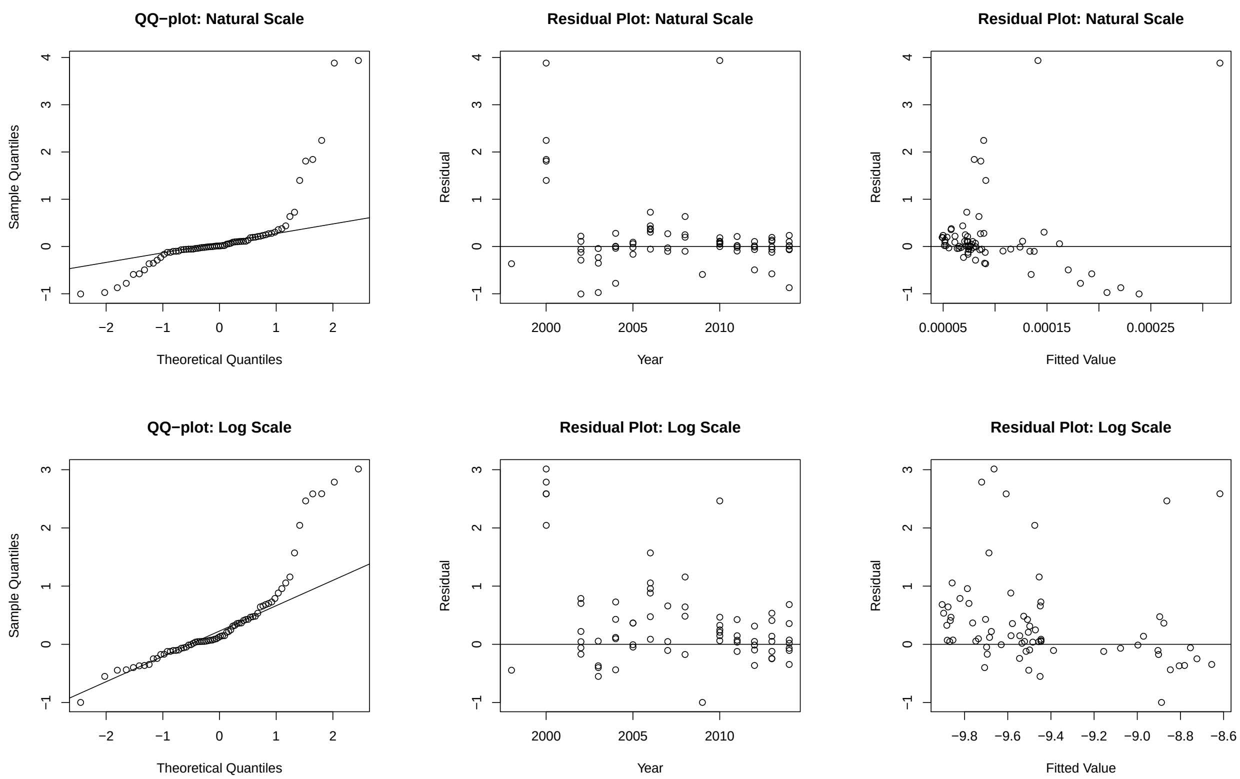


1.2 Reference



Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, and 1616-30 (LLCF) was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Vulture-Polar, Kodiak-Little, the Lower PDC, Moose-Nero, Nema-Martine, and Slipper-Lac de Gras was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
91	Lower PDC	2000	0.00	0.00	3.88
101	Lower PDC	2010	0.00	0.00	3.94

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
112	Moose-Nero	2000	0.00	-9.66	3.01

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

Two of three reference streams were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Lower PDC	0.5107	2	0.7746
Kodiak-Little	1.2119	2	0.5456
Leslie-Moose	0.6033	2	0.7396
Moose-Nero	0.5738	2	0.7506
Nema-Martine	0.6656	2	0.7169
Slipper-Lac de Gras	0.2371	2	0.8882

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

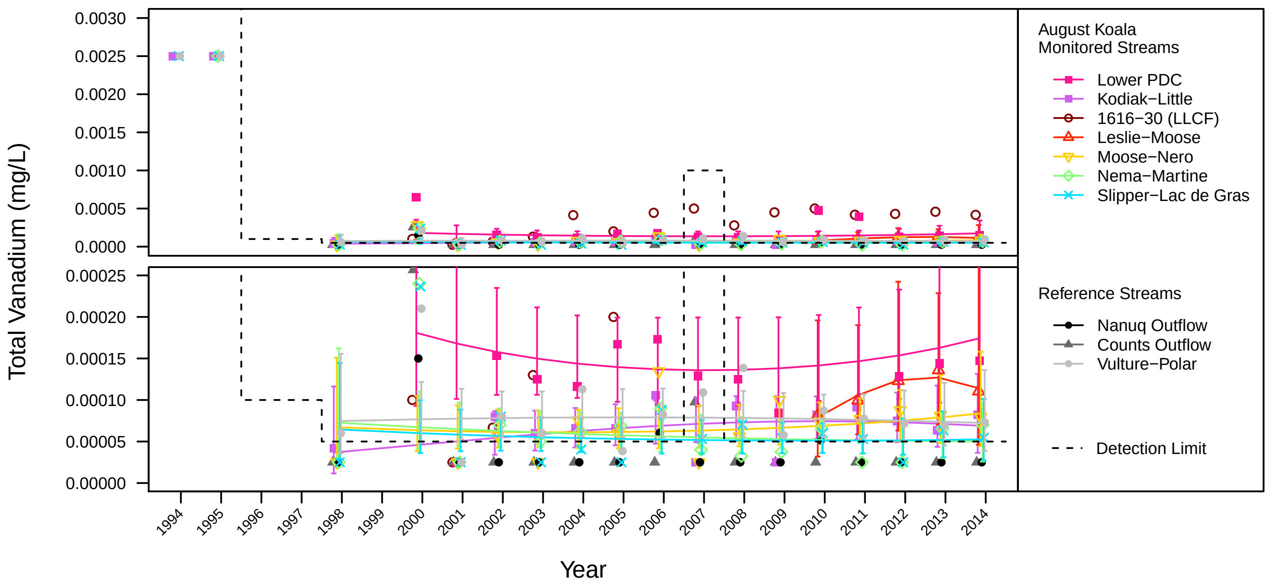
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Vulture-Polar	0.0040
Monitored Stream	Kodiak-Little	0.1500
Monitored Stream	Leslie-Moose	0.9340
Monitored Stream	Lower PDC	0.0170
Monitored Stream	Moose-Nero	0.0280
Monitored Stream	Nema-Martine	0.0690
Monitored Stream	Slipper-Lac de Gras	0.0290

- Conclusions:
  Model fit for Vulture-Polar, Kodiak-Little, the Lower PDC, Moose-Nero, Nema-Martine, and Slipper-Lac de Gras is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total vanadium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Lower PDC	1.47e-04	1.74e-04	6.00e-05	8.87e-05	3.42e-04	1.76e-04
Kodiak-Little	8.25e-05	6.92e-05	2.27e-05	3.64e-05	1.32e-04	6.63e-05
Leslie-Moose	1.10e-04	1.14e-04	5.29e-05	4.61e-05	2.83e-04	1.55e-04
Moose-Nero	7.95e-05	8.37e-05	2.71e-05	4.44e-05	1.58e-04	7.94e-05
Nema-Martine	7.00e-05	5.00e-05	1.68e-05	2.59e-05	9.66e-05	4.91e-05
Slipper-Lac de Gras	5.45e-05	5.25e-05	1.75e-05	2.73e-05	1.01e-04	5.13e-05
Nanuq Outflow	2.50e-05	NA	NA	NA	NA	NA
Counts Outflow	2.50e-05	NA	NA	NA	NA	NA
Vulture-Polar	7.30e-05	7.24e-05	2.33e-05	3.85e-05	1.36e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Vanadium	August	Koala	Stream	Water	Counts Outflow Nanuq Outflow 1616-30 (LLCF)	log e	Tobit regression	#1b separate intercepts & slopes	0.03	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

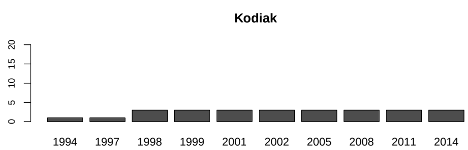
Analysis of Total Organic Carbon in Sediments in Lakes of the Koala Watershed and Lac de Gras

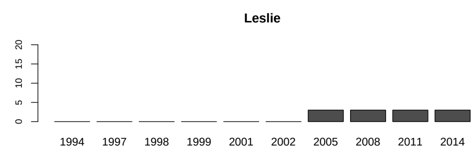
December 31, 2014

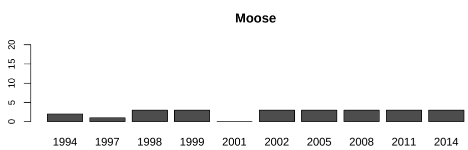
1 Censored Values:

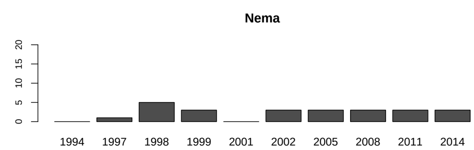
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

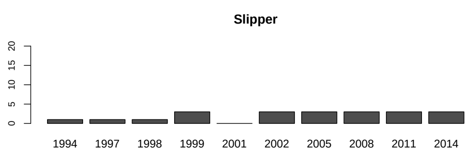
1.1 Monitored

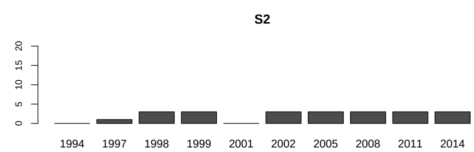




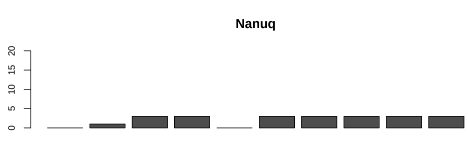


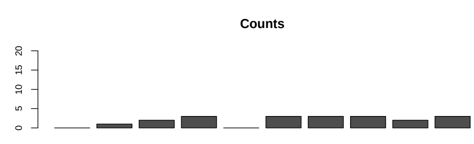






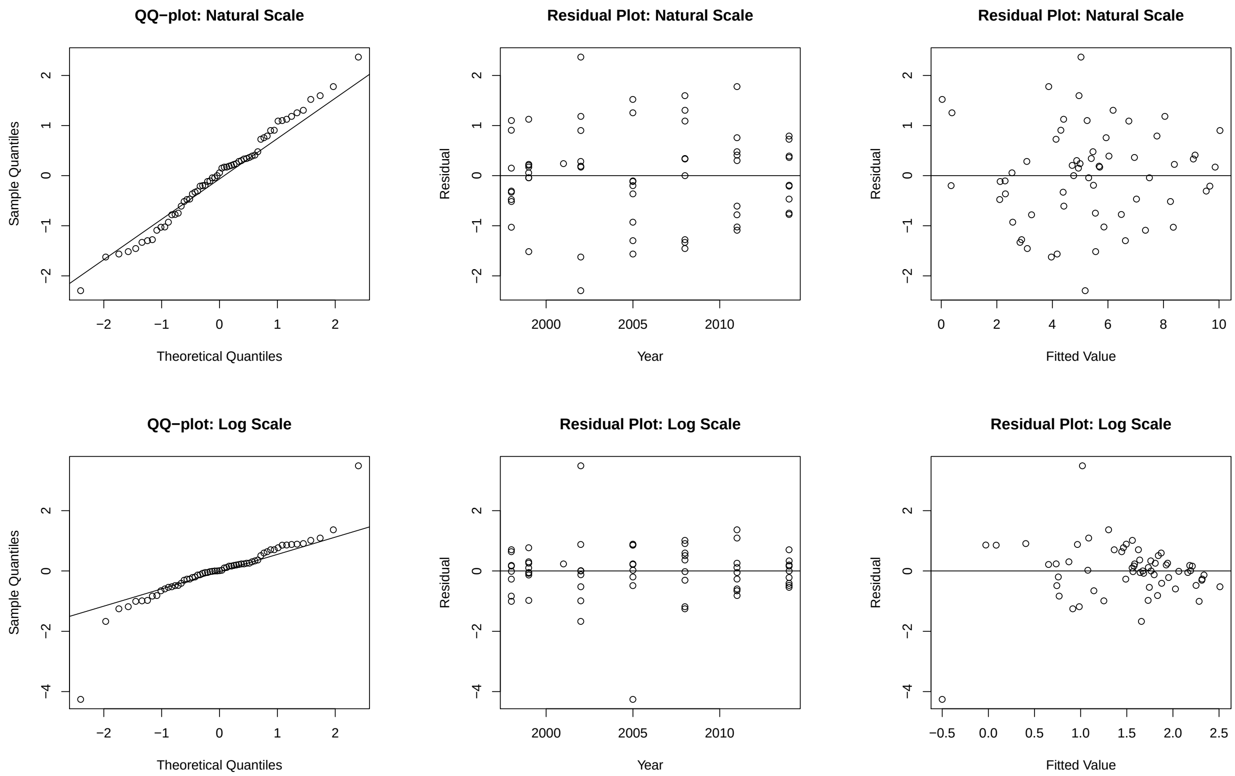
1.2 Reference





Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
93	Nanuq	2002	6.87	1.02	3.49
96	Nanuq	2005	0.20	-0.50	-4.26

AIC weights and model comparison:

Natural Model	Log Model	Best Model
9.58E-30	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
535.55	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
31.44	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	2.3419	2	0.3101
Leslie	6.6701	2	0.0356
Moose	2.1522	2	0.3409
Nema	4.4427	2	0.1085
Slipper	4.2262	2	0.1209
S2	8.3940	2	0.0150

- Conclusions:
  Leslie Lake and site S2 show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Leslie-vs-Nanuq	27.0515	3	0.0000
Leslie-vs-Counts	141.4132	3	0.0000
Leslie-vs-Vulture	39.1706	3	0.0000
S2-vs-Nanuq	26.1884	3	0.0000
S2-vs-Counts	436.1309	3	0.0000
S2-vs-Vulture	9.9494	3	0.0190

- Conclusions:
  Leslie Lake and site S2 show significant deviation from the slopes of individual reference lakes.

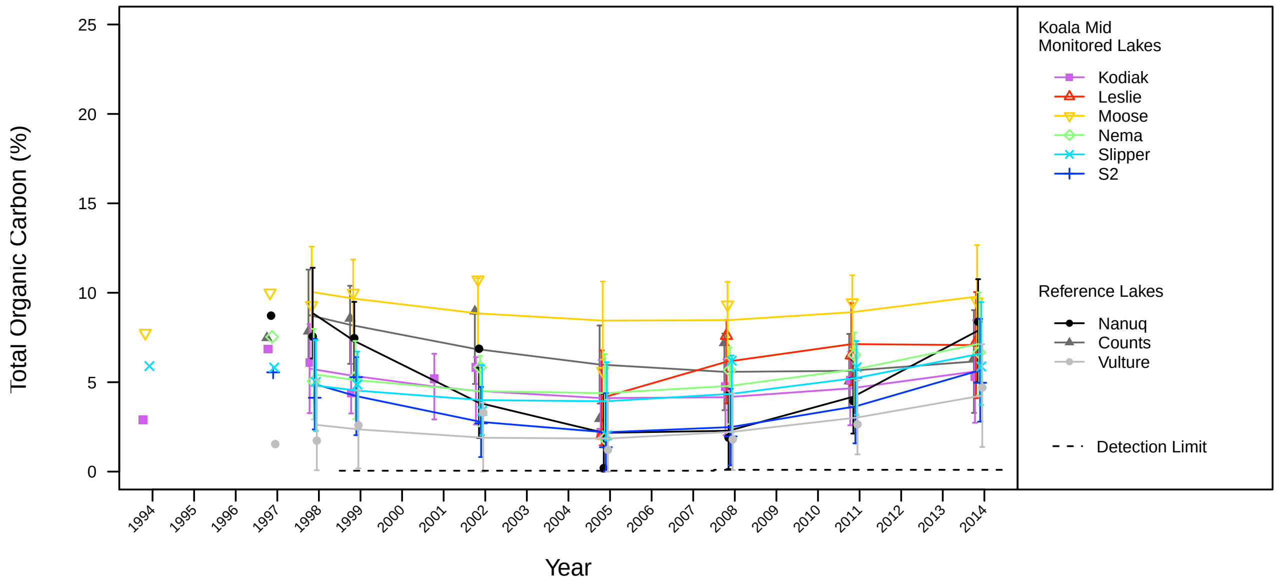
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.3570
Reference Lake	Nanuq	0.7500
Reference Lake	Vulture	0.5290
Monitored Lake	Kodiak	0.2810
Monitored Lake	Leslie	0.4730
Monitored Lake	Moose	0.1640
Monitored Lake	Nema	0.3490
Monitored Lake	S2	0.6380
Monitored Lake	Slipper	0.3770

- Conclusions:
  Model fit for Counts, Kodiak, Leslie, Nema, and Slipper lakes is weak. Model fit for Moose Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	5.33E+00	5.60E+00	1.46E+00	2.73E+00	8.47E+00	4.28E+00
Leslie	7.24E+00	7.07E+00	1.51E+00	4.11E+00	1.00E+01	4.43E+00
Moose	9.51E+00	9.79E+00	1.47E+00	6.92E+00	1.27E+01	4.29E+00
Nema	6.66E+00	7.15E+00	1.47E+00	4.27E+00	1.00E+01	4.29E+00
Slipper	5.88E+00	6.60E+00	1.47E+00	3.73E+00	9.48E+00	4.29E+00
S2	4.97E+00	5.67E+00	1.47E+00	2.80E+00	8.54E+00	4.29E+00
Nanuq	8.38E+00	7.89E+00	1.47E+00	5.01E+00	1.08E+01	
Counts	6.34E+00	6.16E+00	1.47E+00	3.28E+00	9.03E+00	
Vulture	4.70E+00	4.25E+00	1.47E+00	1.38E+00	7.13E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
TOC	Summer	Koala	Lake	Sediment	none	none	linear mixed effects regression	#1b separate intercepts & slopes	NA	Leslie S2

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

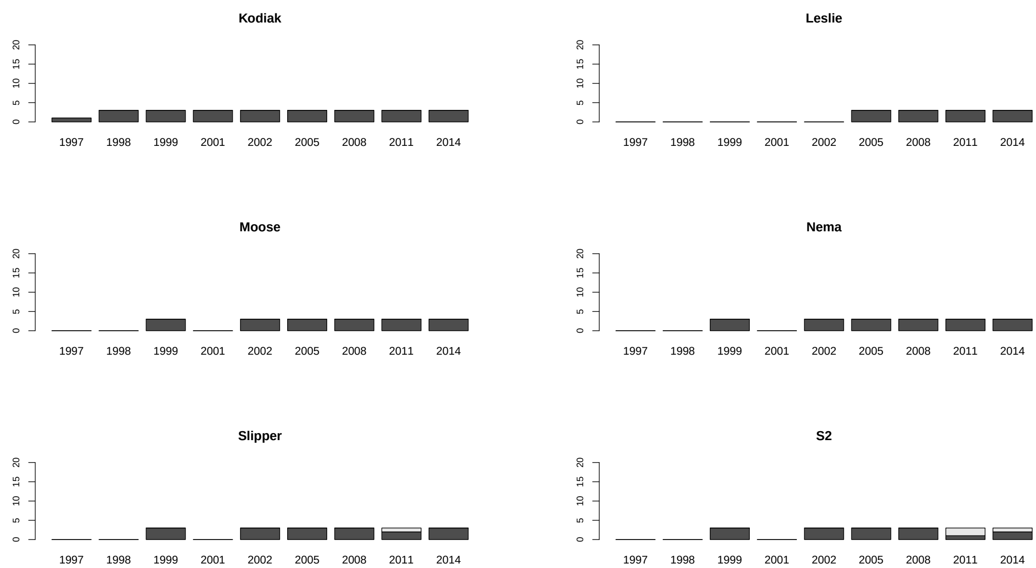
Analysis of Available Phosphorus in Sediments in Lakes of the Koala Watershed and Lac de Gras

December 30, 2014

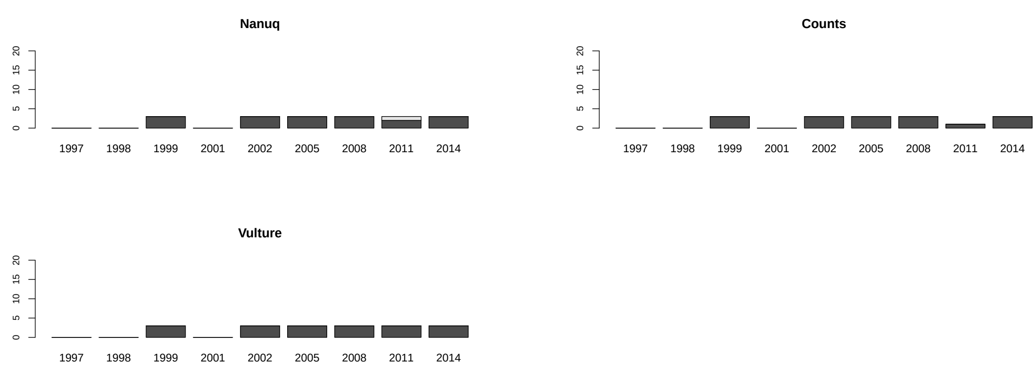
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

1.1 Monitored

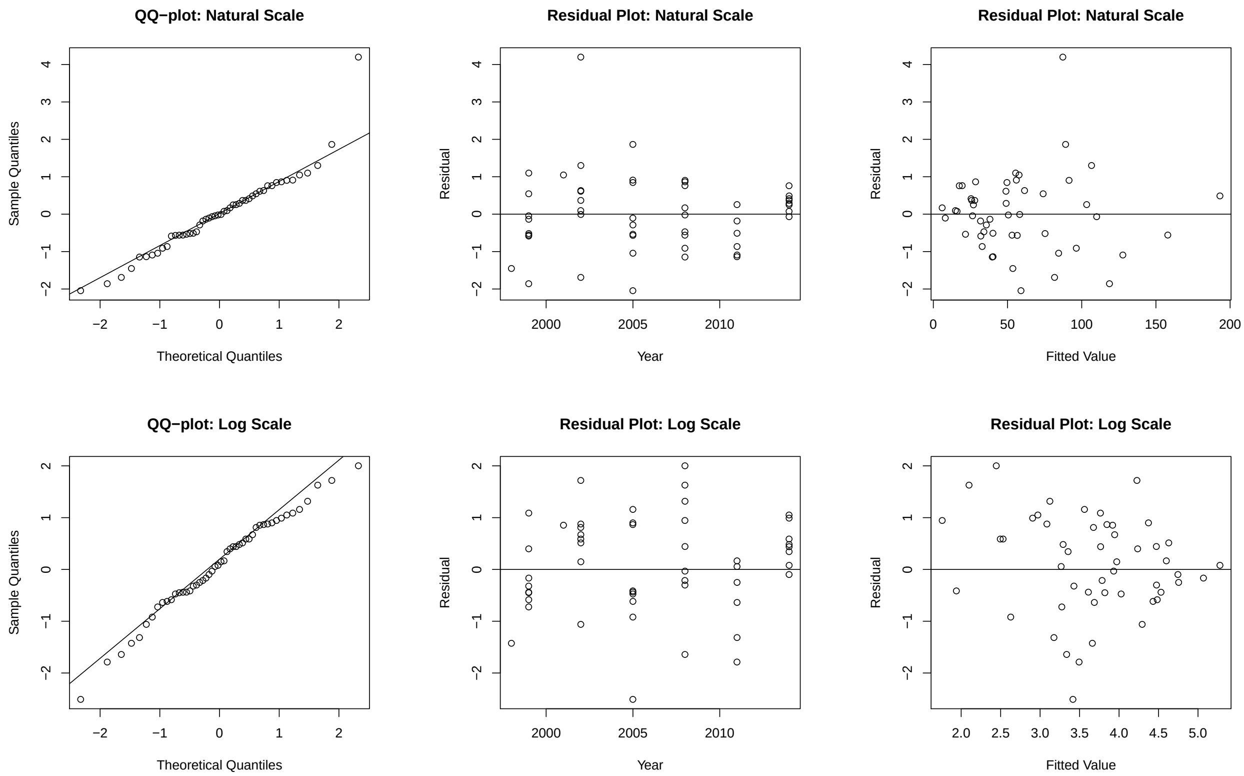


1.2 Reference



Comment:
10-60% of data in S2 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
135	S2	2002	195.00	87.27	4.20

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.32E-88	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
34.29	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
5.20	4.00	0.27

- Conclusions:
  The slopes do not differ significantly among reference lakes.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.180	0.820	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model

Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Kodiak	1.3503	2	0.5091
Leslie	0.4671	2	0.7917
Moose	0.8722	2	0.6465
Nema	1.0067	2	0.6045
Slipper	1.7618	2	0.4144
S2	13.7079	2	0.0011

- Conclusions:
  Site S2 shows significant deviation from the common slope of reference lakes.

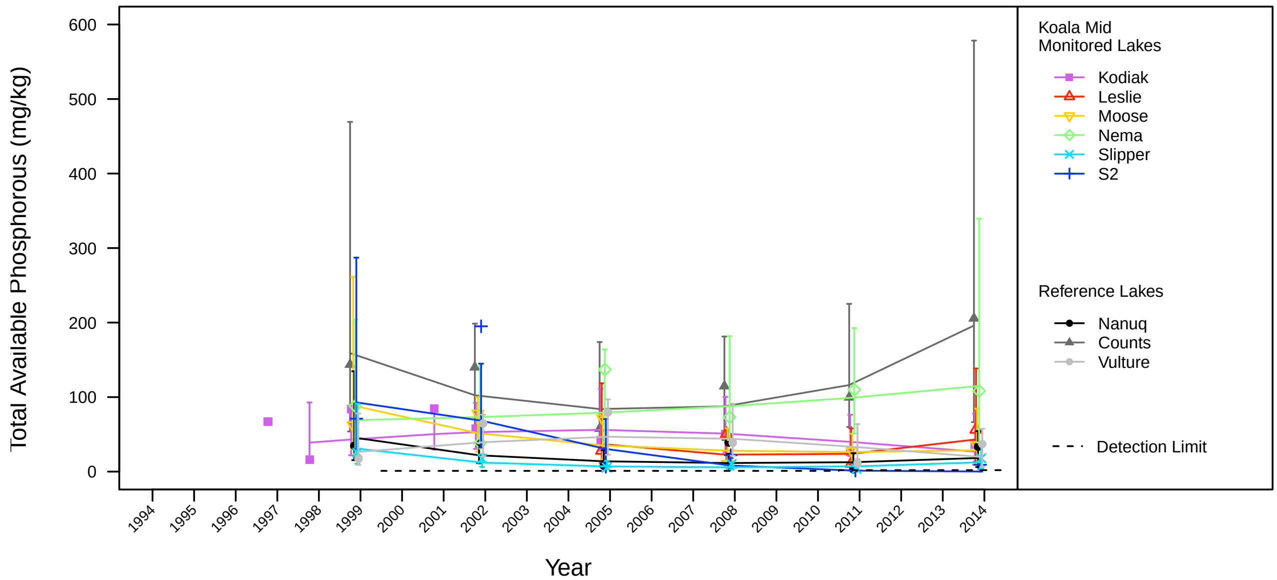
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.5570
Monitored Lake	Kodiak	0.1830
Monitored Lake	Leslie	0.1760
Monitored Lake	Moose	0.3790
Monitored Lake	Nema	0.1850
Monitored Lake	S2	0.6140
Monitored Lake	Slipper	0.6270

- Conclusions:
  Model fit for Moose Lake is weak. Model fit for Kodiak, Leslie, and Nema lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean available phosphorus for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	3.60e+01	2.69e+01	1.46e+01	9.29e+00	7.78e+01	4.27e+01
Leslie	5.65e+01	4.32e+01	2.57e+01	1.35e+01	1.38e+02	7.51e+01
Moose	3.53e+01	2.86e+01	1.58e+01	9.70e+00	8.45e+01	4.63e+01
Nema	1.08e+02	1.15e+02	6.35e+01	3.90e+01	3.40e+02	1.86e+02
Slipper	1.80e+01	1.26e+01	7.04e+00	4.19e+00	3.77e+01	2.06e+01
S2	9.17e+00	1.29e-01	2.24e-01	4.24e-03	3.91e+00	6.56e-01
Nanuq	3.34e+01	1.83e+01	1.02e+01	6.14e+00	5.43e+01	NA
Counts	2.06e+02	1.96e+02	1.08e+02	6.64e+01	5.78e+02	NA
Vulture	3.70e+01	1.95e+01	1.08e+01	6.61e+00	5.76e+01	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Available Phosphorus	Summer	Koala	Lake	Sediment	none	log e	Tobit regression	#2 shared slopes	NA	S2

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

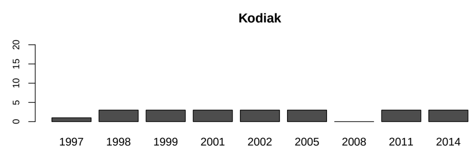
Analysis of Total Nitrogen in Sediments in Lakes of the Koala Watershed and Lac de Gras

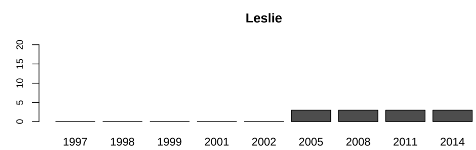
December 31, 2014

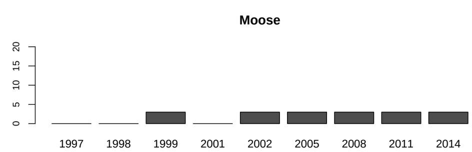
1 Censored Values:

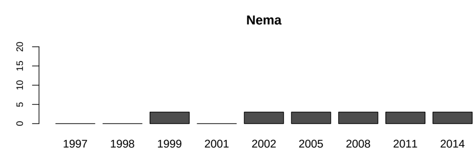
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

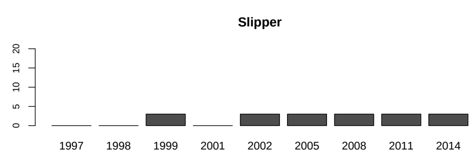
1.1 Monitored

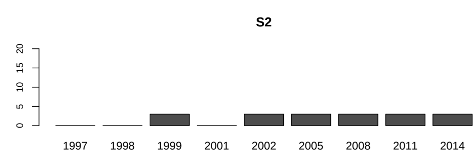




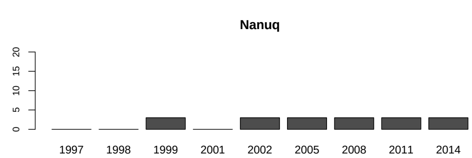


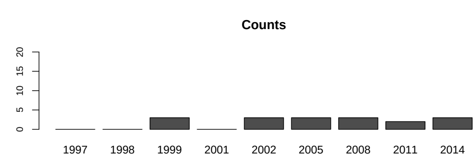


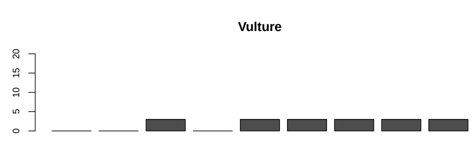




1.2 Reference

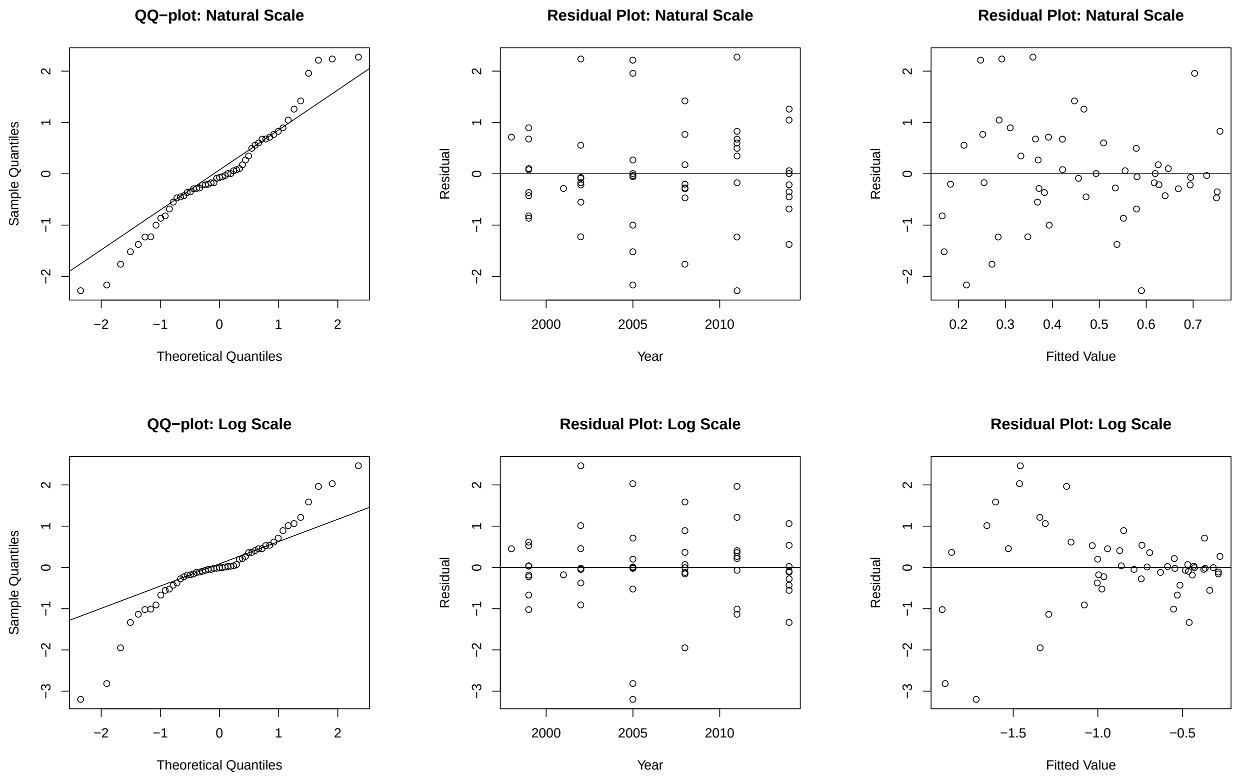






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
138	S2	2005	0.08	-1.72	-3.20

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.29E-32	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
221.15	6.00	0.00

- Conclusions:
The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
34.43	4.00	0.00

- Conclusions:
The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	1.0337	2	0.5964
Leslie	0.6603	2	0.7188
Moose	1.1635	2	0.5589
Nema	3.7140	2	0.1561
Slipper	6.4423	2	0.0399
S2	8.7521	2	0.0126

- Conclusions:
Slipper Lake and site S2 show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Slipper-vs-Nanuq	26.8317	3	0.0000
Slipper-vs-Counts	7.1043	3	0.0686
Slipper-vs-Vulture	28.5959	3	0.0000
S2-vs-Nanuq	6.3782	3	0.0946
S2-vs-Counts	12.5418	3	0.0057
S2-vs-Vulture	13.9388	3	0.0030

- Conclusions:
  Slipper Lake and site S2 show significant deviation from the slopes of individual reference lakes.

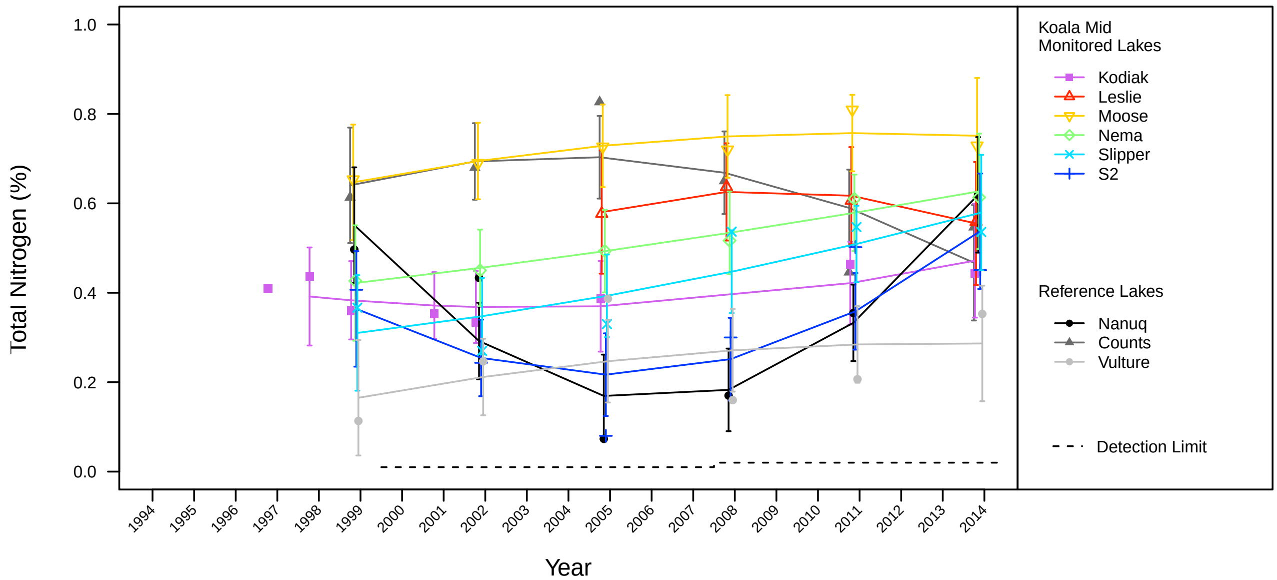
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4730
Reference Lake	Nanuq	0.8440
Reference Lake	Vulture	0.1990
Monitored Lake	Kodiak	0.5520
Monitored Lake	Leslie	0.9220
Monitored Lake	Moose	0.6900
Monitored Lake	Nema	0.9510
Monitored Lake	S2	0.5770
Monitored Lake	Slipper	0.6770

- Conclusions:
  Model fit for Counts Lake is weak. Model fit for Vulture Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nitrogen for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	4.43E-01	4.72E-01	6.49E-02	3.44E-01	5.99E-01	1.90E-01
Leslie	5.59E-01	5.55E-01	7.02E-02	4.17E-01	6.93E-01	2.05E-01
Moose	7.29E-01	7.51E-01	6.59E-02	6.22E-01	8.80E-01	1.93E-01
Nema	6.13E-01	6.27E-01	6.59E-02	4.98E-01	7.56E-01	1.93E-01
Slipper	5.36E-01	5.79E-01	6.59E-02	4.50E-01	7.08E-01	1.93E-01
S2	4.51E-01	5.38E-01	6.59E-02	4.08E-01	6.67E-01	1.93E-01
Nanuq	6.19E-01	6.19E-01	6.59E-02	4.90E-01	7.48E-01	
Counts	5.47E-01	4.67E-01	6.59E-02	3.38E-01	5.96E-01	
Vulture	3.53E-01	2.87E-01	6.59E-02	1.57E-01	4.16E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Total Nitrogen	Summer	Koala	Lake	Sediment	none	none	linear mixed effects regression	#1b separate intercepts & slopes	NA	Slipper S2

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

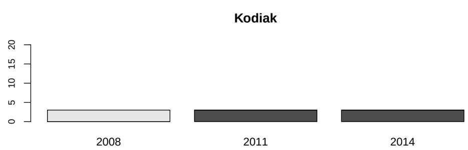
Analysis of Antimony in Sediments in Lakes of the Koala Watershed and Lac de Gras

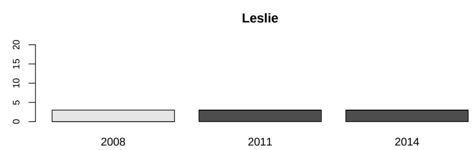
December 31, 2014

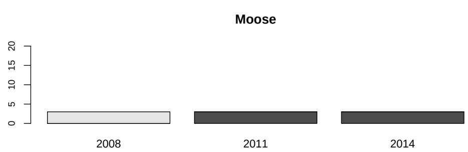
1 Censored Values:

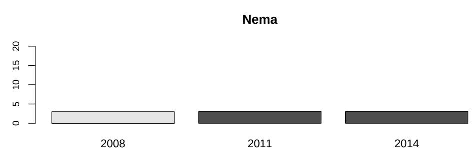
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

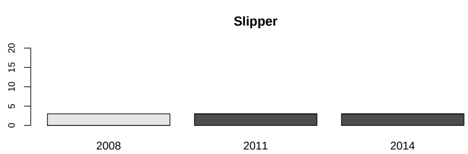
1.1 Monitored

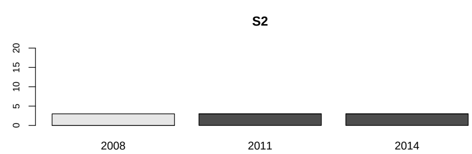




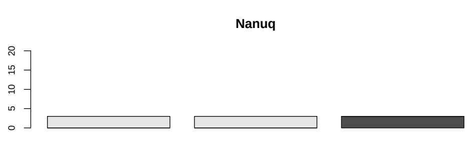


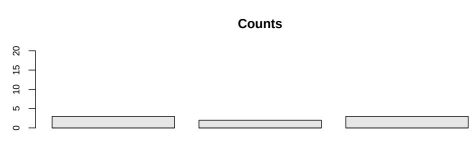


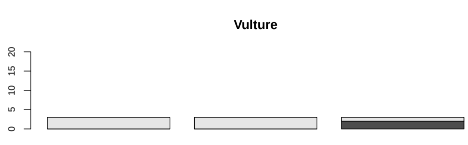




1.2 Reference

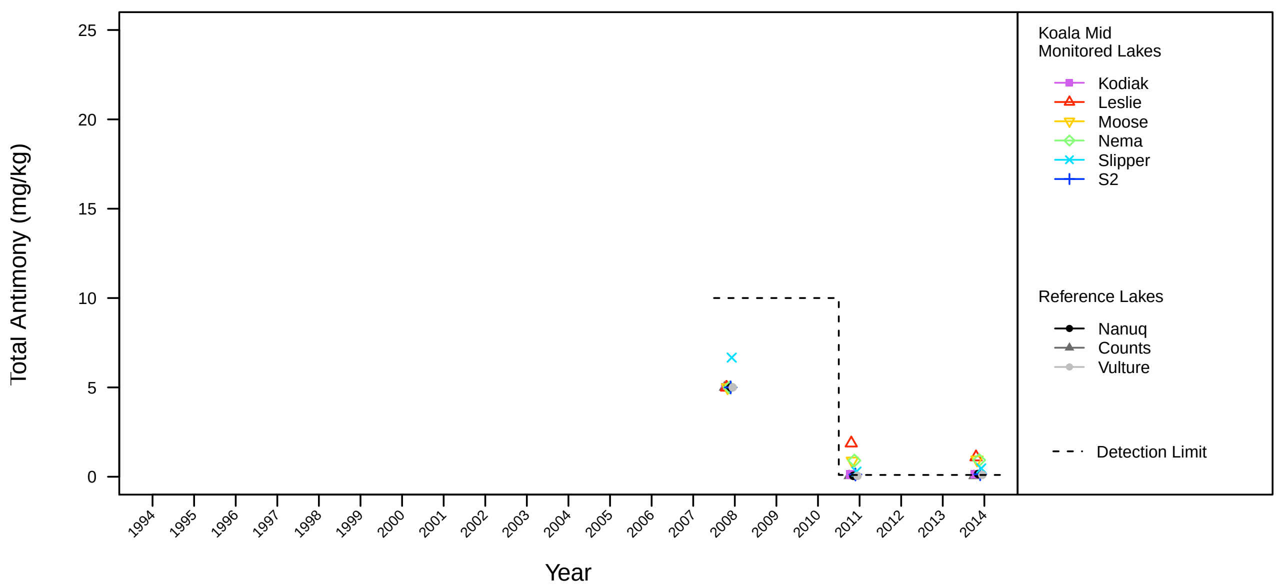






Comment:
Greater than 60% of data in Counts, Nanuq, and Vulture was less than the detection limit. These lakes were excluded from further analyses. Less than four years of data with observations greater than the detection limit were available in all monitored and reference lakes. All monitored lakes were excluded from further analyses. All monitored and reference lakes were excluded from analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Antimony	Summer	Koala	Lake	Sediment	ALL	NA	NA	NA	NA	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

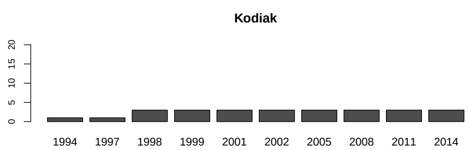
Analysis of Arsenic in Sediments in Lakes of the Koala Watershed and Lac de Gras

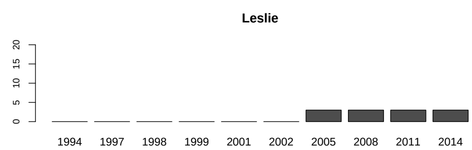
February 11, 2015

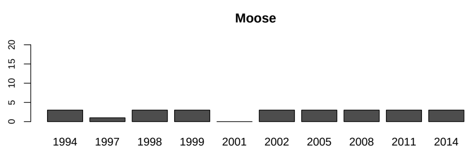
1 Censored Values:

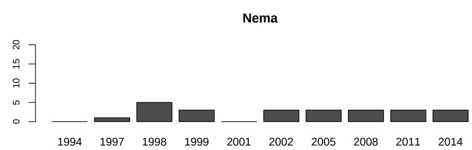
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

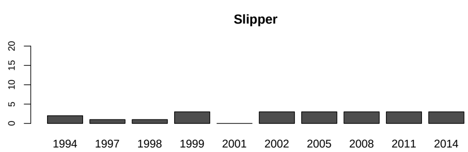
1.1 Monitored

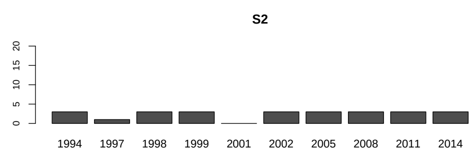




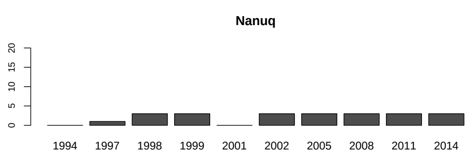


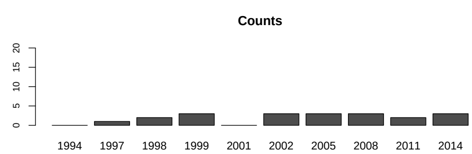


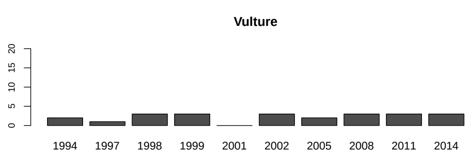




1.2 Reference

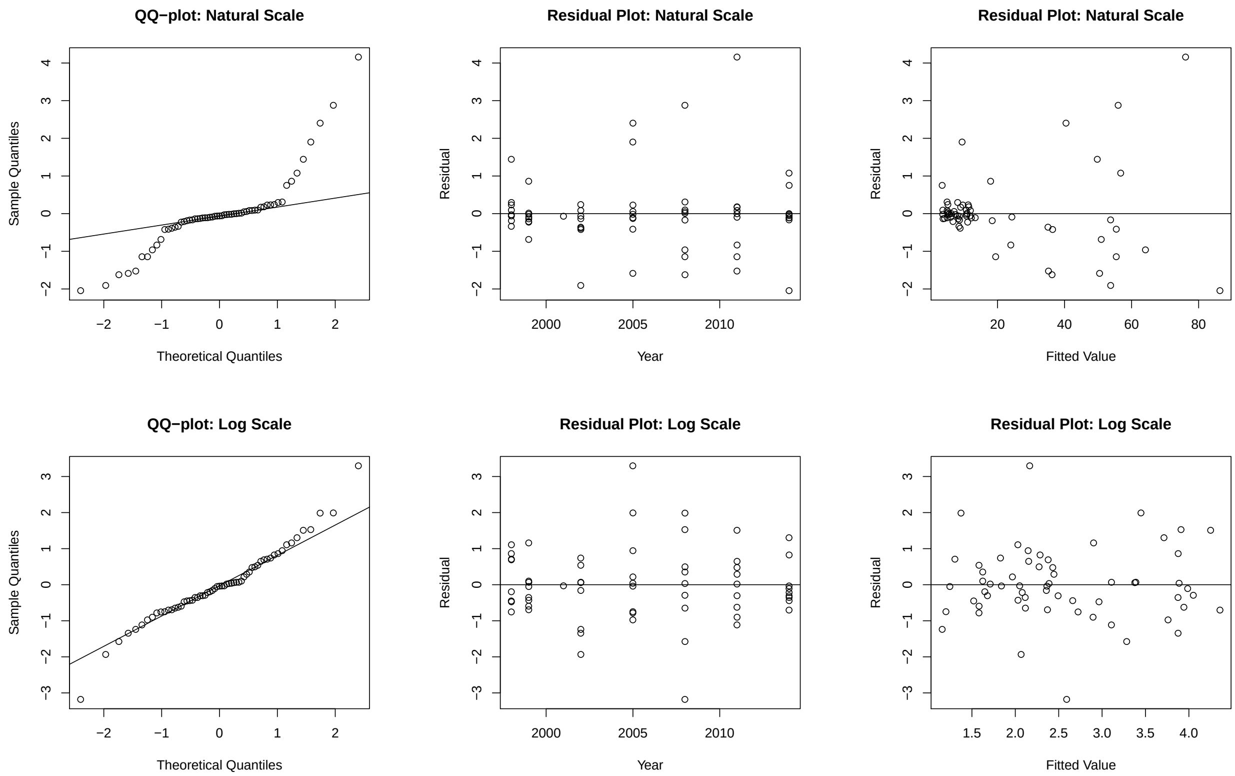






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
144	S2	2011	134.40	76.10	4.16

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
180	Vulture	2005	36.10	2.17	3.30
183	Vulture	2008	3.39	2.59	-3.18

AIC weights and model comparison:

Natural Model	Log Model	Best Model
5.51E-93	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
68.57	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
14.03	4.00	0.01

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.999	0.000	0.001	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	0.9734	2	0.6146
Leslie	0.0972	2	0.9525
Moose	1.9090	2	0.3850
Nema	0.1346	2	0.9349
Slipper	0.0290	2	0.9856
S2	6.7998	2	0.0334

- Conclusions:
  Site S2 shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
S2-vs-Nanuq	34.8219	3	0.0000
S2-vs-Counts	64.8843	3	0.0000
S2-vs-Vulture	32.2399	3	0.0000

- Conclusions:
  Site S2 shows significant deviation from the slopes of individual reference lakes.

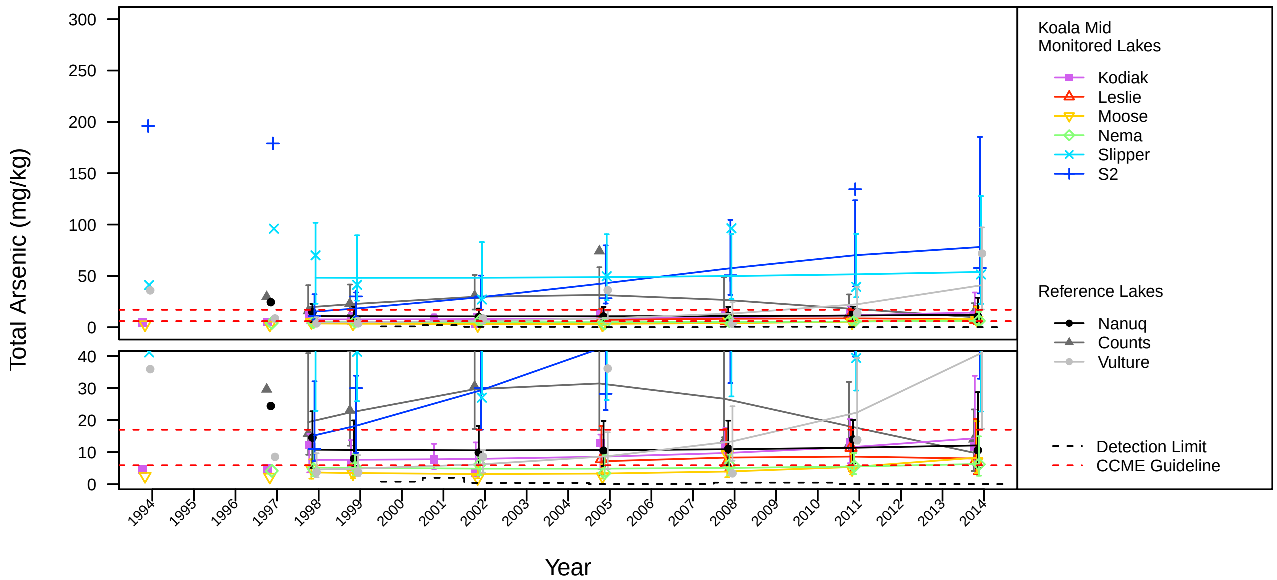
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.3840
Reference Lake	Nanuq	0.0550
Reference Lake	Vulture	0.4670
Monitored Lake	Kodiak	0.2360
Monitored Lake	Leslie	0.1010
Monitored Lake	Moose	0.3610
Monitored Lake	Nema	0.2000
Monitored Lake	S2	0.7040
Monitored Lake	Slipper	0.0110

- Conclusions:
  Model fit for Counts, Vulture, Kodiak, Moose, and Nema lakes is weak. Model fit Nanuq, Leslie, and Slipper lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean arsenic for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	1.18E+01	1.43E+01	6.28E+00	6.06E+00	3.38E+01	1.84E+01
Leslie	7.29E+00	8.00E+00	3.80E+00	3.15E+00	2.03E+01	1.11E+01
Moose	7.11E+00	8.28E+00	3.65E+00	3.49E+00	1.97E+01	1.07E+01
Nema	6.20E+00	6.30E+00	2.78E+00	2.65E+00	1.49E+01	8.12E+00
Slipper	5.14E+01	5.38E+01	2.37E+01	2.27E+01	1.28E+02	6.94E+01
S2	5.77E+01	7.81E+01	3.44E+01	3.29E+01	1.85E+02	1.01E+02
Nanuq	1.06E+01	1.21E+01	5.33E+00	5.10E+00	2.87E+01	
Counts	1.40E+01	9.83E+00	4.33E+00	4.14E+00	2.33E+01	
Vulture	7.18E+01	4.10E+01	1.81E+01	1.73E+01	9.72E+01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Arsenic	Summer	Koala	Lake	Sediment	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	5.9/ 17	S2

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

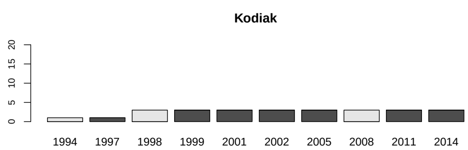
Analysis of Cadmium in Sediments in Lakes of the Koala Watershed and Lac de Gras

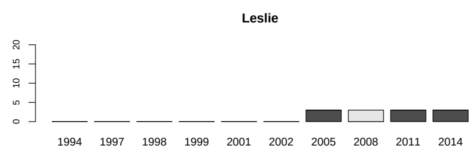
February 11, 2015

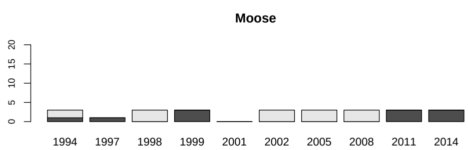
1 Censored Values:

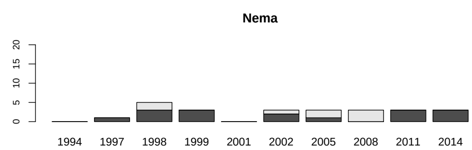
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

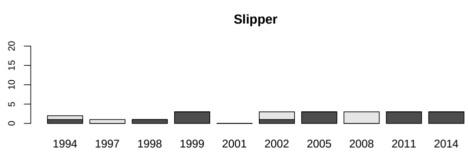
1.1 Monitored



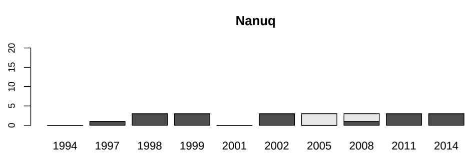


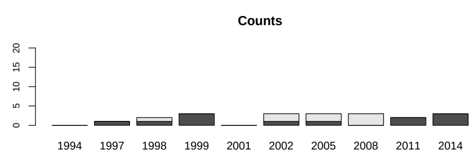


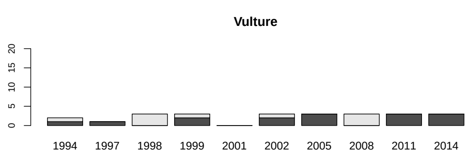




1.2 Reference

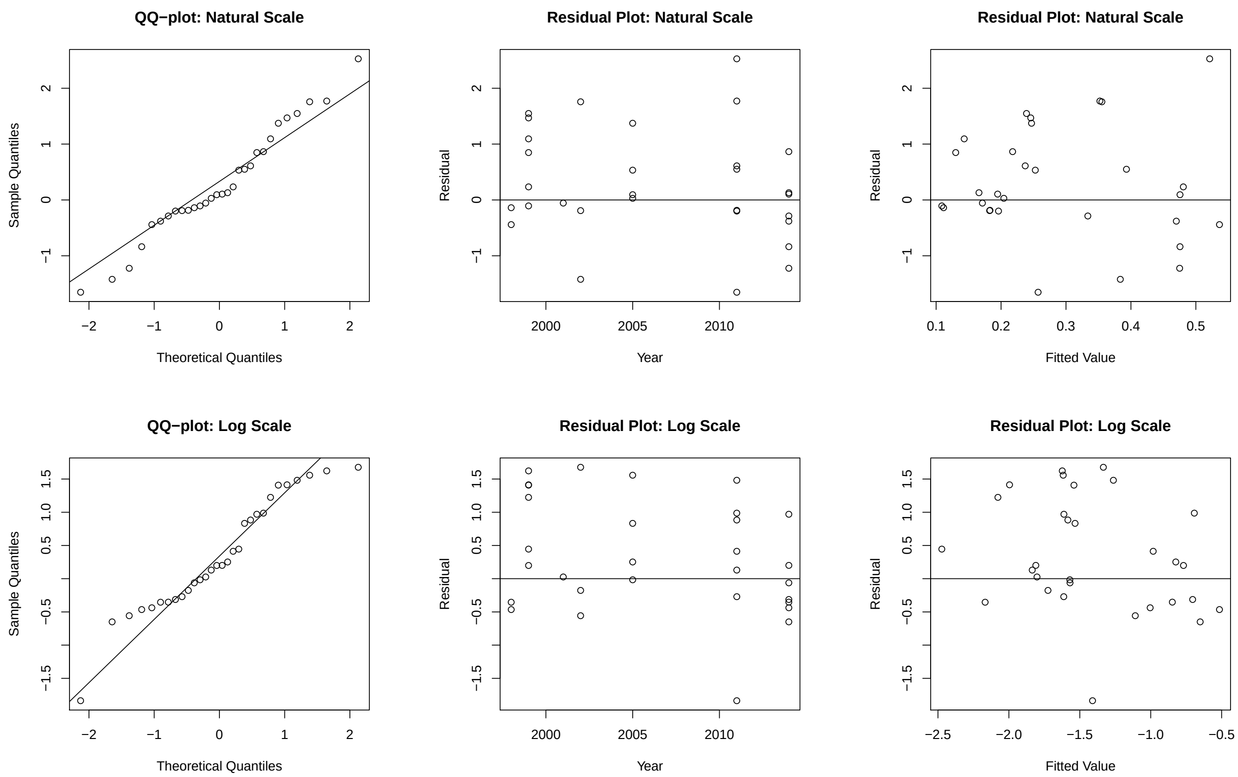






Comment:
Less than four years of data with observations greater than detection limit were available in Leslie and Moose lakes. These lakes were excluded from further analyses. 10-60% of data in Counts, Nanuq, Vulture, Kodiak, Nema, Slipper, and S2 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.26E-13	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
34.49	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
9.83	4.00	0.04

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.617	0.383	0.001	Indistinguishable support for 1 & 2; choose Model 2.

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	0.6632	2	0.7178
Nema	1.0961	2	0.5781
Slipper	15.5706	2	0.0004
S2	15.3250	2	0.0005

- Conclusions:
  Slipper and S2 show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Slipper-vs-Nanuq	24.6203	3	0.0000
Slipper-vs-Counts	6.4838	3	0.0903
Slipper-vs-Vulture	6.1220	3	0.1058
S2-vs-Nanuq	19.2987	3	0.0002
S2-vs-Counts	20.8342	3	0.0001
S2-vs-Vulture	19.8420	3	0.0002

- Conclusions:
  Site S2 shows significant deviation from the slopes of individual reference lakes.

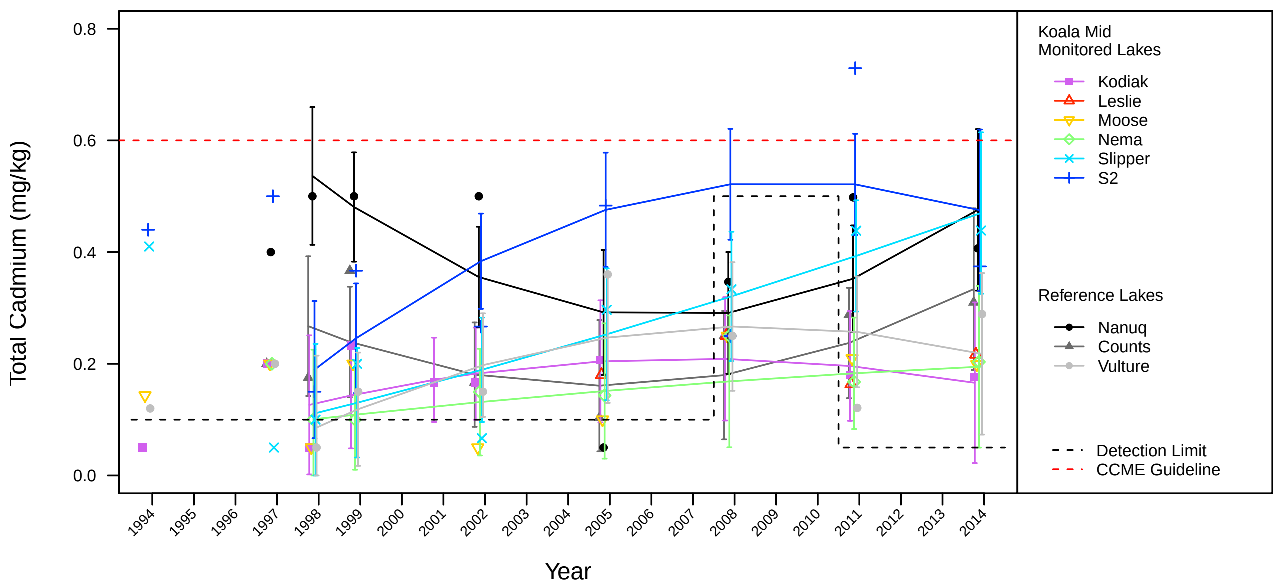
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.3830
Reference Lake	Nanuq	0.3470
Reference Lake	Vulture	0.4210
Monitored Lake	Kodiak	0.2720
Monitored Lake	Nema	0.5390
Monitored Lake	S2	0.4220
Monitored Lake	Slipper	0.8130

- Conclusions:
  Model fit for Counts, Nanuq, Vulture, Kodiak, and S2 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean cadmium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	1.77E-01	1.66E-01	7.34E-02	2.21E-02	3.10E-01	2.15E-01
Nema	2.03E-01	1.95E-01	7.39E-02	4.99E-02	3.40E-01	2.16E-01
Slipper	4.39E-01	4.70E-01	7.38E-02	3.25E-01	6.14E-01	2.16E-01
S2	3.74E-01	4.75E-01	7.37E-02	3.31E-01	6.19E-01	2.16E-01
Nanuq	4.07E-01	4.76E-01	7.37E-02	3.31E-01	6.20E-01	
Counts	3.10E-01	3.34E-01	7.38E-02	1.89E-01	4.78E-01	
Vulture	2.89E-01	2.18E-01	7.38E-02	7.32E-02	3.62E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Cadmium	Summer	Koala	Lake	Sediment	Leslie Moose	none	Tobit regression	#1b separate intercepts & slopes	0.6/ 3.5	S2

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

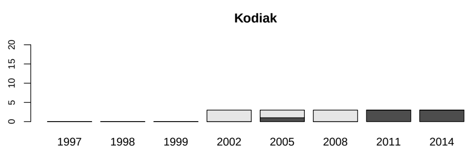
Analysis of Molybdenum in Sediments in Lakes of the Koala Watershed and Lac de Gras

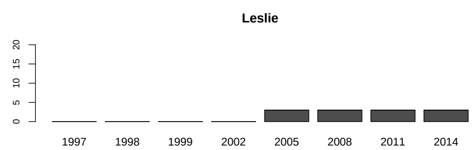
January 2, 2015

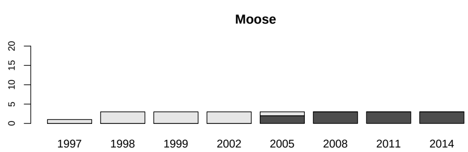
1 Censored Values:

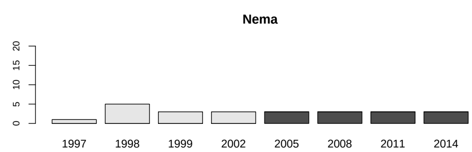
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

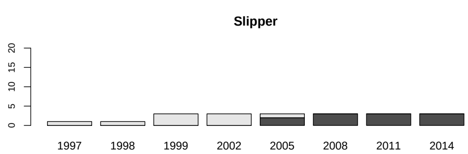
1.1 Monitored

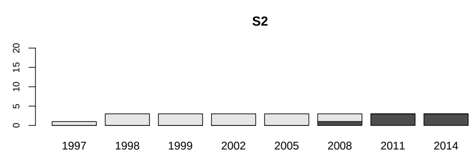




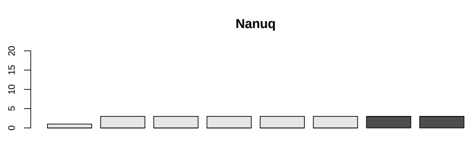


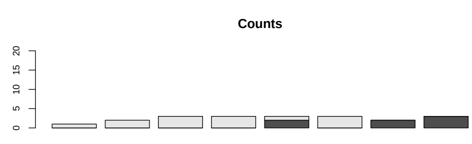


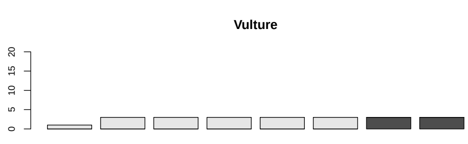




1.2 Reference

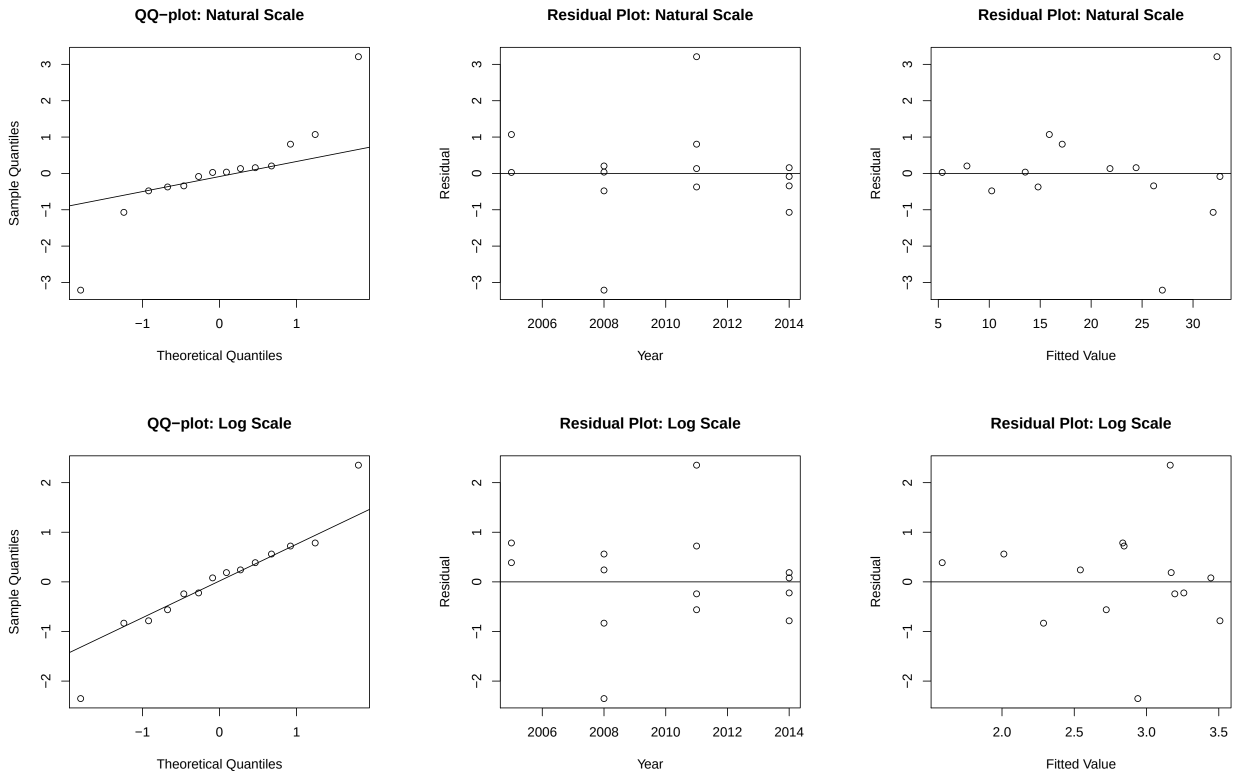






Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and S2 was less than the detection limit. These lakes were excluded from further analyses. Less than four years of data with observations greater than the detection limit were available in Kodiak Lake. This lakes was also excluded from further analyses. 10-60% of data in Moose, Nema, and Slipper lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
57	Leslie	2008	8.87	26.99	-3.21
60	Leslie	2011	50.47	32.35	3.21

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
3.87E-26	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Leslie	2.5622	2	0.2777
Moose	7.5691	2	0.0227
Nema	18.3539	2	0.0001
Slipper	12.6042	2	0.0018

- Conclusions:
  Moose, Nema, and Slipper lakes show significant deviation from a slope of zero.

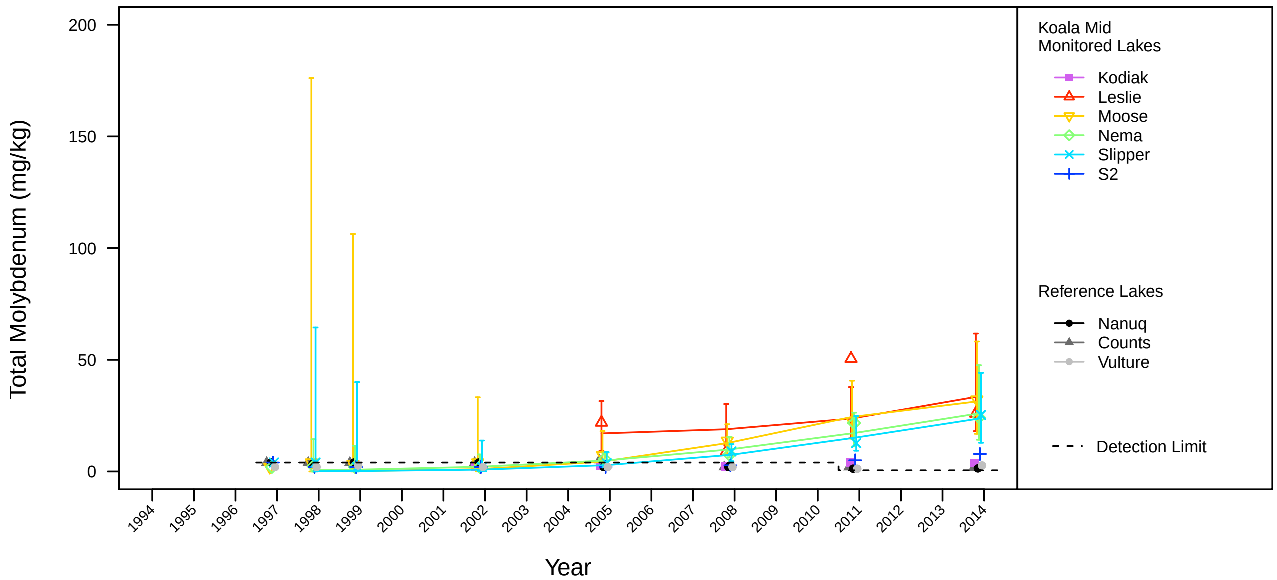
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Leslie	0.1720
Monitored Lake	Moose	0.6320
Monitored Lake	Nema	0.8160
Monitored Lake	Slipper	0.6370

- Conclusions:
  Model fit for Leslie Lake is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean molybdenum for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Leslie	2.59E+01	3.34E+01	1.05E+01	1.80E+01	6.18E+01	3.07E+01
Moose	3.22E+01	3.13E+01	9.89E+00	1.69E+01	5.82E+01	2.90E+01
Nema	2.42E+01	2.60E+01	8.01E+00	1.42E+01	4.76E+01	2.35E+01
Slipper	2.53E+01	2.38E+01	7.50E+00	1.29E+01	4.41E+01	2.19E+01
Nanuq	1.38E+00					
Counts	1.62E+00					
Vulture	2.71E+00					

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Molybdenum	Summer	Koala	Lake	Sediment	Counts Nanuq Vulture Kodiak S2	log e	Tobit regression	#1a slope of zero	NA	Moose Nema Slipper

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

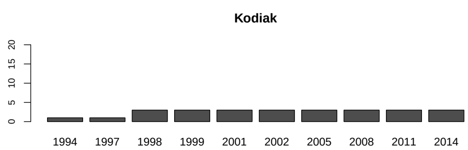
Analysis of Nickel in Sediments in Lakes of the Koala Watershed and Lac de Gras

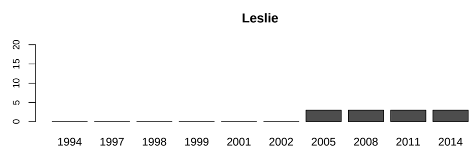
December 30, 2014

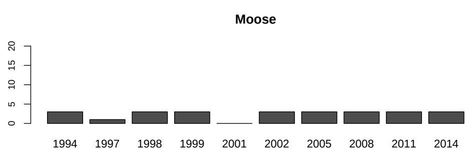
1 Censored Values:

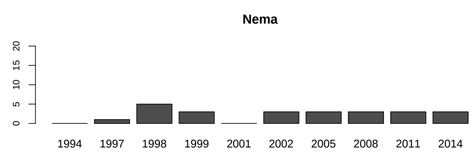
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

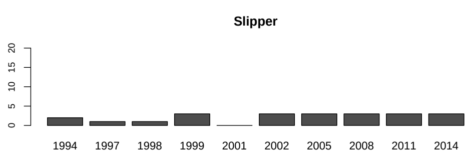
1.1 Monitored

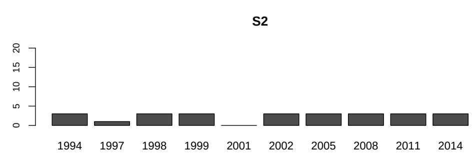




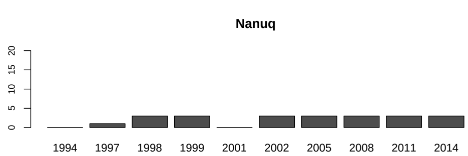


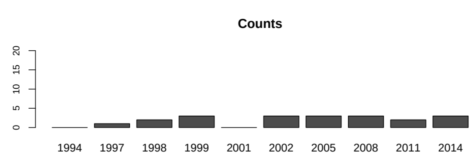


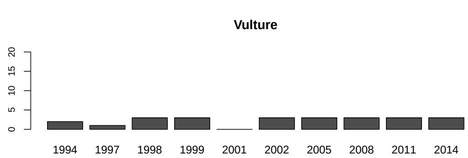




1.2 Reference

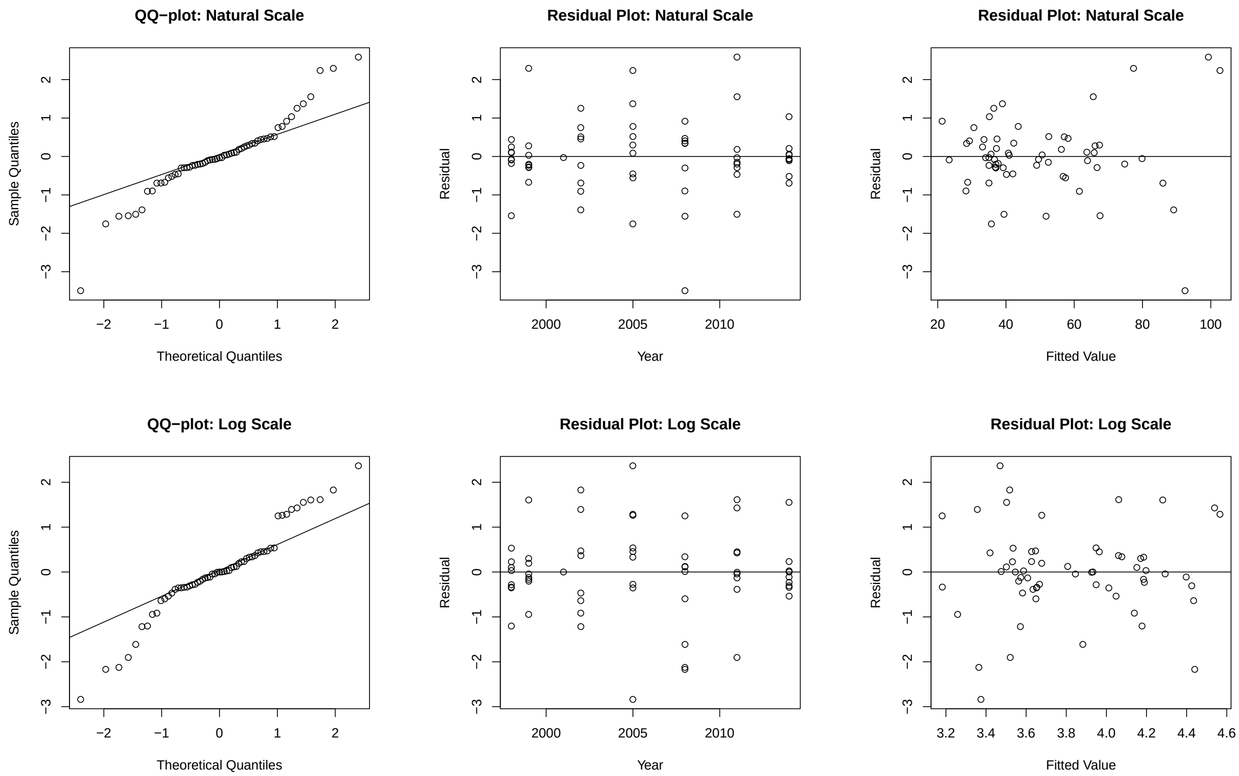






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
141	S2	2008	51.90	92.45	-3.49

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.58E-105	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
783.22	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
8.07	4.00	0.09

- Conclusions:
  The slopes do not differ significantly among reference lakes.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model

Outliers:

None

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Kodiak	2.3122	2	0.3147
Leslie	0.0173	2	0.9914
Moose	0.3089	2	0.8569
Nema	0.1397	2	0.9325
Slipper	0.4762	2	0.7881
S2	1.4715	2	0.4791

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

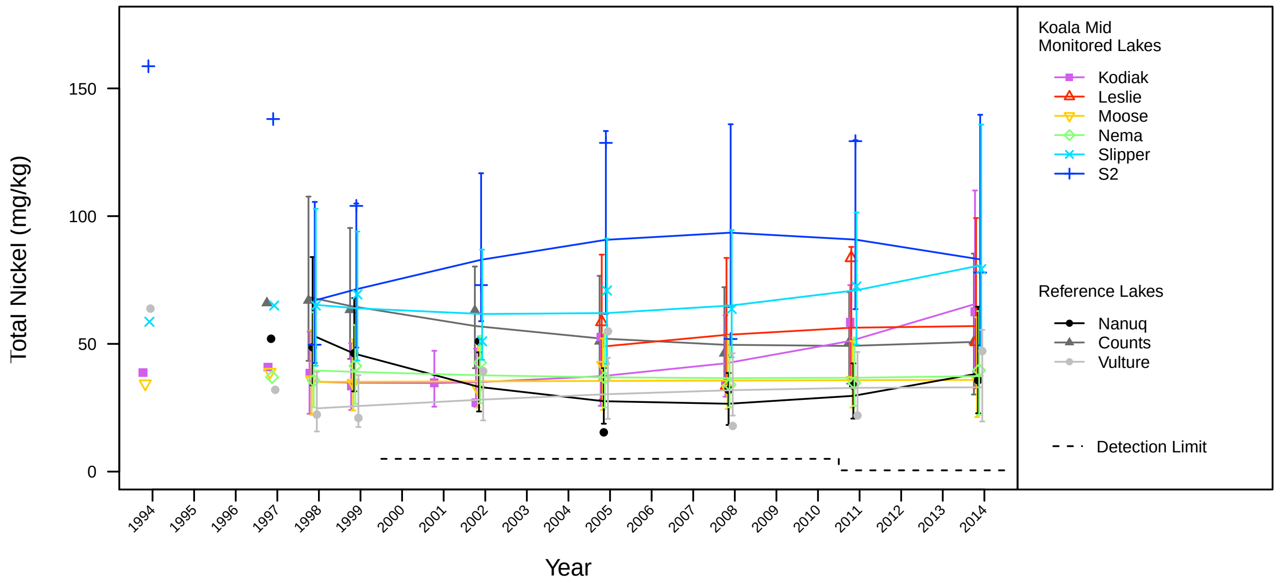
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0440
Monitored Lake	Kodiak	0.5870
Monitored Lake	Leslie	0.0280
Monitored Lake	Moose	0.0100
Monitored Lake	Nema	0.1210
Monitored Lake	S2	0.1040
Monitored Lake	Slipper	0.4700

- Conclusions:
  Model fit for Slipper Lake is weak. Model fit for pooled reference lakes, Leslie, Moose, Nema, and S2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nickel for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	6.26E+01	6.56E+01	1.73E+01	3.91E+01	1.10E+02	5.07E+01
Leslie	5.07E+01	5.70E+01	1.61E+01	3.27E+01	9.93E+01	4.72E+01
Moose	3.63E+01	3.59E+01	9.52E+00	2.14E+01	6.04E+01	2.79E+01
Nema	3.96E+01	3.74E+01	9.91E+00	2.22E+01	6.28E+01	2.90E+01
Slipper	7.92E+01	8.08E+01	2.14E+01	4.80E+01	1.36E+02	6.27E+01
S2	7.79E+01	8.31E+01	2.20E+01	4.94E+01	1.40E+02	6.44E+01
Nanuq	3.57E+01	3.84E+01	1.02E+01	2.28E+01	6.45E+01	
Counts	5.11E+01	5.08E+01	1.35E+01	3.02E+01	8.53E+01	
Vulture	4.72E+01	3.30E+01	8.75E+00	1.96E+01	5.55E+01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Nickel	Summer	Koala	Lake	Sediment	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

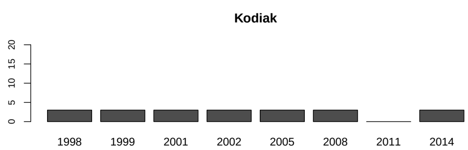
Analysis of Phosphorus in Sediments in Lakes of the Koala Watershed and Lac de Gras

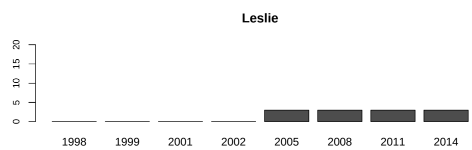
December 31, 2014

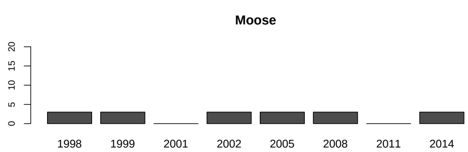
1 Censored Values:

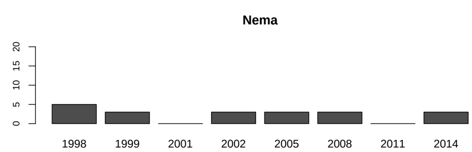
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

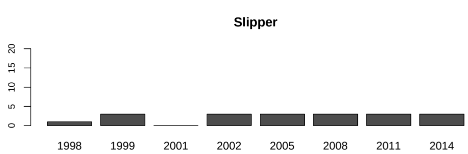
1.1 Monitored



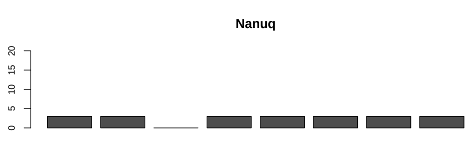


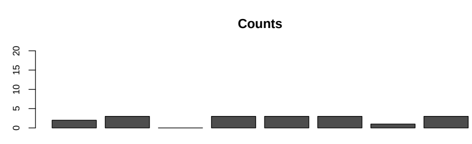






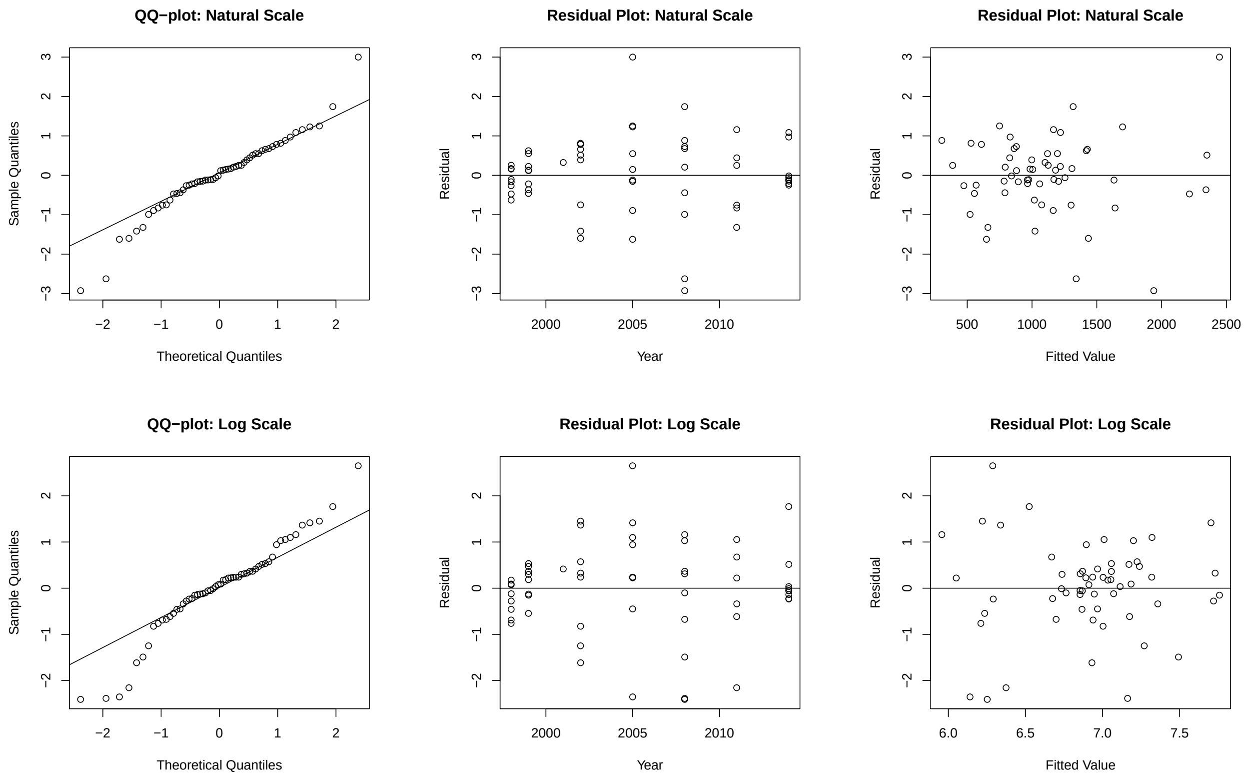
1.2 Reference





Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.46E-174	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
262.74	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
8.53	4.00	0.07

- Conclusions:
  The slopes do not differ significantly among reference lakes.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. AIC suggests that reference lakes are best modeled using separate slopes and intercepts. Contrasts suggest that reference lakes share a common slope; however, these results are marginally significant, suggesting that there may be important differences in reference lake slopes. Proceeding with monitored contrasts using reference model 1b (fitting separate slopes and intercepts for reference lakes).

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	0.7596	2	0.6840
Leslie	0.2054	2	0.9024
Moose	0.4401	2	0.8025
Nema	0.0970	2	0.9527
Slipper	0.4555	2	0.7963
S2	3.6233	2	0.1634

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

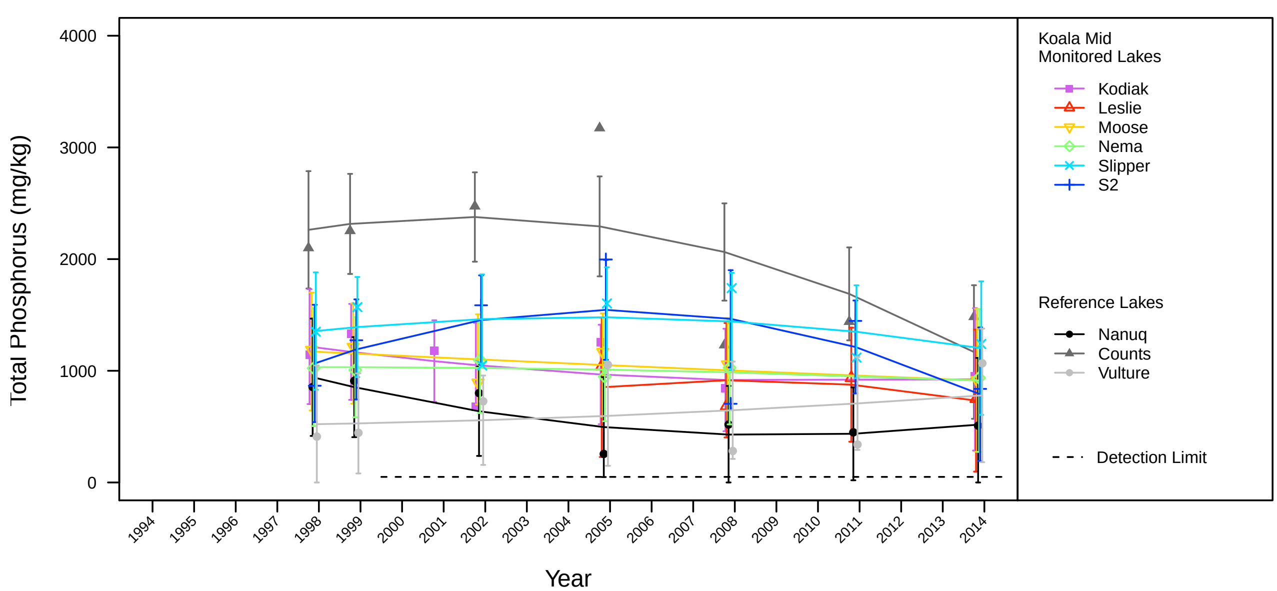
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4150
Reference Lake	Nanuq	0.7110
Reference Lake	Vulture	0.0850
Monitored Lake	Kodiak	0.2400
Monitored Lake	Leslie	0.1670
Monitored Lake	Moose	0.4290
Monitored Lake	Nema	0.4860
Monitored Lake	S2	0.3200
Monitored Lake	Slipper	0.1280

- Conclusions:
  Model fit for Counts, Kodiak, Moose, Nema, and S2 is weak. Model fit for Vulture, Leslie, and Slipper lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean phosphorus for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	9.48e+02	9.23e+02	3.25e+02	2.86e+02	1.56e+03	9.52e+02
Leslie	7.49e+02	7.33e+02	3.24e+02	9.76e+01	1.37e+03	9.49e+02
Moose	9.15e+02	9.14e+02	3.26e+02	2.75e+02	1.55e+03	9.54e+02
Nema	9.36e+02	9.13e+02	3.26e+02	2.74e+02	1.55e+03	9.54e+02
Slipper	1.24e+03	1.20e+03	3.05e+02	6.05e+02	1.80e+03	8.93e+02
S2	8.38e+02	7.90e+02	3.05e+02	1.92e+02	1.39e+03	8.93e+02
Nanuq	5.09e+02	5.17e+02	3.05e+02	0.00e+00	1.12e+03	NA
Counts	1.48e+03	1.17e+03	3.05e+02	5.70e+02	1.77e+03	NA
Vulture	1.07e+03	7.80e+02	3.05e+02	1.82e+02	1.38e+03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Phosphorus	Summer	Koala	Lake	Sediment	none	none	linear mixed effects regression	#1b separate intercepts & slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

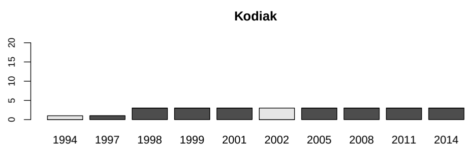
Analysis of Selenium in Sediments in Lakes of the Koala Watershed and Lac de Gras

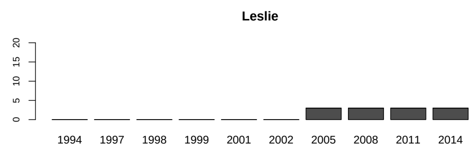
December 31, 2014

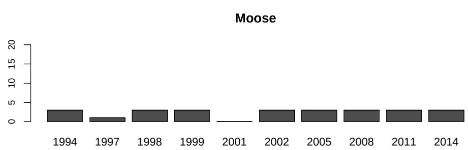
1 Censored Values:

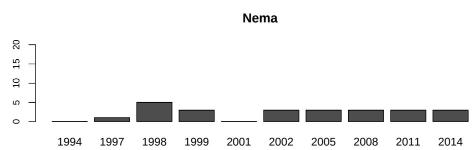
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

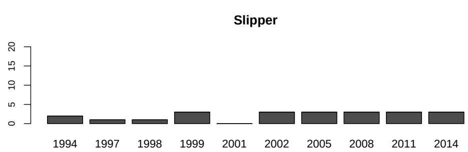
1.1 Monitored

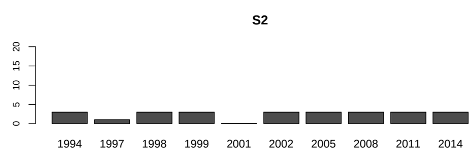




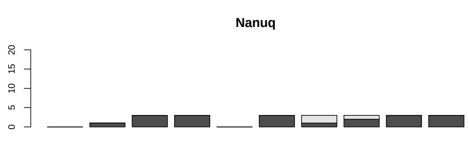


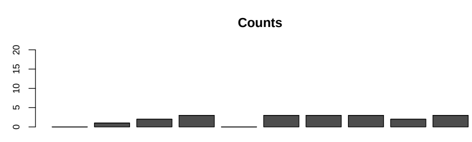


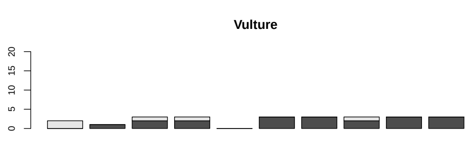




1.2 Reference

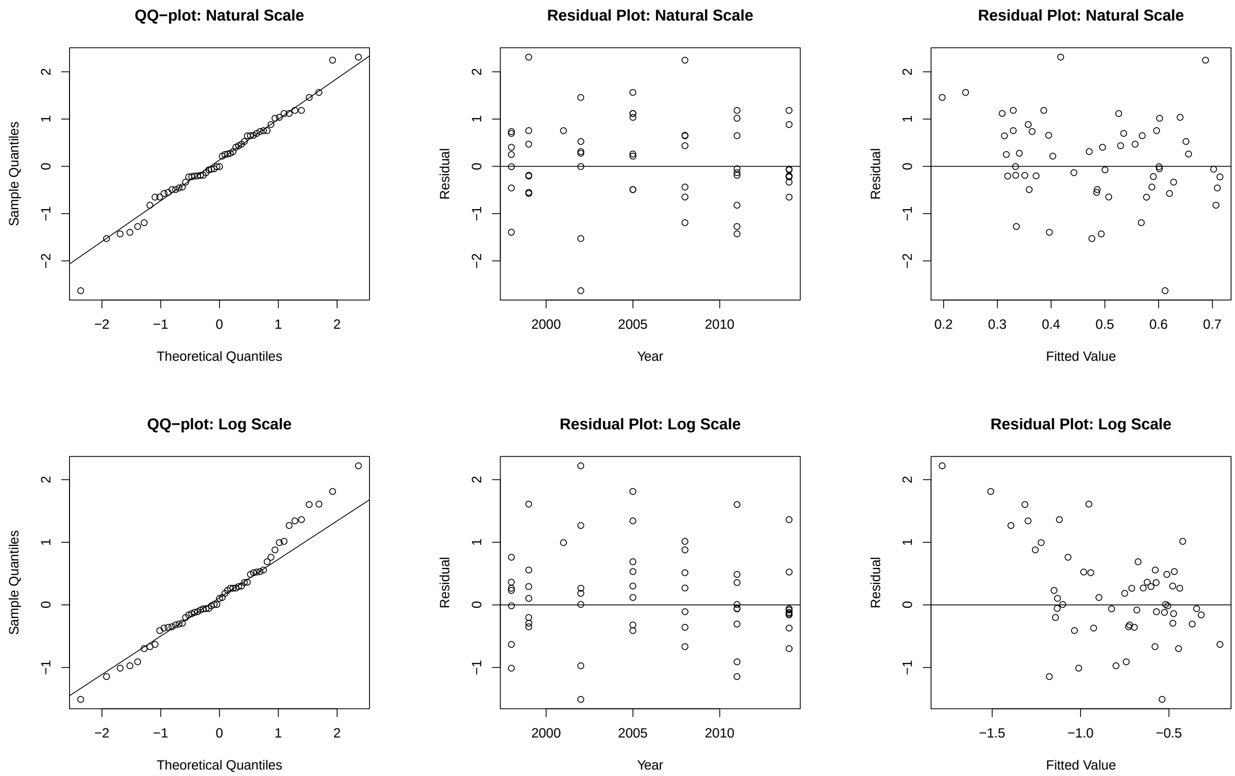






Comment:
10-60% of data in Nanuq, Vulture, and Kodiak lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	3.73E-26	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
76.05	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
36.18	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Kodiak	0.4406	2	0.8023
Leslie	2.4325	2	0.2963
Moose	4.9370	2	0.0847
Nema	3.3183	2	0.1903
Slipper	3.5868	2	0.1664
S2	5.5321	2	0.0629

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

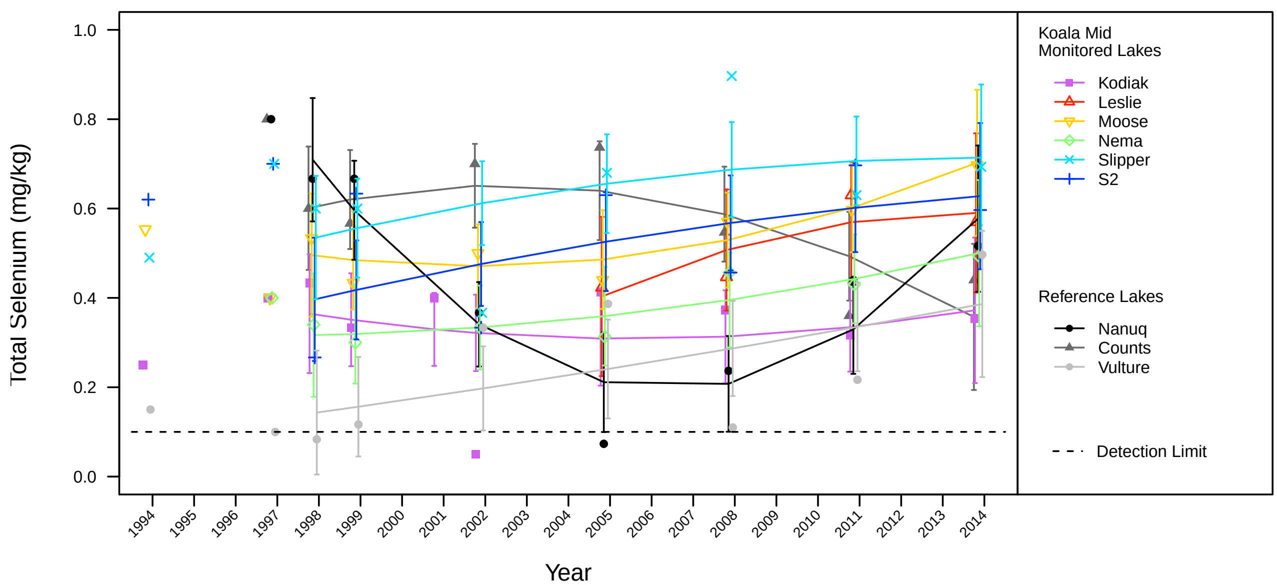
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.6180
Reference Lake	Nanuq	0.8490
Reference Lake	Vulture	0.3290
Monitored Lake	Kodiak	0.0380
Monitored Lake	Leslie	0.7220
Monitored Lake	Moose	0.8310
Monitored Lake	Nema	0.8060
Monitored Lake	S2	0.2920
Monitored Lake	Slipper	0.2100

- Conclusions:
  Model fit for Vulture, Slipper, and S2 is weak. Model fit for Kodiak is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean selenium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	3.53E-01	3.72E-01	8.31E-02	2.09E-01	5.35E-01	2.43E-01
Leslie	5.70E-01	5.90E-01	9.09E-02	4.12E-01	7.68E-01	2.66E-01
Moose	6.97E-01	7.02E-01	8.35E-02	5.39E-01	8.66E-01	2.44E-01
Nema	4.93E-01	5.00E-01	8.35E-02	3.37E-01	6.64E-01	2.44E-01
Slipper	6.93E-01	7.14E-01	8.35E-02	5.50E-01	8.78E-01	2.44E-01
S2	5.97E-01	6.28E-01	8.35E-02	4.64E-01	7.91E-01	2.44E-01
Nanuq	5.17E-01	5.77E-01	8.35E-02	4.14E-01	7.41E-01	
Counts	4.40E-01	3.57E-01	8.35E-02	1.94E-01	5.21E-01	
Vulture	4.97E-01	3.86E-01	8.35E-02	2.23E-01	5.50E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Selenium	Summer	Koala	Lake	Sediment	none	none	Tobit regression	#1b separate intercepts & slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

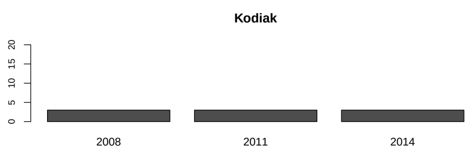
Analysis of Strontium in Sediments in Lakes of the Koala Watershed and Lac de Gras

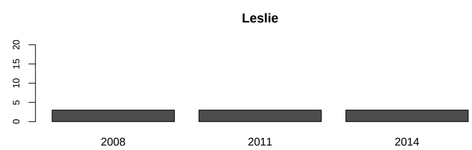
December 31, 2014

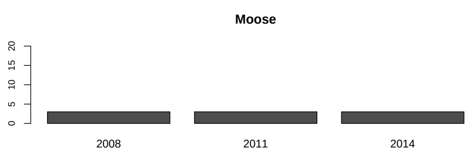
1 Censored Values:

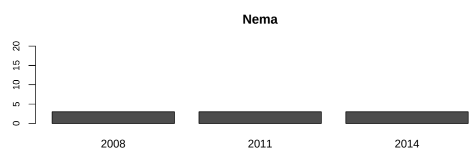
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

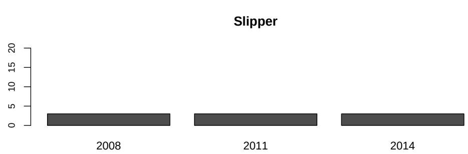
1.1 Monitored



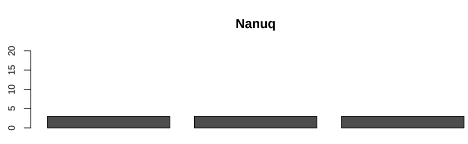


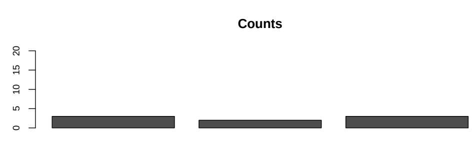






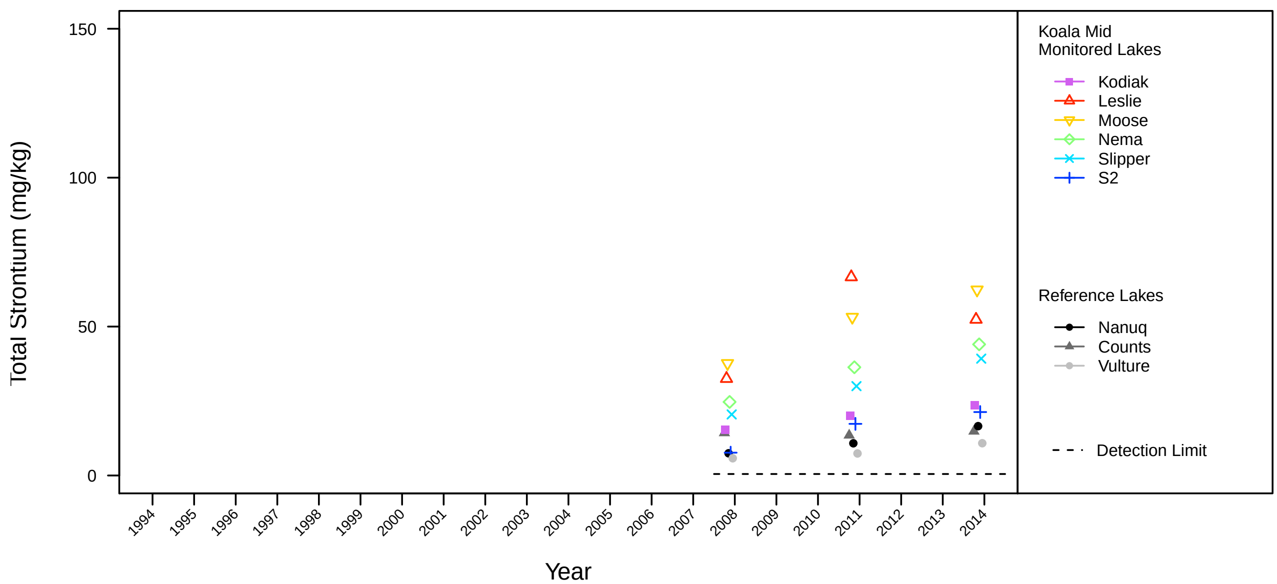
1.2 Reference





Comment:
Less than four years of data with observations greater than the detection limit were available in all monitored and reference lakes. All lakes were excluded from further analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Strontium	Summer	Koala	Lake	Sediment	ALL	NA	NA	NA	NA	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

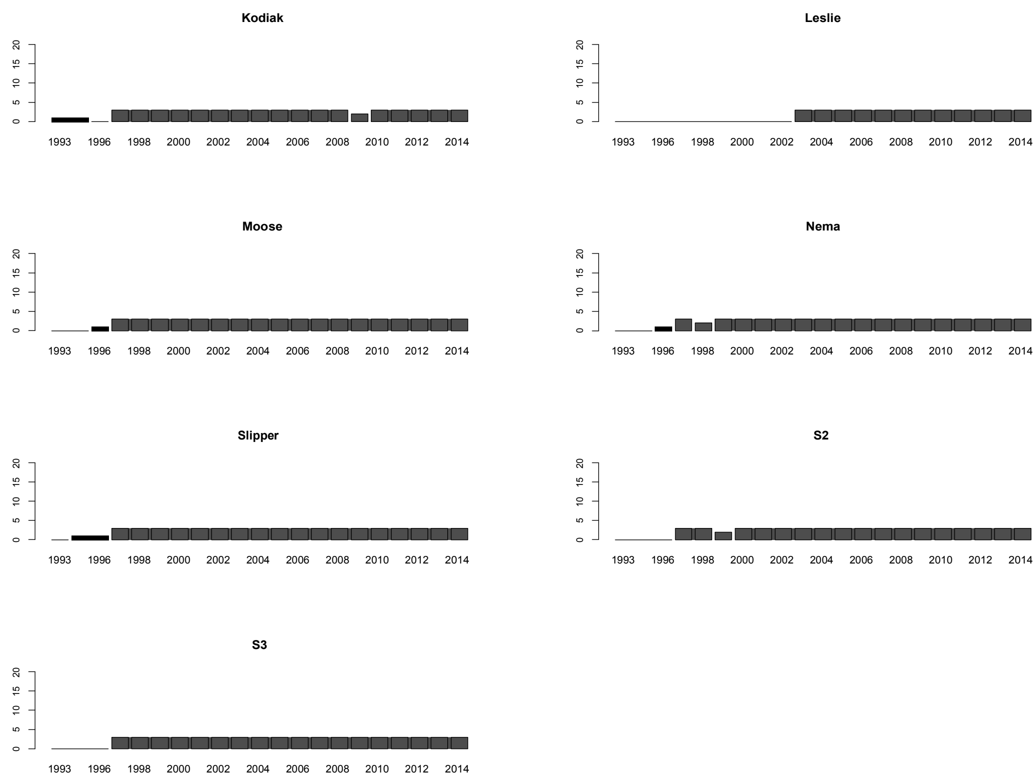
Analysis of August Chlorophyll *a* in Lakes of the Koala Watershed and Lac de Gras

February 11, 2015

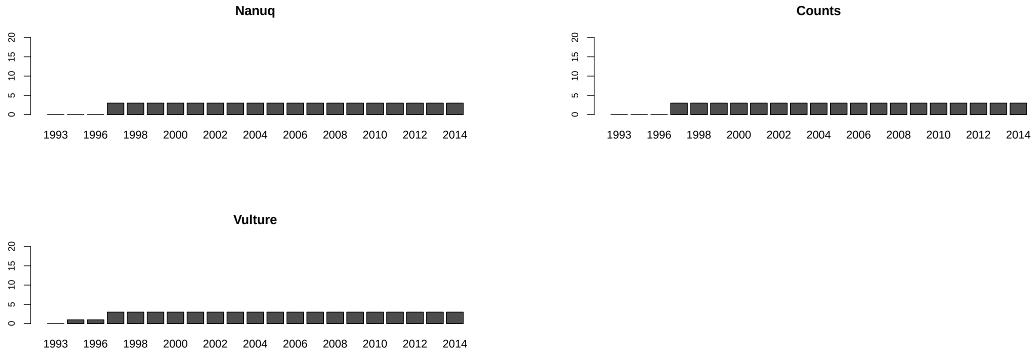
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

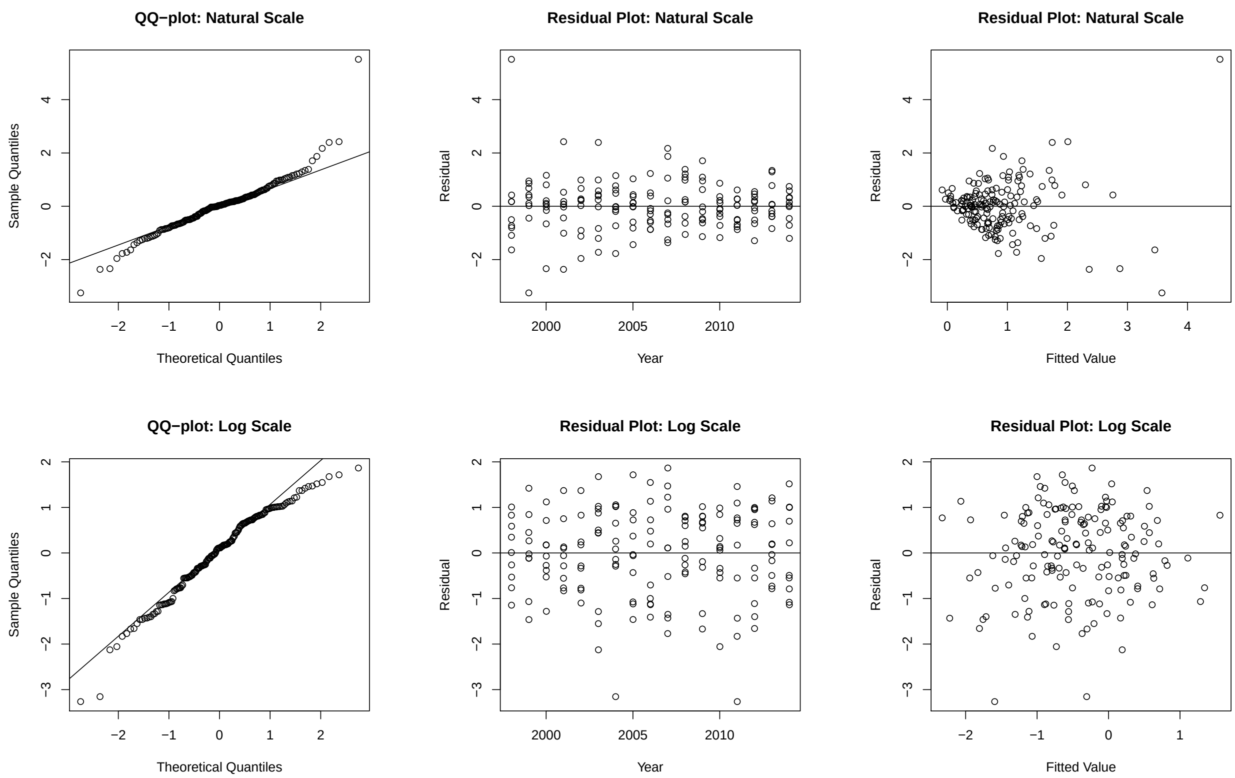


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
68	Kodiak	1998	6.48	4.54	5.51
69	Kodiak	1999	2.43	3.57	-3.25

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
116	Moose	2004	0.23	-0.31	-3.15
207	S3	2011	0.06	-1.59	-3.26

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
6.62	6.00	0.36

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

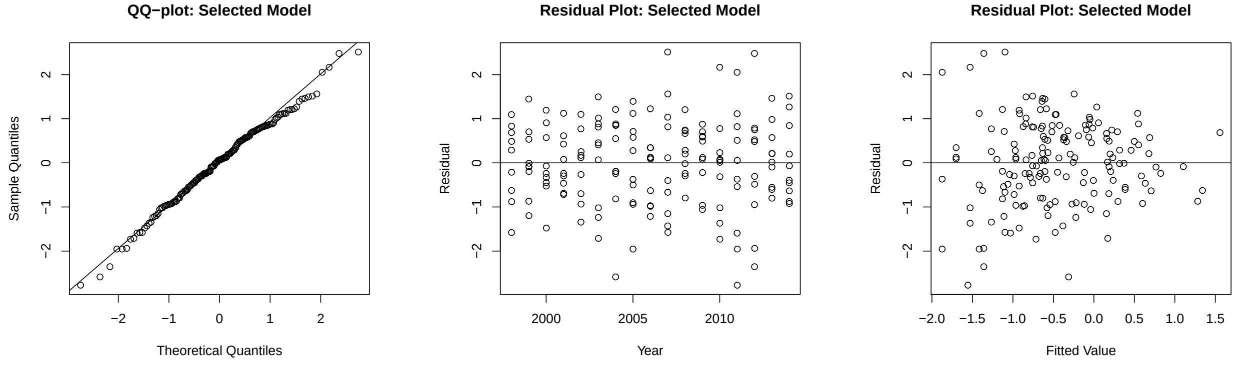
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope and intercept. Proceeding with monitored contrasts using reference model 3 (fitting a common slope and intercept for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.3 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-square	DF	P-value
Kodiak	19.0087	3	0.0003
Leslie	4.0459	3	0.2566
Moose	3.0637	3	0.3819
Nema	14.5789	3	0.0022
Slipper	4.8394	3	0.1839
S2	2.8006	3	0.4234
S3	0.2358	3	0.9716

- Conclusions:
  Kodiak and Nema lakes show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-square	DF	P-value
Kodiak	4.3961	2	0.1110
Leslie	3.0669	2	0.2158
Moose	0.1981	2	0.9057
Nema	0.7735	2	0.6793
Slipper	0.4204	2	0.8104
S2	2.4689	2	0.2910
S3	0.2358	2	0.8888

- Conclusions:
  When allowing for differences in intercept, no significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

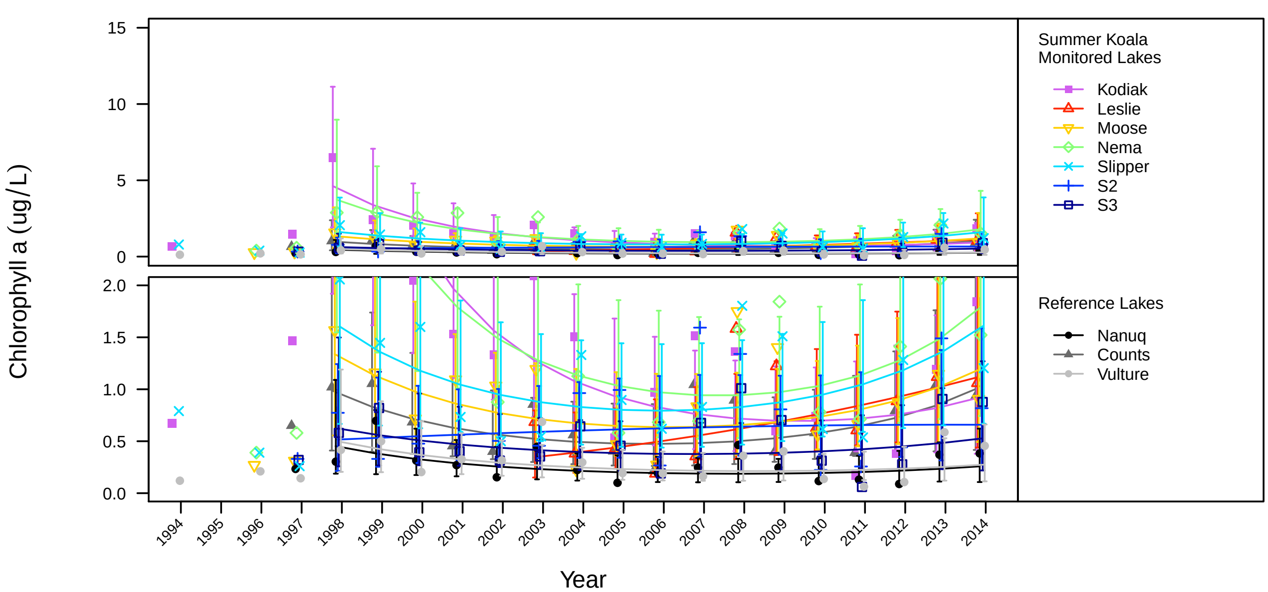
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1110
Monitored Lake	Kodiak	0.5310
Monitored Lake	Leslie	0.3520
Monitored Lake	Moose	0.1760
Monitored Lake	Nema	0.4920
Monitored Lake	S2	0.0170
Monitored Lake	S3	0.0470
Monitored Lake	Slipper	0.2370

- Conclusions:
  Model fit for Leslie, Nema, and Slipper lakes is weak. Model fit for pooled reference lakes, Moose, S2, and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean phytoplankton biomass for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	1.84E+00	9.14E-01	4.10E-01	3.79E-01	2.20E+00	1.20E+00
Leslie	1.06E+00	1.12E+00	5.31E-01	4.39E-01	2.84E+00	1.55E+00
Moose	9.06E-01	1.19E+00	5.32E-01	4.93E-01	2.86E+00	1.56E+00
Nema	1.52E+00	1.79E+00	8.02E-01	7.43E-01	4.31E+00	2.35E+00
Slipper	1.20E+00	1.61E+00	7.22E-01	6.69E-01	3.88E+00	2.11E+00
S2	8.18E-01	6.59E-01	2.95E-01	2.73E-01	1.59E+00	8.64E-01
S3	8.78E-01	5.27E-01	2.36E-01	2.19E-01	1.27E+00	6.92E-01
Nanuq	3.83E-01	2.58E-01	1.16E-01	1.07E-01	6.21E-01	
Counts	9.33E-01	1.00E+00	4.49E-01	4.16E-01	2.41E+00	
Vulture	4.56E-01	2.75E-01	1.23E-01	1.14E-01	6.61E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Biomass	Summer	Koala	Lake	Biology	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	Kodiak Nema

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

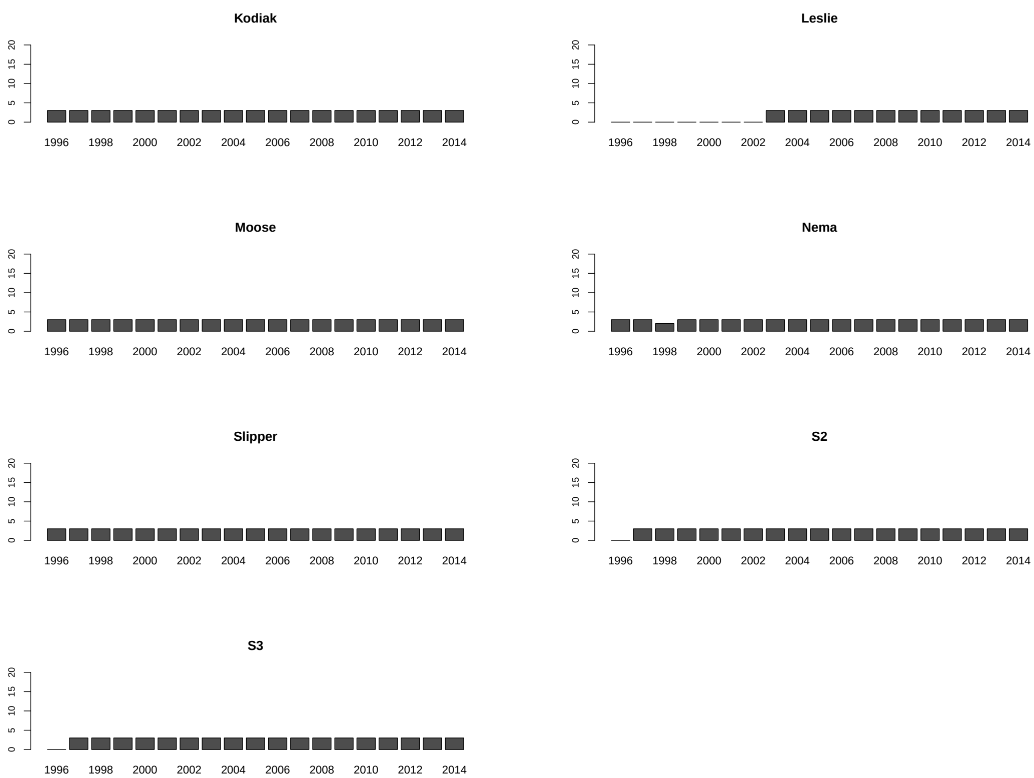
Analysis of August Phytoplankton Density in Lakes of the Koala Watershed and Lac de Gras

February 11, 2015

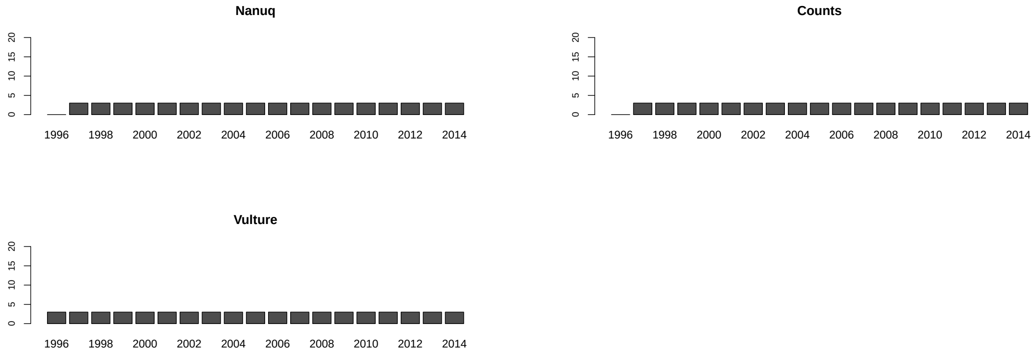
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

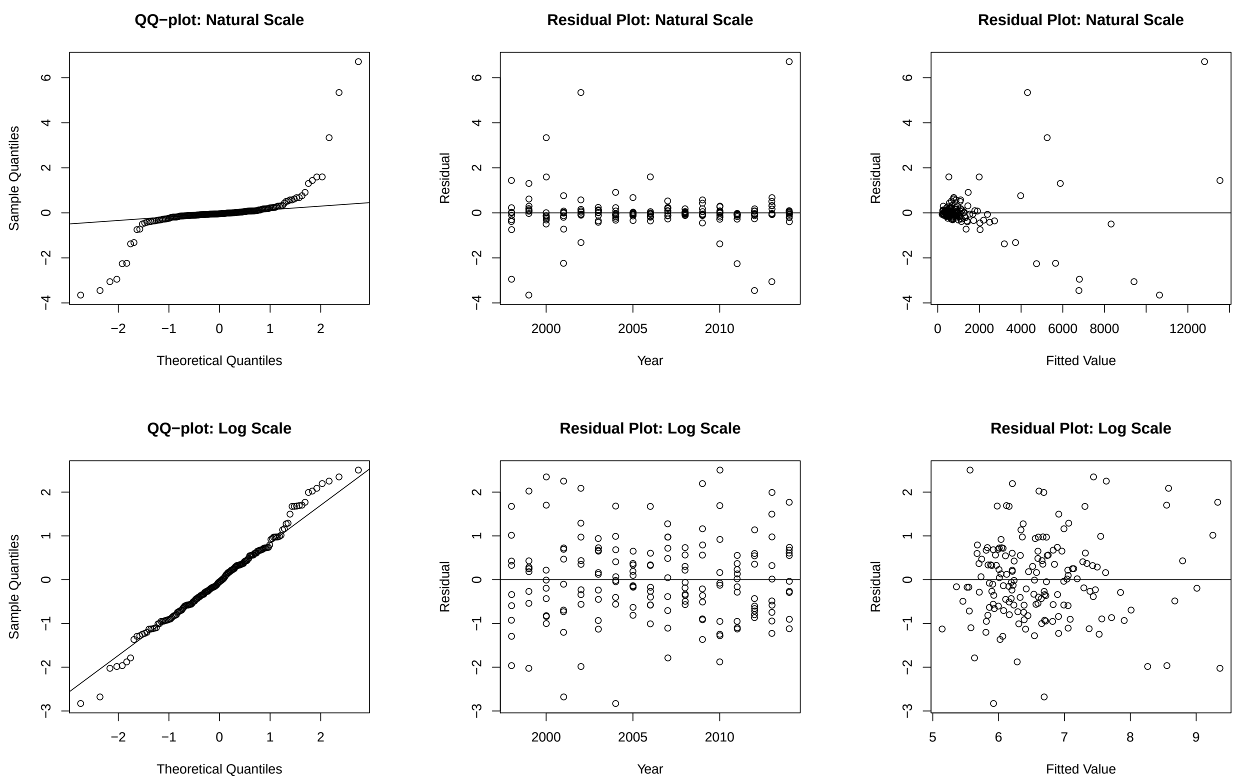


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
69	Kodiak	1999	5142.27	10639.42	-3.65
72	Kodiak	2002	12353.07	4306.64	5.34
82	Kodiak	2012	1581.07	6773.80	-3.45
83	Kodiak	2013	4815.45	9416.18	-3.06
84	Kodiak	2014	22912.45	12801.69	6.71
154	Nema	2000	10276.53	5250.87	3.34

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
5.29	6.00	0.51

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

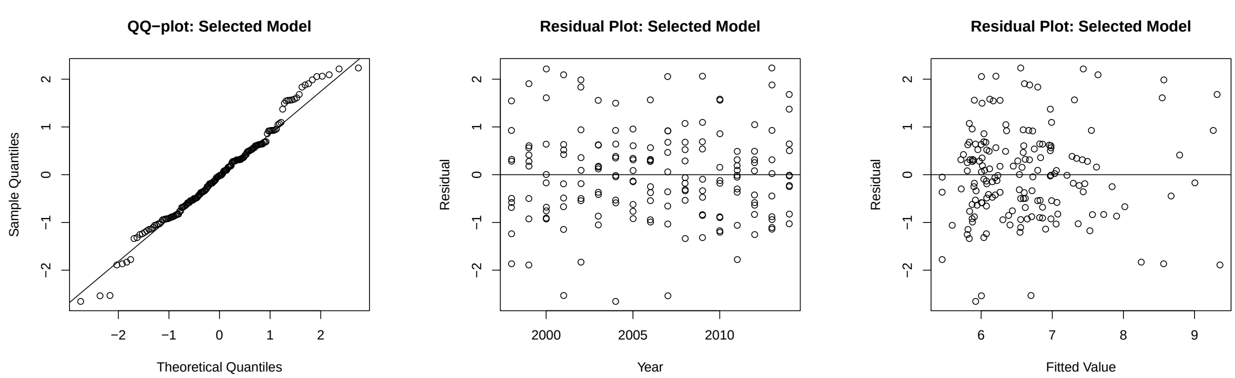
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.971	0.000	0.029	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope and intercept. Proceeding with monitored contrasts using reference model 3 (fitting a common slope and intercept for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.3 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-square	DF	P-value
Kodiak	41.7763	3	0.0000
Leslie	7.2053	3	0.0656
Moose	2.6045	3	0.4567
Nema	18.9145	3	0.0003
Slipper	0.8050	3	0.8483
S2	4.0831	3	0.2526
S3	3.6553	3	0.3012

- Conclusions:
  Kodiak and Nema lakes show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-square	DF	P-value
Kodiak	4.2222	2	0.1211
Leslie	7.0334	2	0.0297
Moose	2.1134	2	0.3476
Nema	3.7420	2	0.1540
Slipper	0.3268	2	0.8492
S2	2.1697	2	0.3379
S3	1.9582	2	0.3756

- Conclusions:
  When allowing for differences in intercept, Leslie Lake shows significant deviation from the common slope of reference lakes.

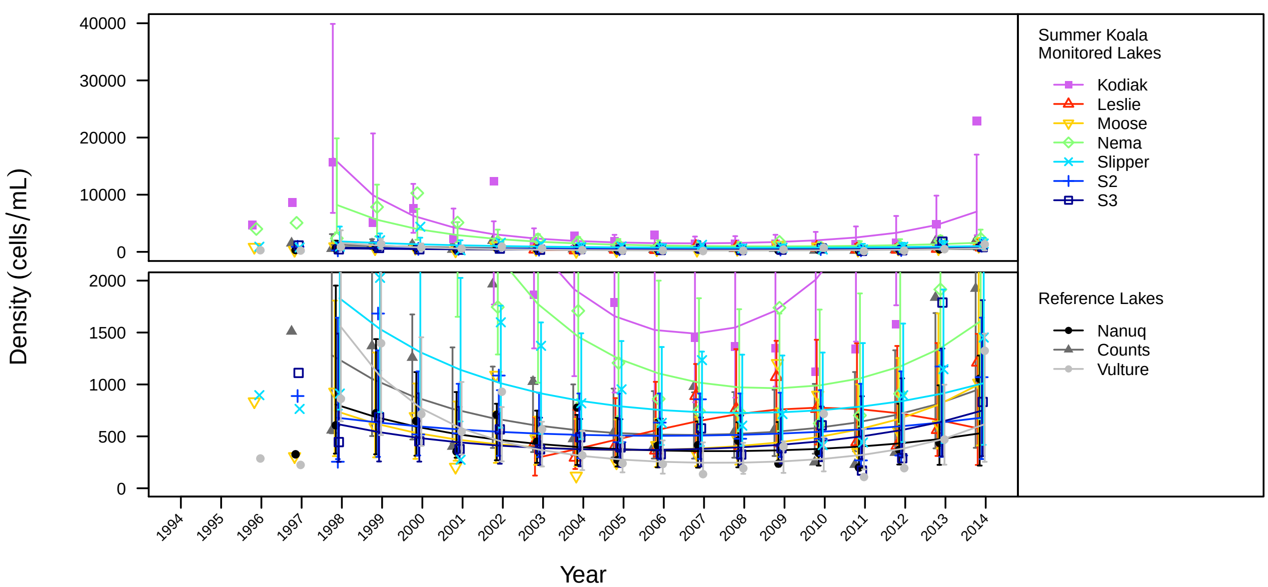
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.2600
Monitored Lake	Kodiak	0.5760
Monitored Lake	Leslie	0.3670
Monitored Lake	Moose	0.2300
Monitored Lake	Nema	0.6170
Monitored Lake	S2	0.0360
Monitored Lake	S3	0.1840
Monitored Lake	Slipper	0.1770

- Conclusions:
  Model fit for pooled reference lakes, Leslie and Moose lakes is weak. Model fit for Slipper Lake, S2, and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean phytoplankton density for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	2.29E+04	7.04E+03	3.17E+03	2.91E+03	1.70E+04	9.28E+03
Leslie	1.21E+03	5.78E+02	2.79E+02	2.25E+02	1.49E+03	8.15E+02
Moose	1.02E+03	9.98E+02	4.50E+02	4.13E+02	2.41E+03	1.32E+03
Nema	2.28E+03	1.61E+03	7.25E+02	6.65E+02	3.89E+03	2.12E+03
Slipper	1.45E+03	1.01E+03	4.56E+02	4.18E+02	2.45E+03	1.33E+03
S2	1.07E+03	6.79E+02	3.06E+02	2.81E+02	1.64E+03	8.96E+02
S3	8.32E+02	7.49E+02	3.38E+02	3.10E+02	1.81E+03	9.88E+02
Nanuq	1.05E+03	5.28E+02	2.38E+02	2.19E+02	1.28E+03	
Counts	1.92E+03	9.42E+02	4.25E+02	3.90E+02	2.28E+03	
Vulture	1.32E+03	6.16E+02	2.77E+02	2.55E+02	1.49E+03	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Density	Summer	Koala	Lake	Biology	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	Kodiak Nema

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

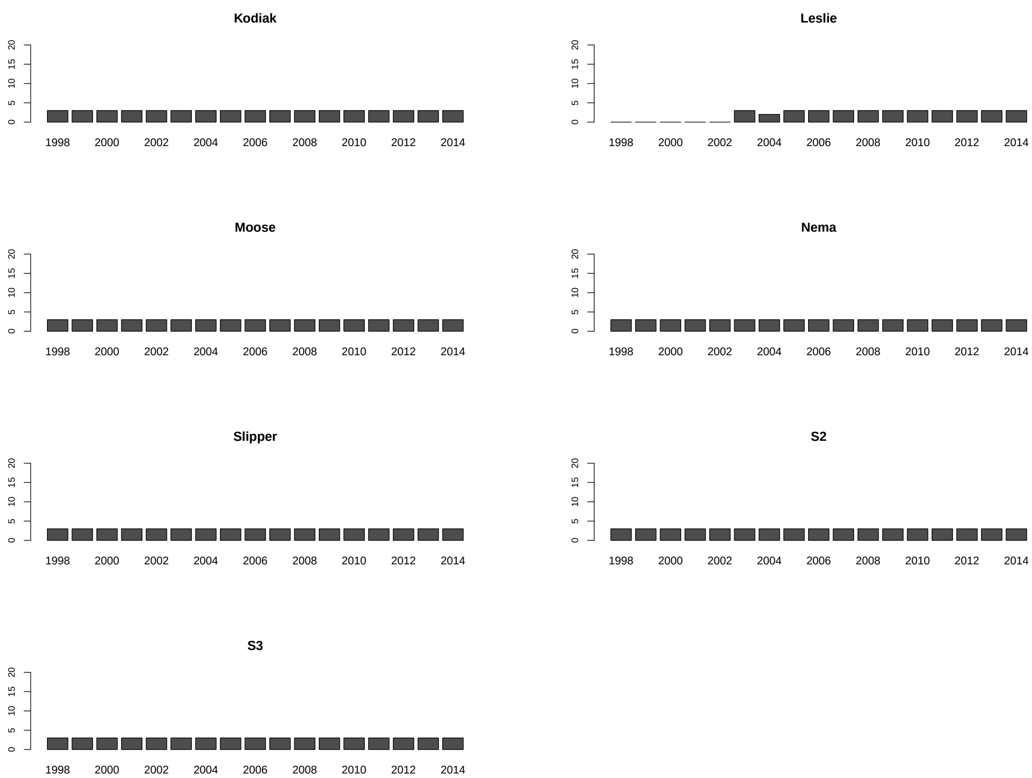
Analysis of August Zooplankton Biomass in Lakes of the Koala Watershed and Lac de Gras

February 11, 2015

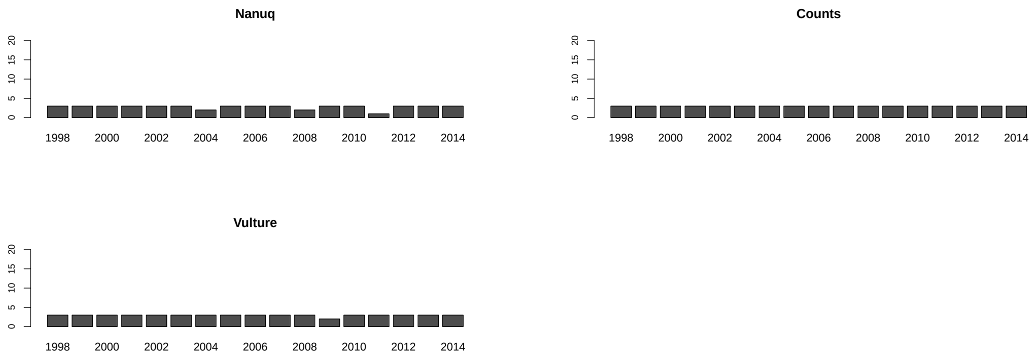
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

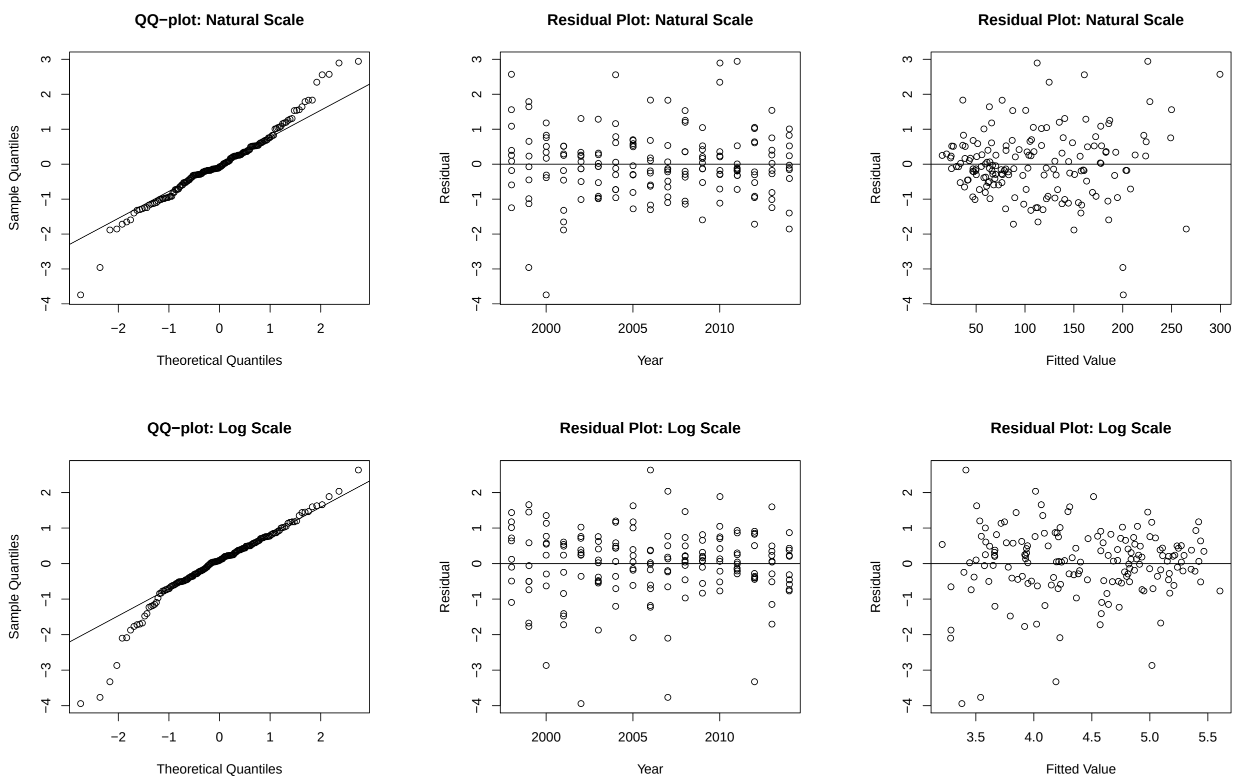


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
70	Kodiak	2000	34.65	200.55	-3.74

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
124	Moose	2012	11.96	4.19	-3.33
177	S2	2002	3.88	3.38	-3.94
203	S3	2007	4.99	3.54	-3.77

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
18.23	6.00	0.01

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
6.37	4.00	0.17

- Conclusions:
  The slopes do not differ significantly among reference lakes.

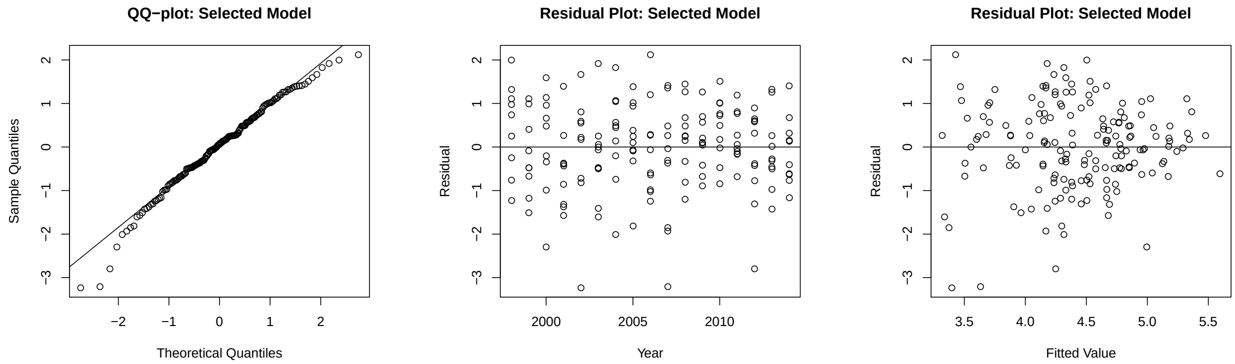
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitrored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
177	S2	2002	3.88	3.40	-3.23
203	S3	2007	4.99	3.63	-3.21

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope while ignoring intercepts (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-square	DF	P-value
Kodiak	0.5606	2	0.7555
Leslie	0.1527	2	0.9265
Moose	0.0894	2	0.9563
Nema	0.5020	2	0.7780
Slipper	0.4827	2	0.7856
S2	0.2307	2	0.8911
S3	0.3768	2	0.8283

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

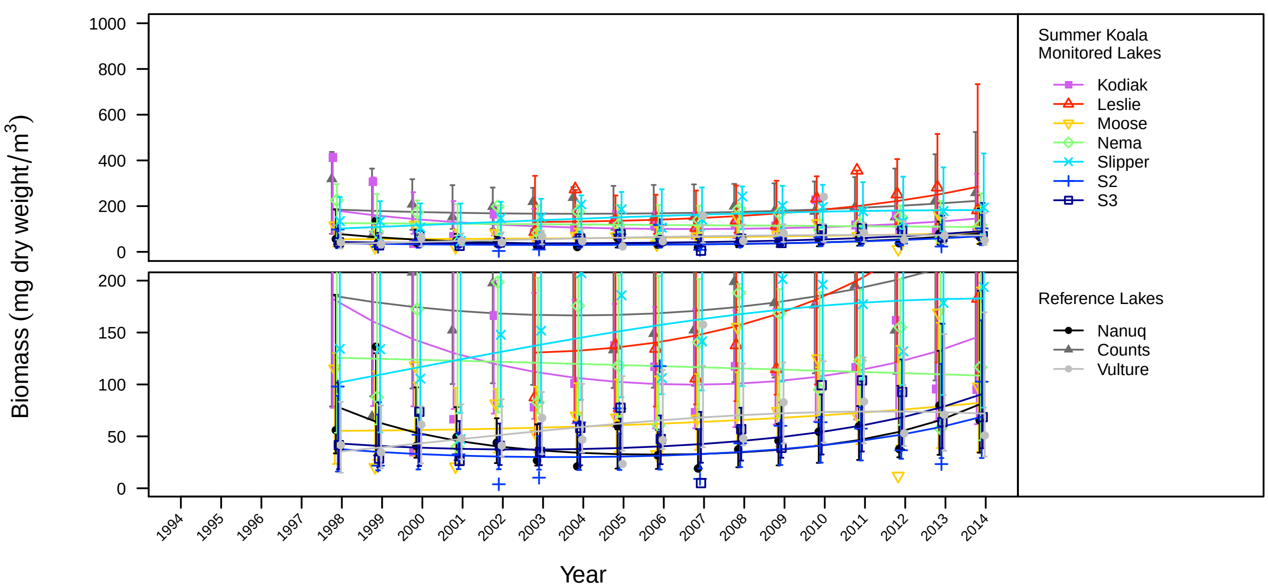
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0310
Monitored Lake	Kodiak	0.0950
Monitored Lake	Leslie	0.3150
Monitored Lake	Moose	0.0290
Monitored Lake	Nema	0.0090
Monitored Lake	S2	0.0710
Monitored Lake	S3	0.1520
Monitored Lake	Slipper	0.2560

- Conclusions:
  Model fit for Leslie and Slipper lakes is weak. Model fit for pooled reference lakes, Kodiak, Moose, Nema, S2, and S3 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean zooplankton biomass for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	9.52E+01	1.45E+02	6.35E+01	6.17E+01	3.42E+02	1.86E+02
Leslie	1.83E+02	2.85E+02	1.37E+02	1.10E+02	7.34E+02	4.02E+02
Moose	9.79E+01	8.21E+01	3.59E+01	3.49E+01	1.93E+02	1.05E+02
Nema	1.17E+02	1.09E+02	4.74E+01	4.61E+01	2.56E+02	1.39E+02
Slipper	1.94E+02	1.83E+02	7.99E+01	7.76E+01	4.31E+02	2.34E+02
S2	1.03E+02	6.87E+01	3.00E+01	2.92E+01	1.62E+02	8.79E+01
S3	6.85E+01	9.08E+01	3.97E+01	3.85E+01	2.14E+02	1.16E+02
Nanuq	6.55E+01	8.07E+01	3.53E+01	3.43E+01	1.90E+02	
Counts	2.58E+02	2.23E+02	9.73E+01	9.45E+01	5.24E+02	
Vulture	5.09E+01	7.20E+01	3.15E+01	3.06E+01	1.70E+02	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Biomass	Summer	Koala	Lake	Biology	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

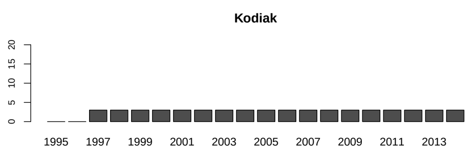
Analysis of August Zooplankton Density in Lakes of the Koala Watershed and Lac de Gras

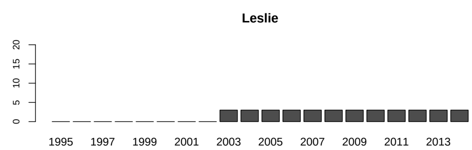
February 11, 2015

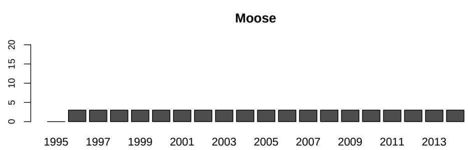
1 Censored Values:

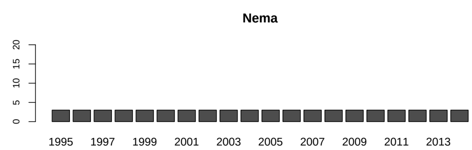
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

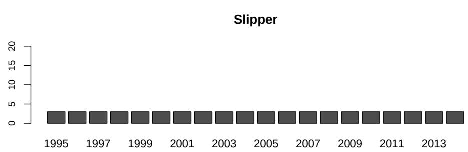
1.1 Monitored

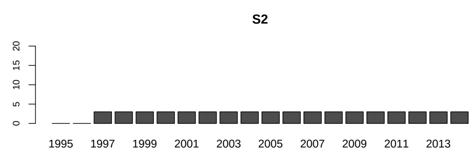




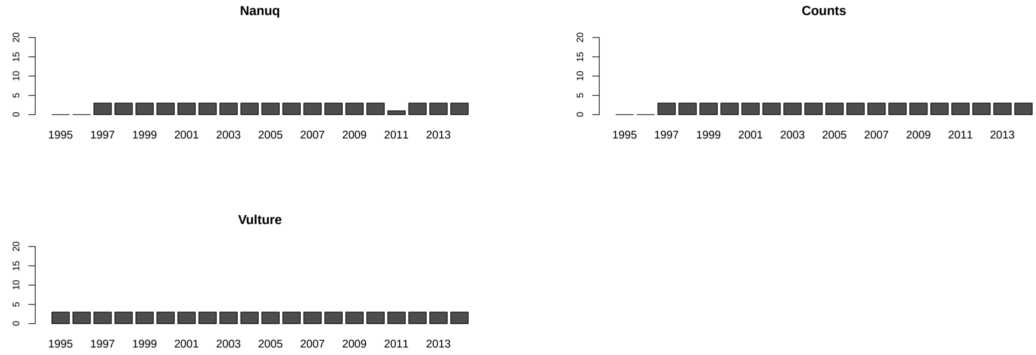






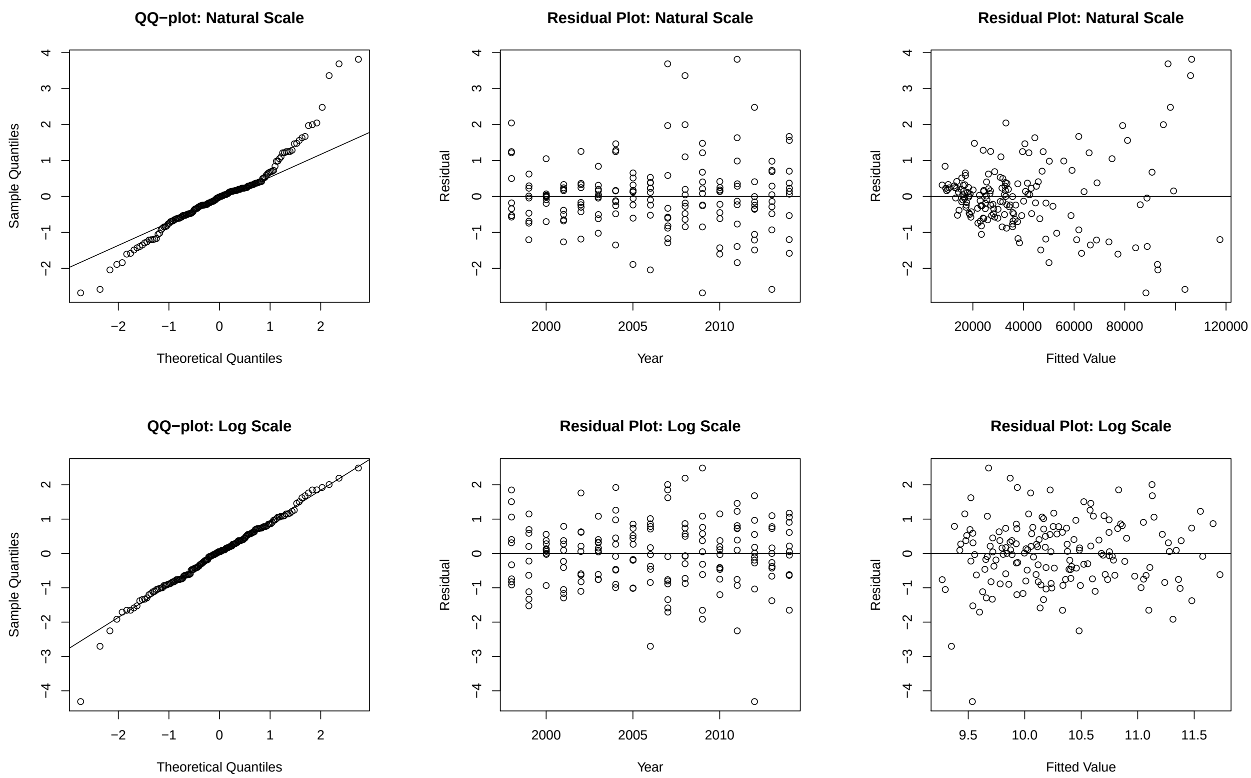


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
35	Counts	2007	172364.55	97096.08	3.69
36	Counts	2008	174581.26	105989.30	3.36
81	Kodiak	2011	184244.35	106407.57	3.82

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
124	Moose	2012	1873.65	9.54	-4.31

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
6.13	6.00	0.41

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

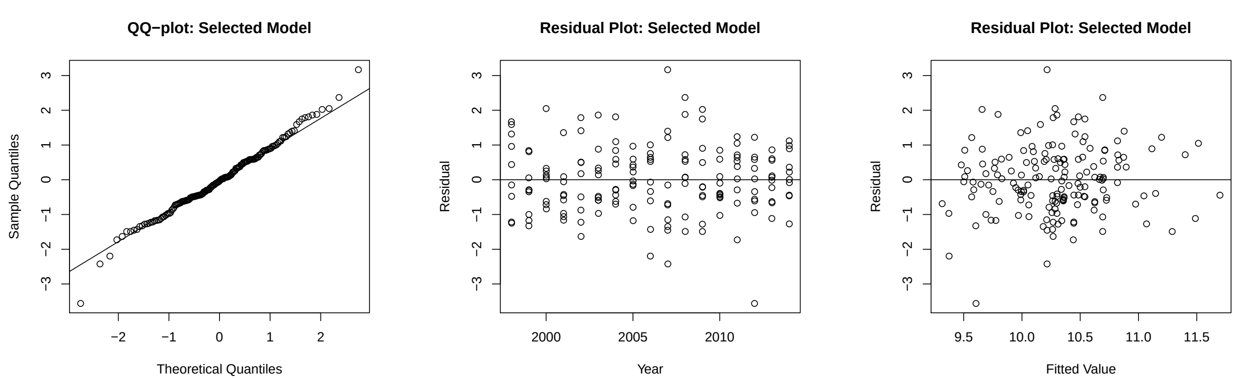
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope and intercept. Proceeding with monitored contrasts using reference model 3 (fitting a common slope and intercept for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.3 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
35	Counts	2007	172364.55	10.22	3.17
124	Moose	2012	1873.65	9.61	-3.56

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-square	DF	P-value
Kodiak	1.6618	3	0.6455
Leslie	1.3512	3	0.7170
Moose	1.0268	3	0.7948
Nema	0.8881	3	0.8283
Slipper	0.1207	3	0.9892
S2	1.7278	3	0.6308
S3	0.5860	3	0.8996

- Conclusions:
  No significant deviations were found when comparing monitored lakes to reference lakes.

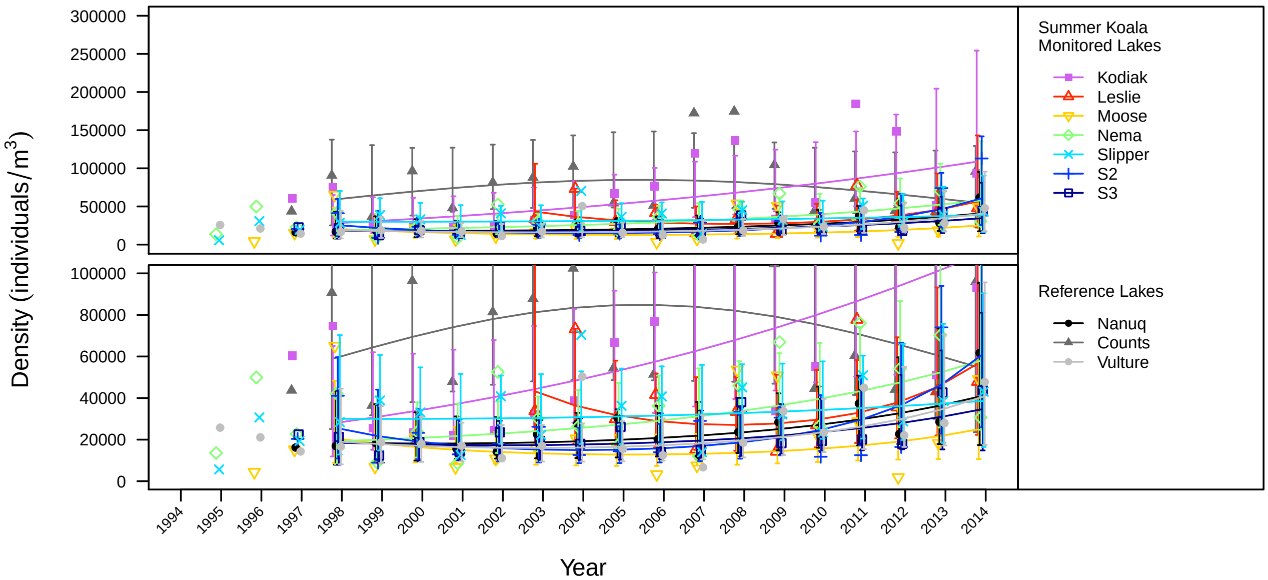
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0460
Monitored Lake	Kodiak	0.3780
Monitored Lake	Leslie	0.2120
Monitored Lake	Moose	0.0420
Monitored Lake	Nema	0.2660
Monitored Lake	S2	0.3670
Monitored Lake	S3	0.3540
Monitored Lake	Slipper	0.0360

- Conclusions:
  Model fit for Kodiak, Leslie, Nema, S2 and S3 is weak. Model fit for pooled reference lakes, Moose, and Slipper is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean zooplankton density for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	9.31E+04	1.09E+05	4.71E+04	4.64E+04	2.54E+05	1.38E+05
Leslie	4.79E+04	5.65E+04	2.68E+04	2.23E+04	1.43E+05	7.84E+04
Moose	4.91E+04	2.50E+04	1.08E+04	1.07E+04	5.84E+04	3.17E+04
Nema	3.07E+04	5.79E+04	2.51E+04	2.47E+04	1.35E+05	7.35E+04
Slipper	4.31E+04	3.86E+04	1.68E+04	1.65E+04	9.04E+04	4.90E+04
S2	1.13E+05	6.06E+04	2.63E+04	2.59E+04	1.42E+05	7.70E+04
S3	4.37E+04	3.46E+04	1.50E+04	1.48E+04	8.11E+04	4.40E+04
Nanuq	6.17E+04	4.07E+04	1.77E+04	1.74E+04	9.53E+04	
Counts	9.59E+04	5.52E+04	2.39E+04	2.36E+04	1.29E+05	
Vulture	4.77E+04	4.09E+04	1.77E+04	1.75E+04	9.56E+04	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Density	Summer	Koala	Lake	Biology	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

Analysis of August Benthos Density in Lakes of the Koala Watershed and Lac de Gras

February 11, 2015

1 Censored Values:

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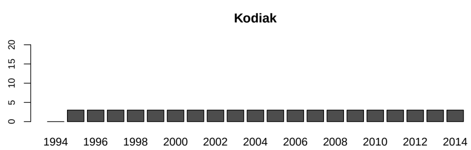
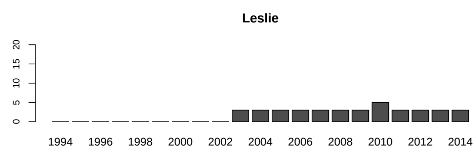
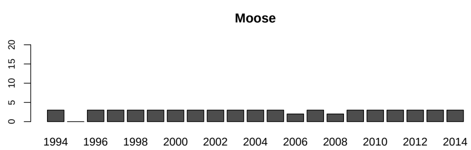
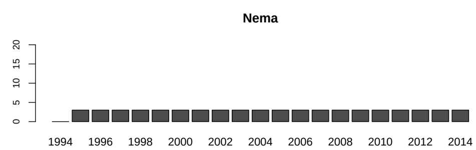
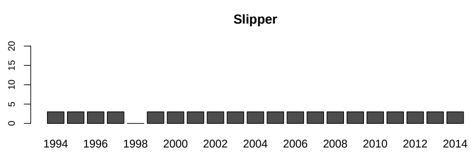
1.1 Monitored

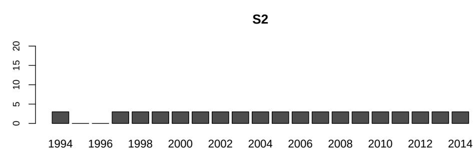




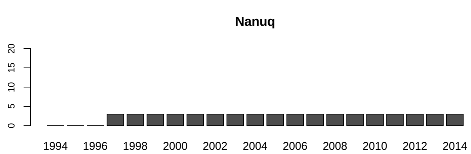


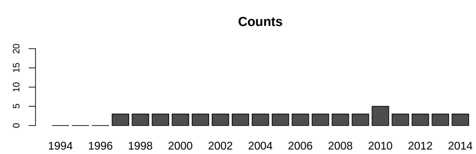


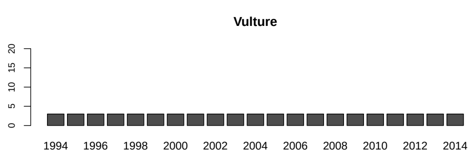




1.2 Reference

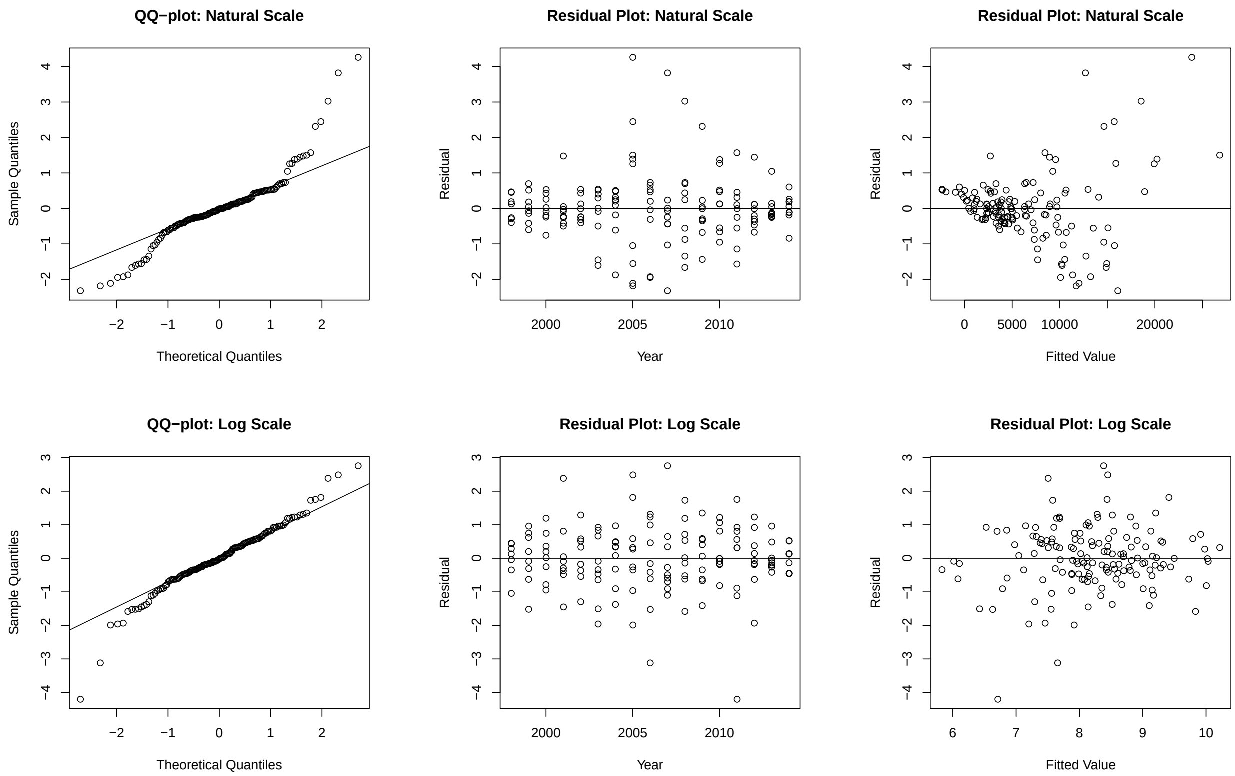






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
78	Kodiak	2008	33881.48	18556.16	3.02
117	Moose	2005	45466.67	23881.00	4.26
119	Moose	2007	32059.26	12703.03	3.82

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
118	Moose	2006	222.23	7.66	-3.12
228	Slipper	2011	39.51	6.71	-4.20

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
13.55	6.00	0.04

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
3.81	4.00	0.43

- Conclusions:
  The slopes do not differ significantly among reference lakes.

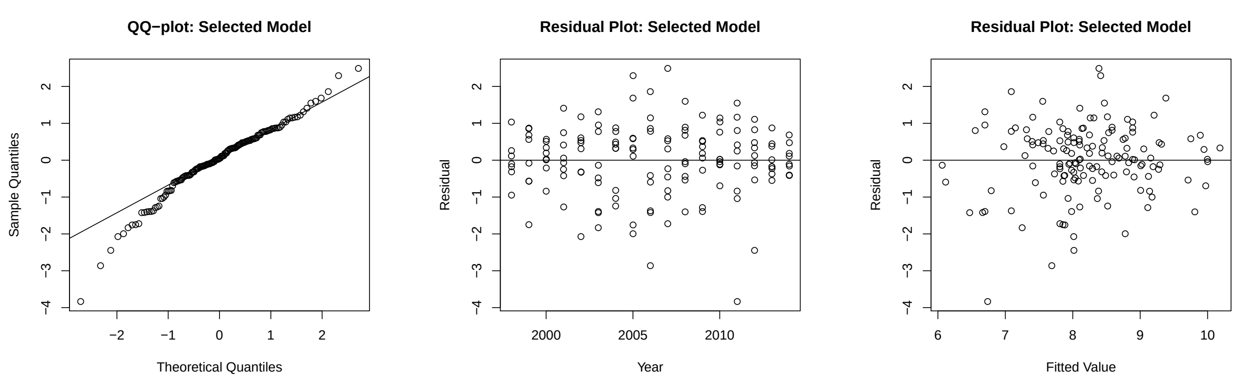
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.999	0.000	0.001	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitrored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
228	Slipper	2011	39.51	6.74	-3.83

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope while ignoring intercepts (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-square	DF	P-value
Kodiak	0.8131	2	0.6659
Leslie	0.2444	2	0.8850
Moose	0.3987	2	0.8192
Nema	1.7341	2	0.4202
Slipper	0.7313	2	0.6938
S2	2.1221	2	0.3461

- Conclusions:
  No significant deviations were found when comparing monitored lakes to reference lakes.

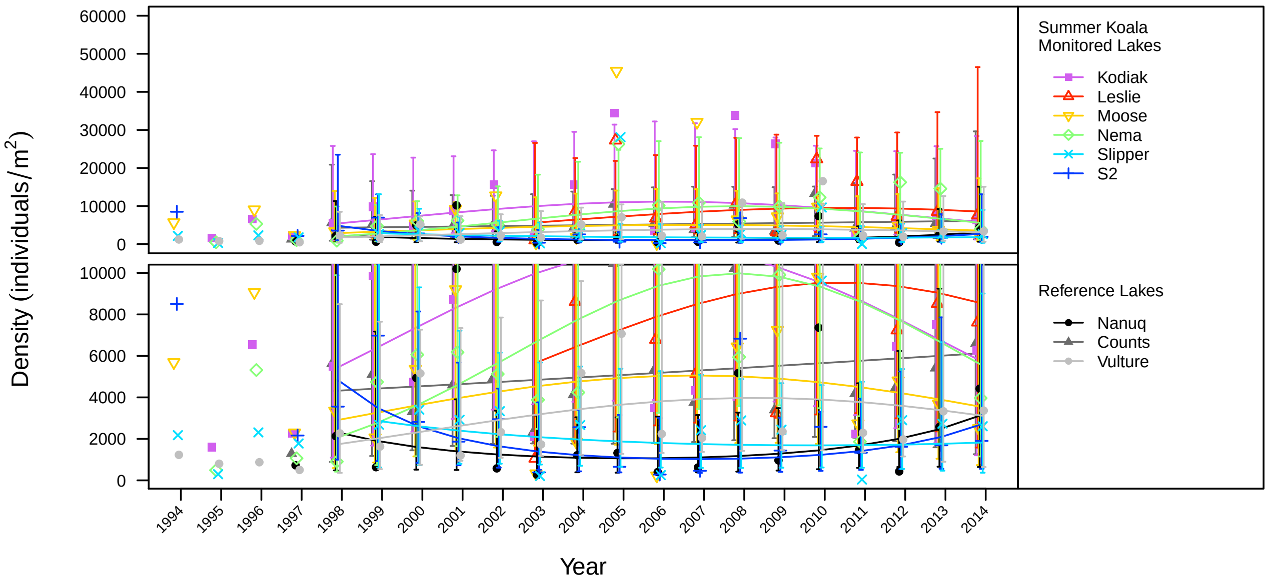
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0200
Monitored Lake	Kodiak	0.0740
Monitored Lake	Leslie	0.0510
Monitored Lake	Moose	0.0150
Monitored Lake	Nema	0.3330
Monitored Lake	S2	0.2570
Monitored Lake	Slipper	0.0120

- Conclusions:
  Model fit for Nema Lake and site S2 is weak. Model fit for pooled reference lakes, Kodiak, leslie, Moose, and Slipper lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean benthos density for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak	6.27E+03	5.86E+03	4.72E+03	1.21E+03	2.84E+04	1.38E+04
Leslie	7.62E+03	8.58E+03	7.40E+03	1.58E+03	4.65E+04	2.17E+04
Moose	2.51E+03	3.57E+03	2.87E+03	7.36E+02	1.73E+04	8.41E+03
Nema	3.97E+03	5.59E+03	4.50E+03	1.15E+03	2.71E+04	1.32E+04
Slipper	2.61E+03	1.82E+03	1.49E+03	3.69E+02	9.01E+03	4.35E+03
S2	1.90E+03	2.70E+03	2.17E+03	5.57E+02	1.31E+04	6.36E+03
Nanuq	4.42E+03	3.12E+03	2.51E+03	6.43E+02	1.51E+04	
Counts	6.59E+03	6.11E+03	4.92E+03	1.26E+03	2.96E+04	
Vulture	3.36E+03	3.11E+03	2.51E+03	6.42E+02	1.51E+04	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Density	Summer	Koala	Lake	Biology	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

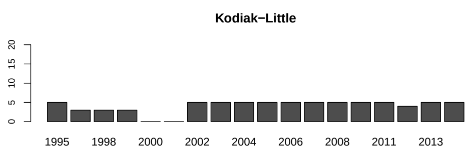
Analysis of Benthos Density in Streams of the Koala Watershed and Lac de Gras

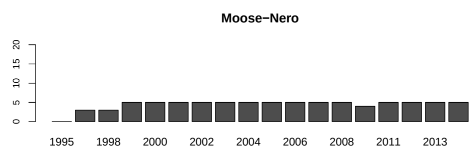
February 11, 2015

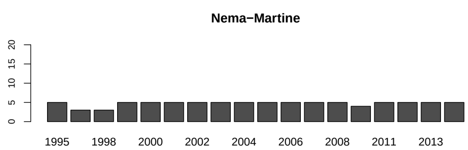
1 Censored Values:

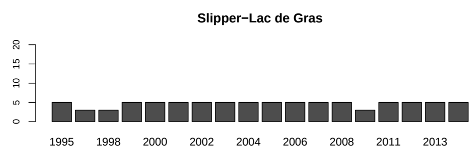
The following charts indicate the number of measurements taken in each year from each stream that were below the detection limit (grey) or above the detection limit (black).

1.1 Monitored

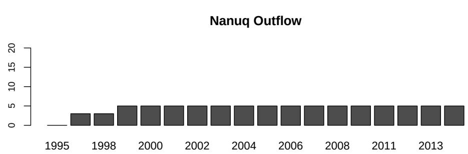


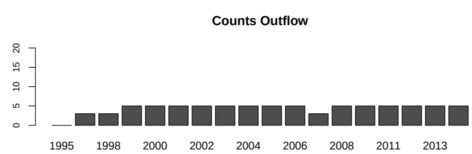


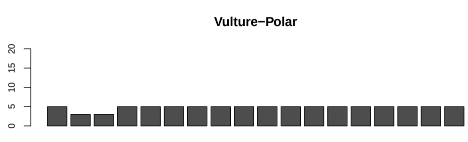




1.2 Reference

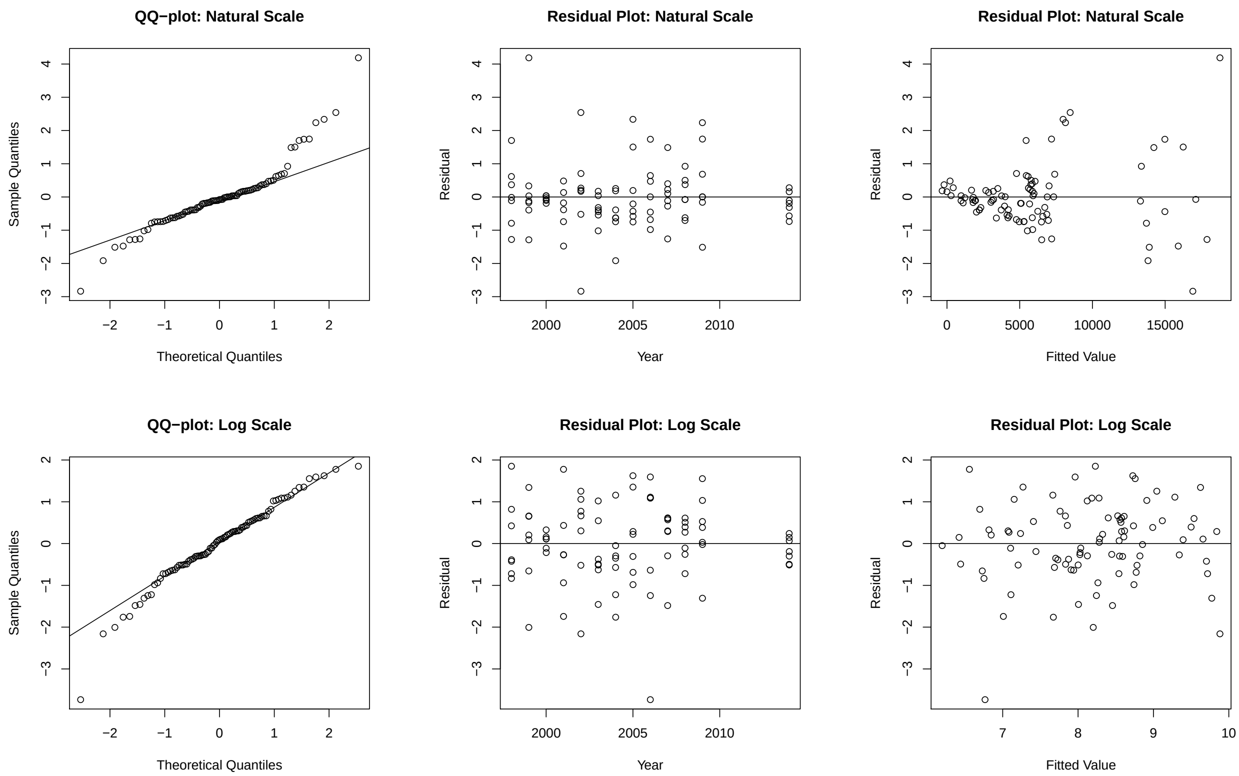






Comment:
None of the streams exhibited greater than 60% of data below the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses. Note: Data from years 2011, 2012 and 2013 were excluded from statistical analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
174	Slipper-Lac de Gras	1999	36813.20	18766.91	4.19

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
118	Moose-Nero	2006	73.20	6.77	-3.74

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-square	DF	p-value
17.58	6.00	0.01

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-square	DF	p-value
6.63	4.00	0.16

- Conclusions:
  The slopes do not differ significantly among reference streams.

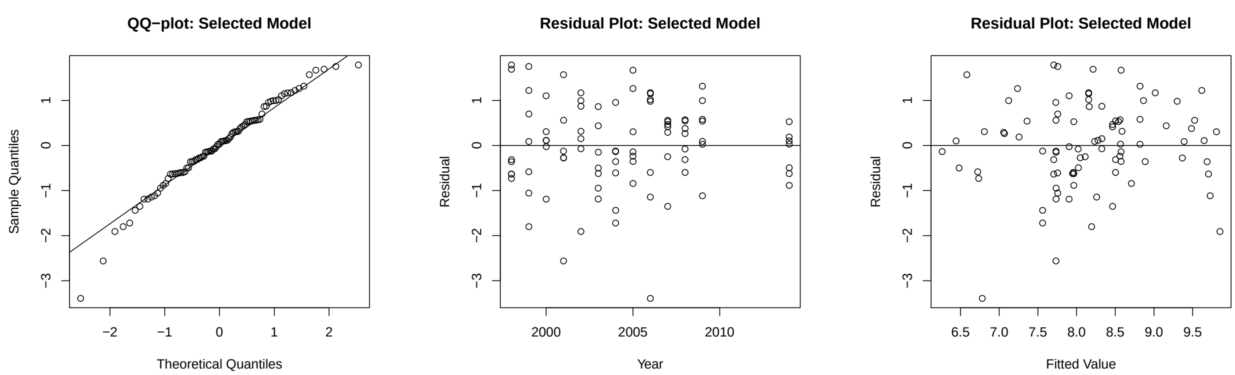
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.862	0.000	0.138	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference streams are best modeled using separate slopes and intercepts, contrasts suggest that reference streams share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference streams) to avoid defaulting to comparing trends in monitored streams against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
118	Moose-Nero	2006	73.20	6.78	-3.39

Conclusion:
Reduced model shows dependence on year. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-square	DF	P-value
Kodiak-Little	6.2754	2	0.0434
Moose-Nero	0.2559	2	0.8799
Nema-Martine	0.2085	2	0.9010
Slipper-Lac de Gras	1.4093	2	0.4943

- Conclusions:
  Kodiak-Little shows significant deviation frmo the common slope of reference streams.

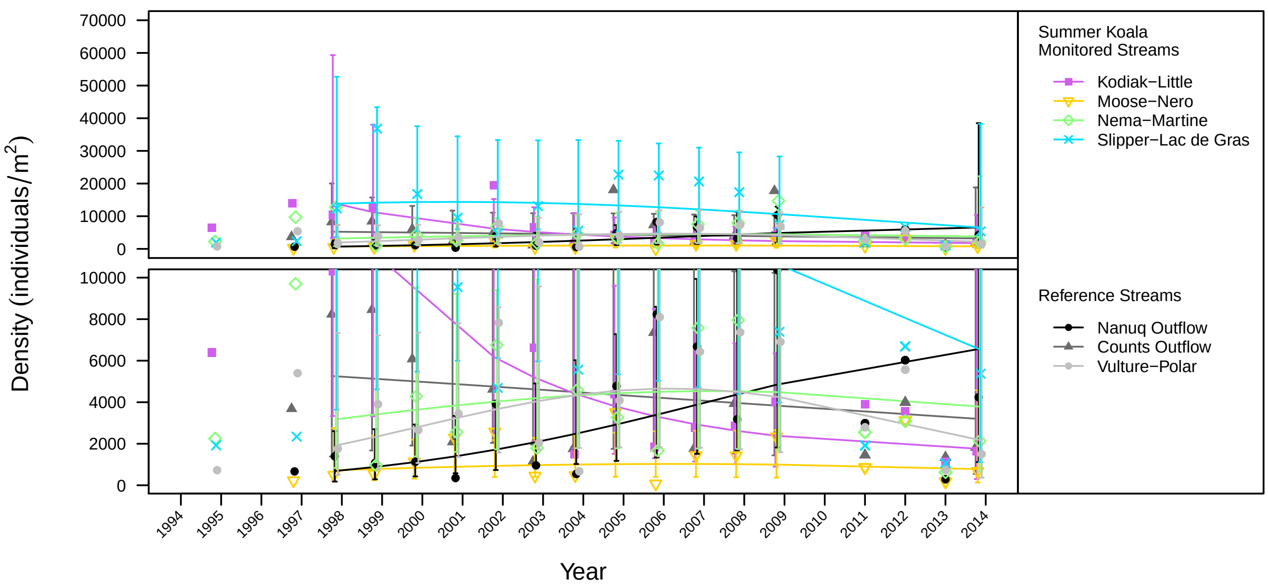
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.0750
Monitored Stream	Kodiak-Little	0.5540
Monitored Stream	Moose-Nero	0.0140
Monitored Stream	Nema-Martine	0.0200
Monitored Stream	Slipper-Lac de Gras	0.1140

- Conclusions:
  Model fit for pooled reference streams, Moose-Nero, Nema-Martine, and Slipper-Lac de Gras streams is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For years 2011 to 2013, only observed means are plotted. No confidence intervals are included as data from these years were not used in statistical analyses.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean stream benthos density for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Kodiak-Little	1.63E+03	1.76E+03	1.59E+03	3.00E+02	1.04E+04	4.67E+03
Moose-Nero	6.78E+02	7.80E+02	7.04E+02	1.33E+02	4.58E+03	2.06E+03
Nema-Martine	2.13E+03	3.79E+03	3.42E+03	6.46E+02	2.22E+04	1.00E+04
Slipper-Lac de Gras	5.37E+03	6.53E+03	5.89E+03	1.11E+03	3.83E+04	1.72E+04
Nanuq Outflow	4.24E+03	6.56E+03	5.92E+03	1.12E+03	3.85E+04	
Counts Outflow	1.82E+03	3.21E+03	2.89E+03	5.47E+02	1.88E+04	
Vulture-Polar	1.50E+03	2.16E+03	1.95E+03	3.69E+02	1.27E+04	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Density	Summer	Koala	Stream	Biology	none	log e	linear mixed effects regression	#2 shared slopes	NA	Kodiak-Little

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

2. King-Cujo Watershed and Lac du Sauvage

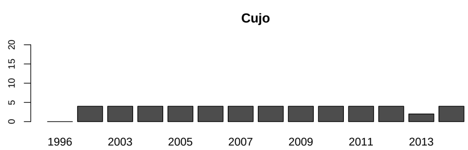
Analysis of April pH in Lakes of the King-Cujo Watershed and Lac du Sauvage

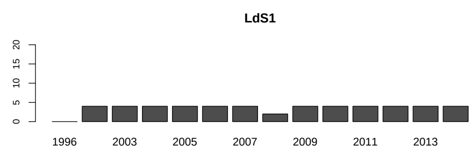
November 17, 2014

1 Censored Values:

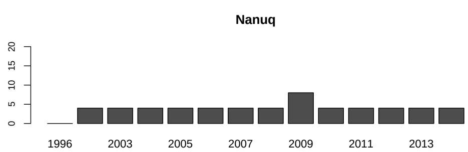
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

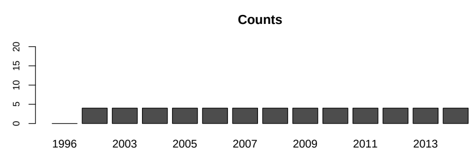
1.1 Monitored

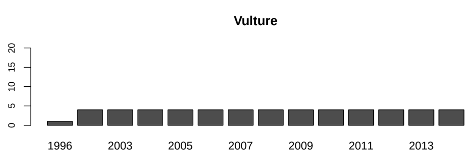




1.2 Reference

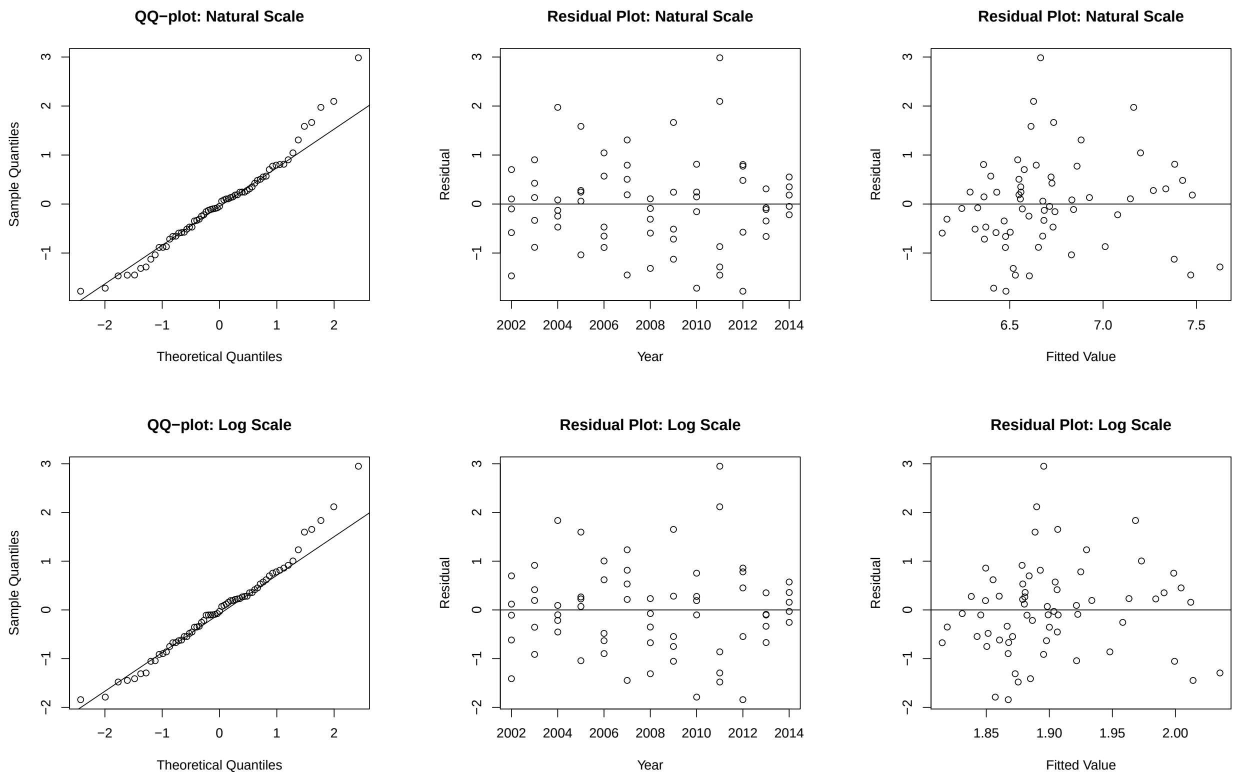






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
2.13E-54	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. Although AIC reveals that the data is modeled best after log transformation, pH is already log scale and should not be transformed. Proceeding with analysis using untransformed, "natural" model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
4769.24	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.88	4.00	0.93

- Conclusions:
  The slopes do not differ significantly among reference lakes.

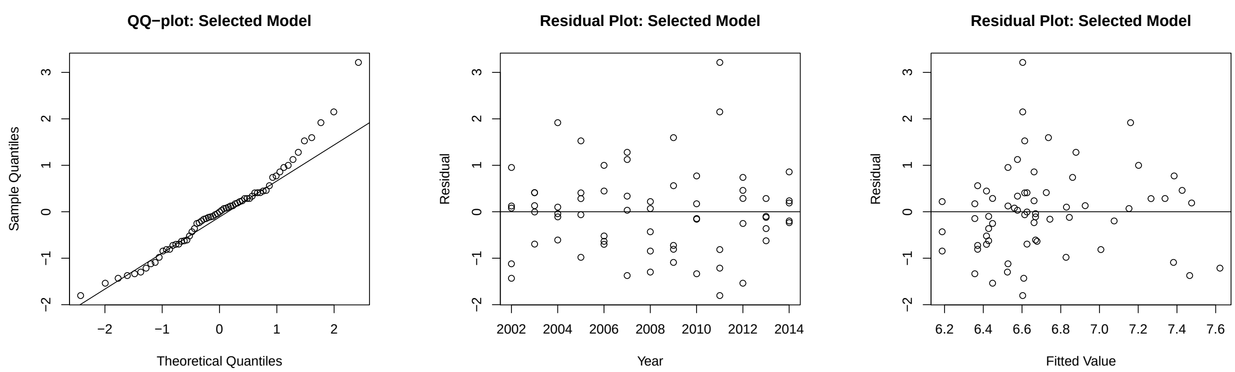
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.018	0.000	0.982	Ref. Model 3

- Conclusions:
  Results of AIC do not agree with reference model testing. Although results of contrasts suggest that reference lakes share a common slope and intercept, AIC reveals that reference lakes are best modeled with separate intercepts. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
144	Vulture	2011	7.18	6.60	3.21

No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	11.51	2.00	0.00
LdS1	2.14	2.00	0.34

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

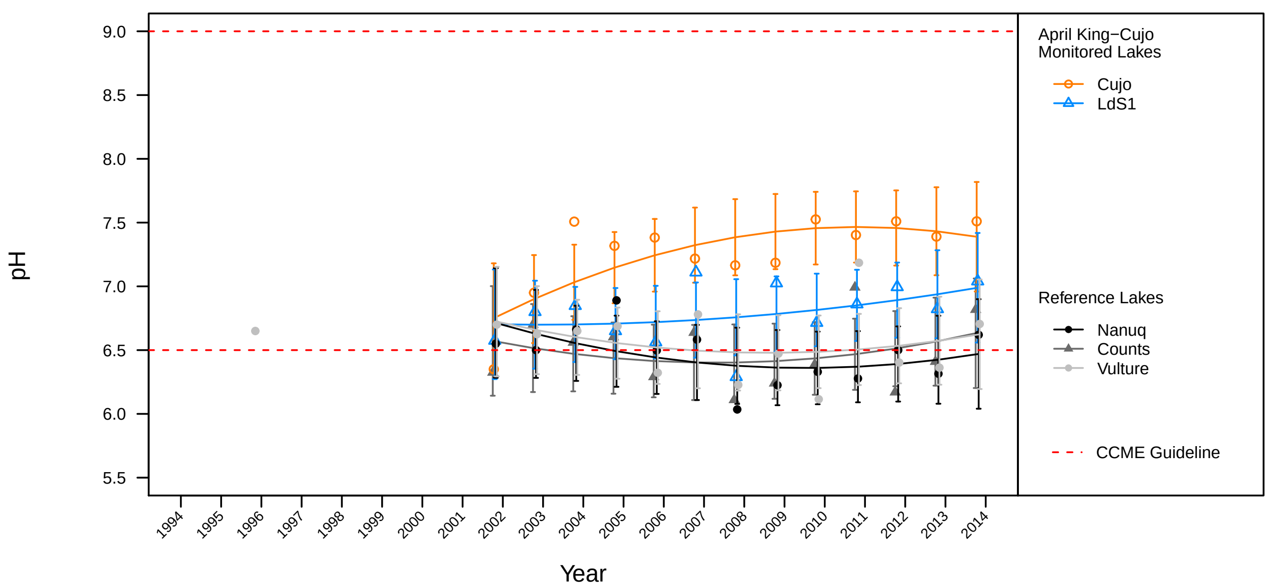
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0920
Monitored Lake	Cujo	0.5330
Monitored Lake	LdS1	0.1790

- Conclusions:
  Model fit for pooled reference lakes and site LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean pH for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	7.51E+00	7.39E+00	2.19E-01	6.96E+00	7.82E+00	6.41E-01
LdS1	7.04E+00	6.99E+00	2.19E-01	6.56E+00	7.42E+00	6.41E-01
Nanuq	6.62E+00	6.47E+00	2.19E-01	6.04E+00	6.90E+00	
Counts	6.82E+00	6.63E+00	2.19E-01	6.20E+00	7.06E+00	
Vulture	6.71E+00	6.62E+00	2.19E-01	6.19E+00	7.05E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
pH	April	King-Cujo	Lake	Water	none	none	linear mixed effects regression	#2 shared slopes	6.5/ 9	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

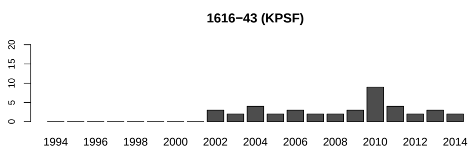
Analysis of August pH in Lakes of the King-Cujo Watershed and Lac du Sauvage

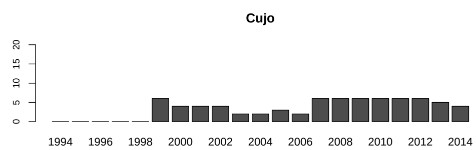
November 14, 2014

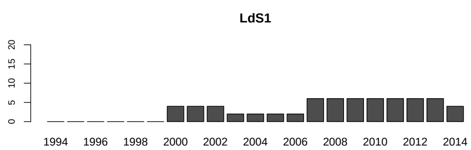
1 Censored Values:

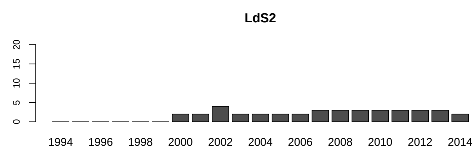
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

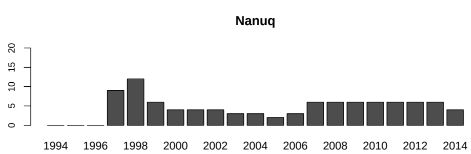


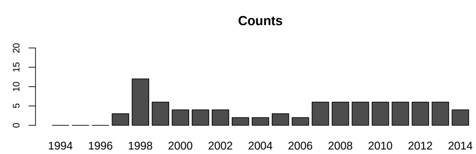


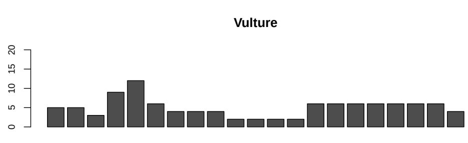




1.2 Reference

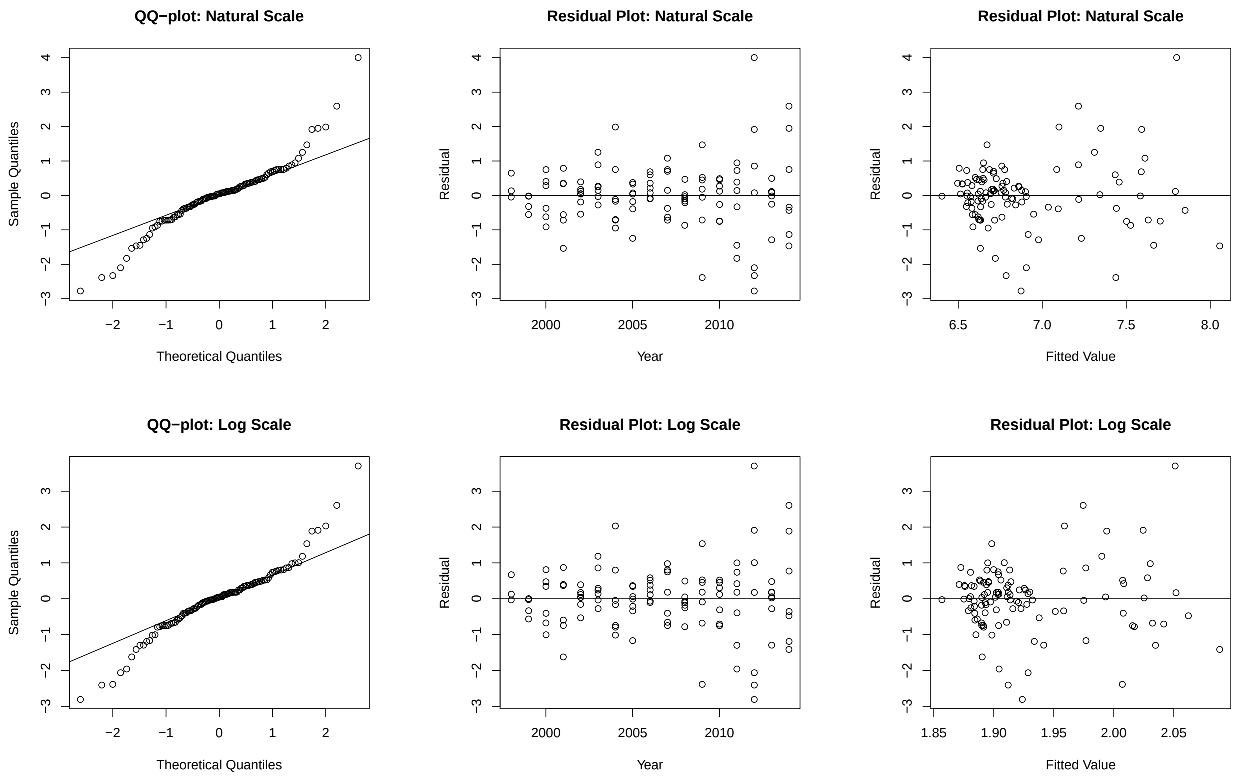






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	8.41	7.80	4.00

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	8.41	2.05	3.70

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. Although AIC reveals that the data is modeled best after log transformation, pH is already log scale and should not be transformed. Proceeding with analysis using untransformed, "natural" model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
6.26	6.00	0.39

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

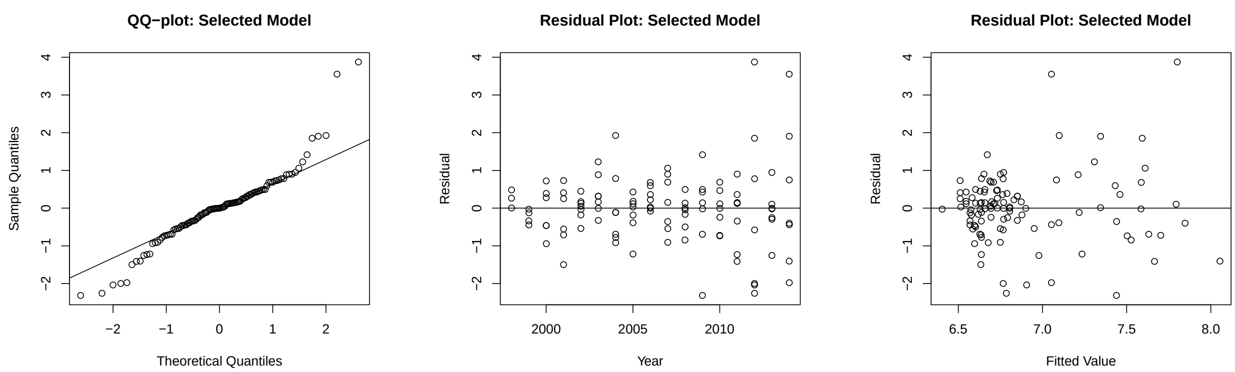
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.049	0.000	0.951	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	8.41	7.80	3.87
42	Counts	2014	7.61	7.05	3.55

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	13.0375	3	0.0046
Cujo	187.8469	3	0.0000
LdS1	6.9946	3	0.0721
LdS2	0.8539	3	0.8365

- Conclusions:
  1616-43 (KPSF) and Cujo Lake show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	6.0297	2	0.0491
Cujo	50.7182	2	0.0000
LdS1	4.8118	2	0.0902
LdS2	0.2643	2	0.8762

- Conclusions:
  When allowing for differences in intercept, 1616-43 (KPSF) and Cujo Lake show significant deviation from the common slope of reference lakes.

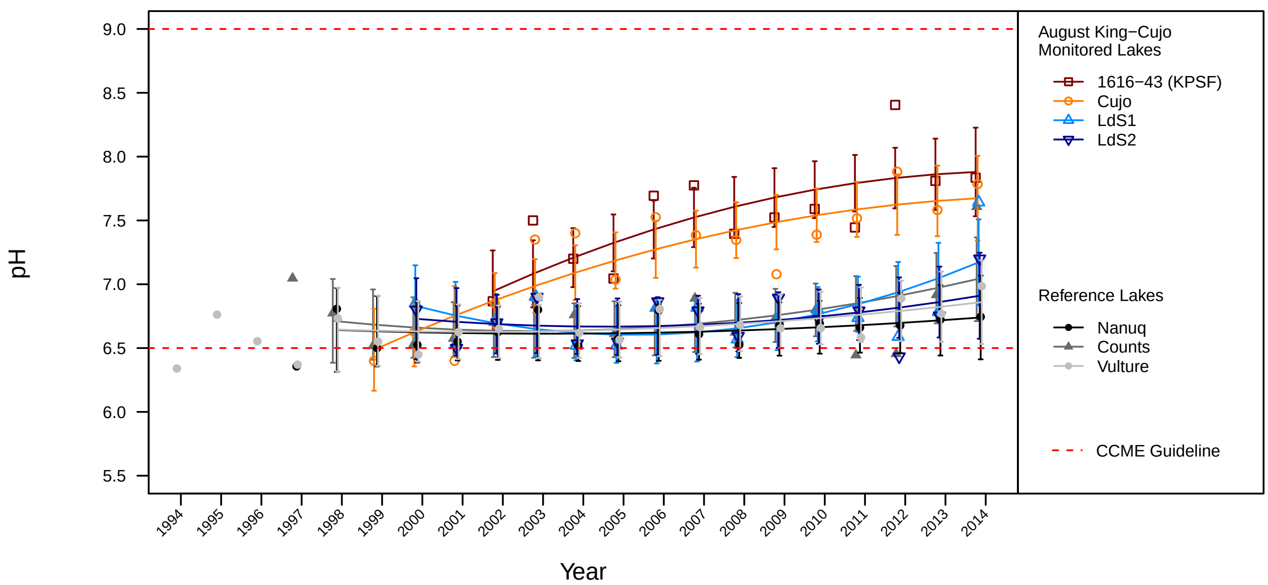
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1770
Monitored Lake	1616-43 (KPSF)	0.5540
Monitored Lake	Cujo	0.7530
Monitored Lake	LdS1	0.3880
Monitored Lake	LdS2	0.1450

- Conclusions:
  Model fit for LdS1 is weak. Model fit for pooled reference lakes and LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean pH for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	7.83E+00	7.88E+00	1.77E-01	7.53E+00	8.23E+00	5.18E-01
Cujo	7.79E+00	7.67E+00	1.70E-01	7.34E+00	8.01E+00	4.96E-01
LdS2	7.20E+00	6.91E+00	1.72E-01	6.57E+00	7.25E+00	5.03E-01
LdS1	7.64E+00	7.17E+00	1.72E-01	6.83E+00	7.51E+00	5.03E-01
Nanuq	6.75E+00	6.74E+00	1.67E-01	6.41E+00	7.07E+00	
Counts	7.61E+00	7.04E+00	1.67E-01	6.71E+00	7.37E+00	
Vulture	6.98E+00	6.86E+00	1.67E-01	6.53E+00	7.19E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
pH	August	King-Cujo	Lake	Water	none	none	linear mixed effects regression	#3 shared intercept & slope	6.5/ 9	1616-43 (KPSF) Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

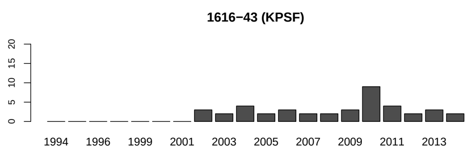
Analysis of August pH in King-Cujo Watershed Streams

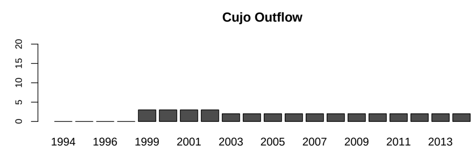
November 17, 2014

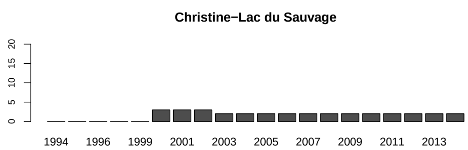
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

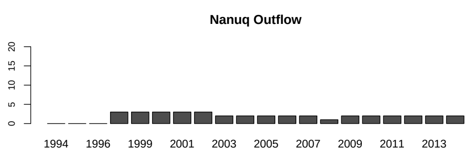
1.1 Monitored

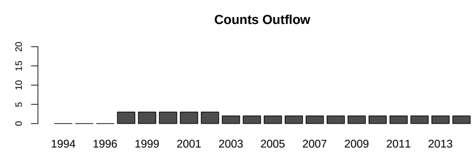


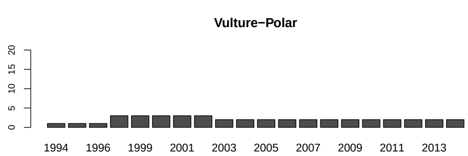




1.2 Reference

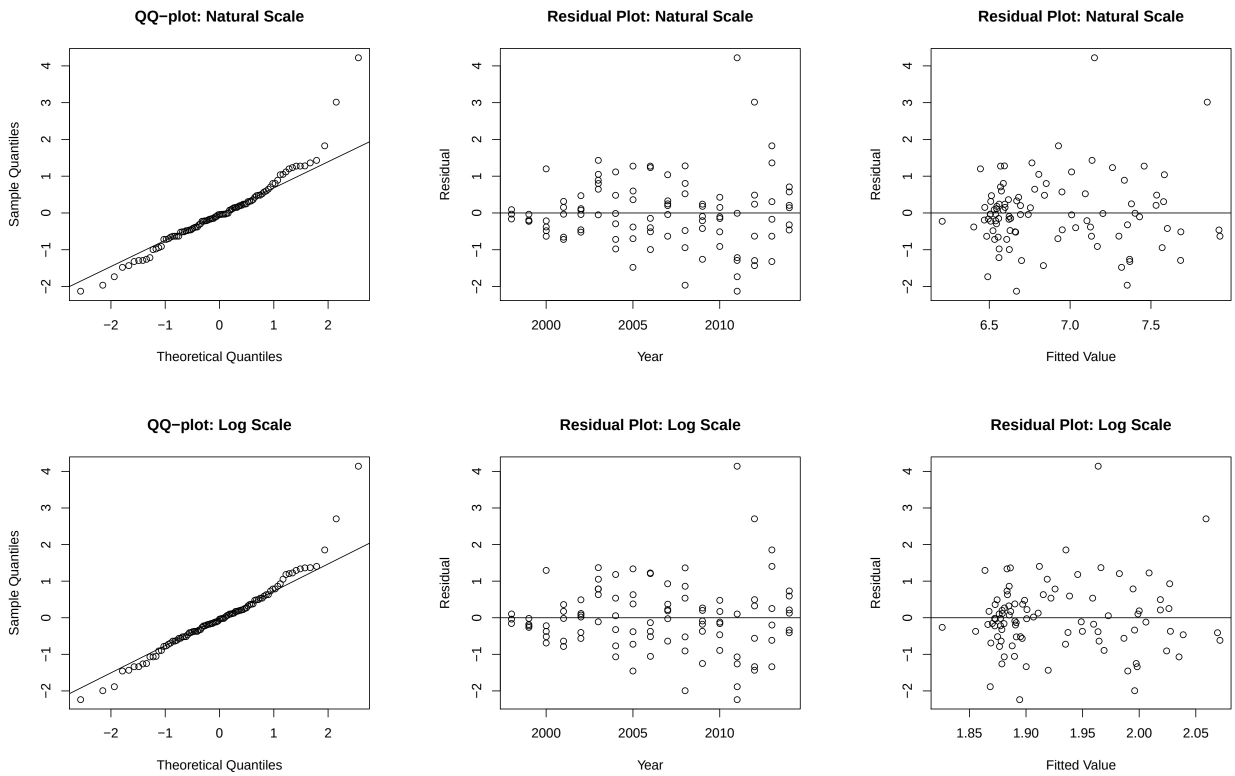






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	8.41	7.85	3.01
39	Christine-Lac du Sauvage	2011	7.93	7.15	4.22

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
39	Christine-Lac du Sauvage	2011	7.93	1.96	4.14

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. Although AIC reveals that the data is modeled best after log transformation, pH is already log scale and should not be transformed. Proceeding with analysis using untransformed, "natural" model.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
7.54	6.00	0.27

- Conclusions:
  The slopes and intercepts do not differ significantly among reference streams.

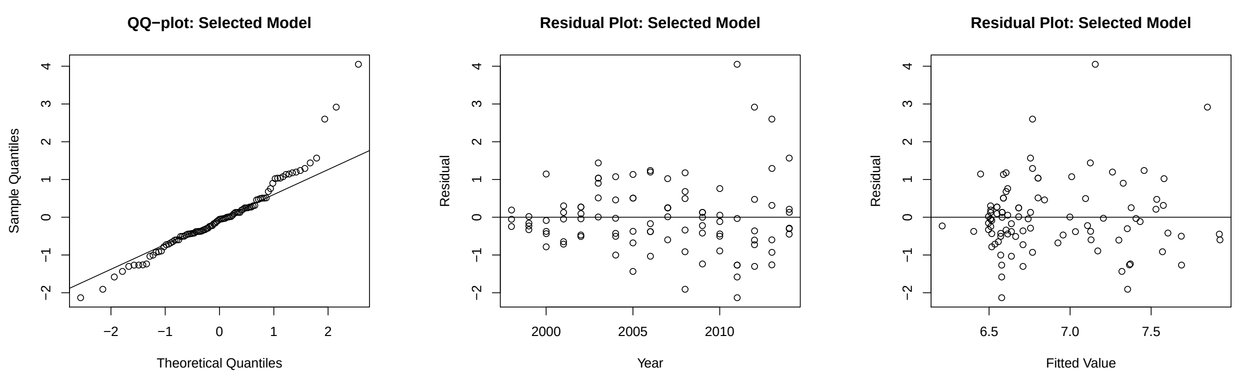
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.036	0.000	0.964	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
39	Christine-Lac du Sauvage	2011	7.93	7.16	4.05

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference stream slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the slope and intercept of each monitored stream compared to a common slope and intercept fitted for all reference streams together (reference model 3).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	5.2203	3	0.1564
Cujo Outflow	124.7833	3	0.0000
Christine-Lac du Sauvage	58.0613	3	0.0000

- Conclusions:
  Cujo Outflow and Christine-Lac du Sauvage streams show significant deviation from the common slope of reference streams.

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	4.6757	2	0.0965
Cujo Outflow	42.9799	2	0.0000
Christine-Lac du Sauvage	15.0218	2	0.0005

- Conclusions:
  When allowing for differences in intercept, Cujo Outflow and Christine-Lac du Sauvage show significant deviation from the common slope of reference streams.

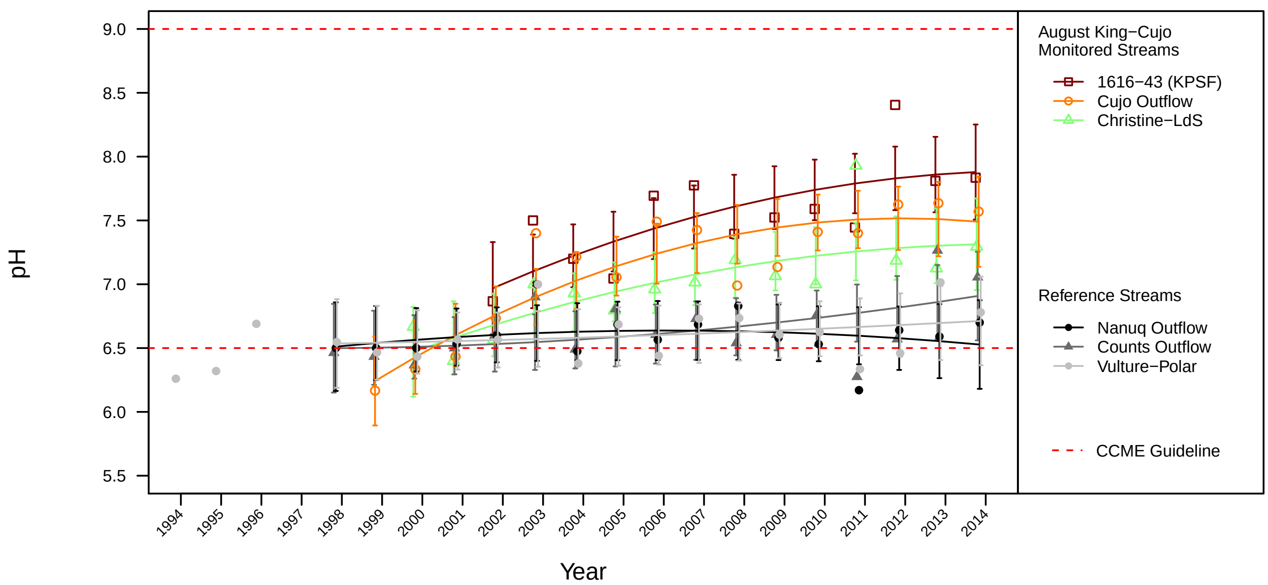
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.0900
Monitored Stream	1616-43 (KPSF)	0.5410
Monitored Stream	Christine-Lac du Sauvage	0.5950
Monitored Stream	Cujo Outflow	0.7890

- Conclusions:
  Model fit for pooled reference streams is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean pH for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	7.83E+00	7.88E+00	1.90E-01	7.51E+00	8.25E+00	5.56E-01
Cujo Outflow	7.57E+00	7.49E+00	1.80E-01	7.14E+00	7.84E+00	5.27E-01
Christine-Lac du Sauvage	7.29E+00	7.31E+00	1.83E-01	6.95E+00	7.67E+00	5.36E-01
Nanuq Outflow	6.70E+00	6.53E+00	1.77E-01	6.18E+00	6.87E+00	
Counts Outflow	7.05E+00	6.91E+00	1.77E-01	6.56E+00	7.26E+00	
Vulture-Polar	6.78E+00	6.71E+00	1.77E-01	6.37E+00	7.06E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
pH	August	King-Cujo	Stream	Water	none	none	linear mixed effects regression	#3 shared intercept & slope	6.5/ 9	Cujo Outflow Christine-Lac du Sauvage

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

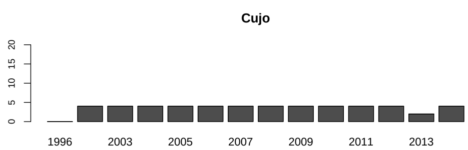
Analysis of April Total Alkalinity in Lakes of the King-Cujo Watershed and Lac du Sauvage

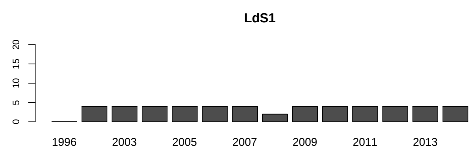
November 17, 2014

1 Censored Values:

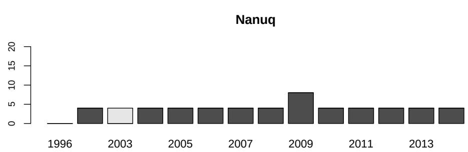
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

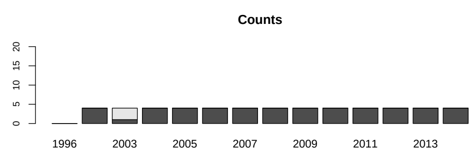
1.1 Monitored

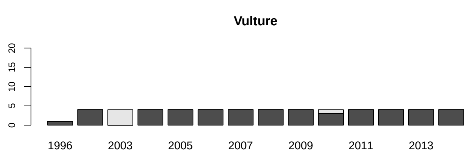




1.2 Reference

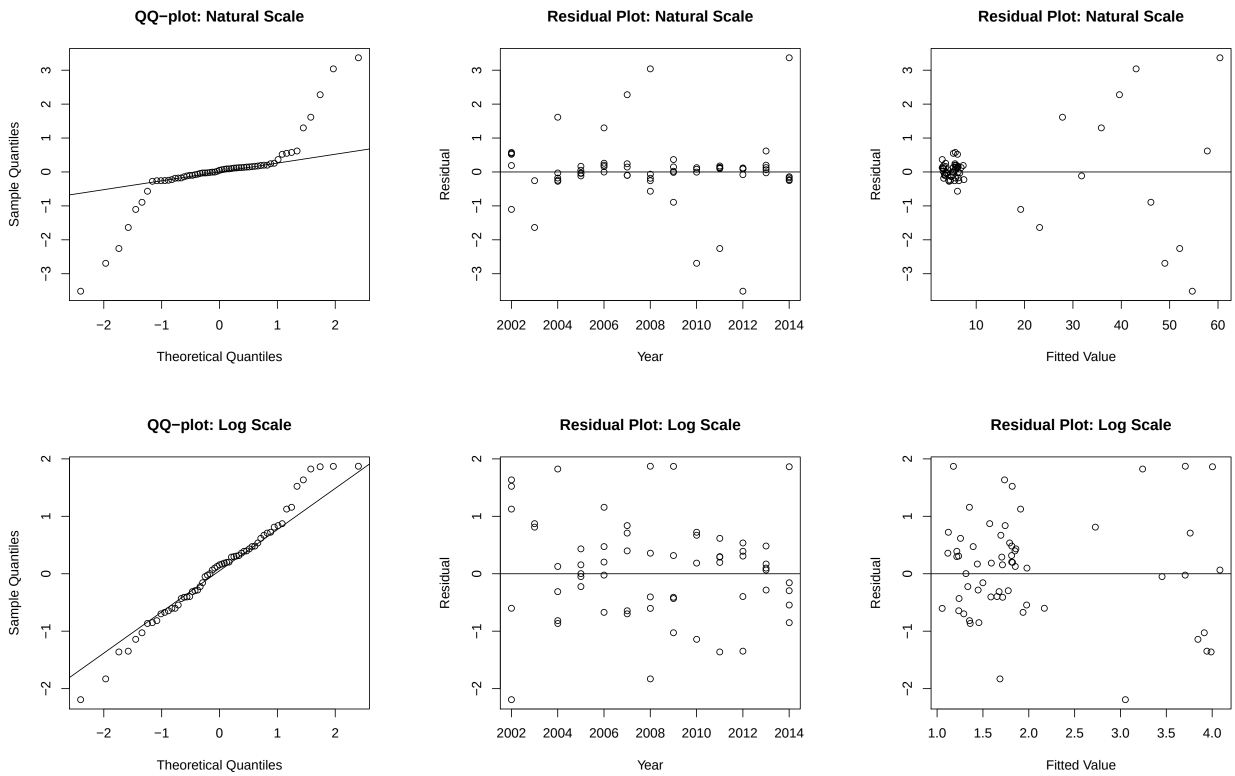






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
57	Cujo	2008	53.95	43.07	3.04
61	Cujo	2012	42.10	54.69	-3.52
63	Cujo	2014	72.45	60.40	3.37

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
5.94E-86	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
659.73	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
1.90	4.00	0.75

- Conclusions:
  The slopes do not differ significantly among reference lakes.

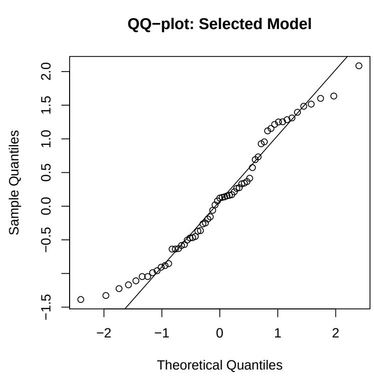
3.3 Compare Reference Models using AIC Weights

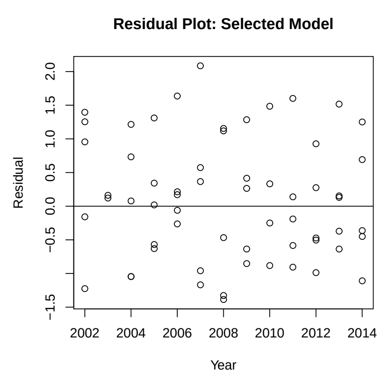
- Results:

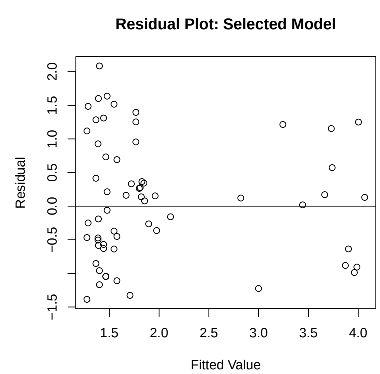
	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model







Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	18.36	2.00	0.00
LdS1	0.07	2.00	0.97

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

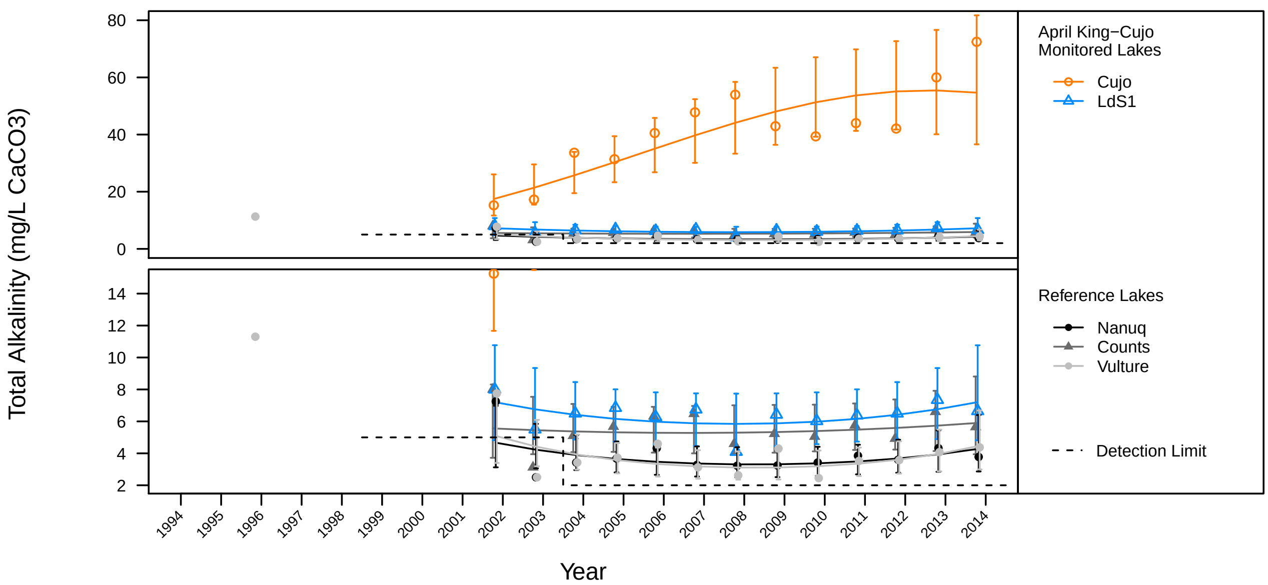
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0910
Monitored Lake	Cujo	0.7830
Monitored Lake	LdS1	0.2240

- Conclusions:
  Model fit for site LdS1 Lake is weak. Model fit for pooled reference lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total alkalinity for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	7.25E+01	5.47E+01	1.12E+01	3.66E+01	8.17E+01	3.28E+01
LdS1	6.65E+00	7.20E+00	1.48E+00	4.82E+00	1.08E+01	4.32E+00
Nanuq	3.77E+00	4.28E+00	8.78E-01	2.86E+00	6.40E+00	
Counts	5.65E+00	5.89E+00	1.21E+00	3.94E+00	8.81E+00	
Vulture	4.38E+00	4.47E+00	9.17E-01	2.99E+00	6.68E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Alkalinity	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

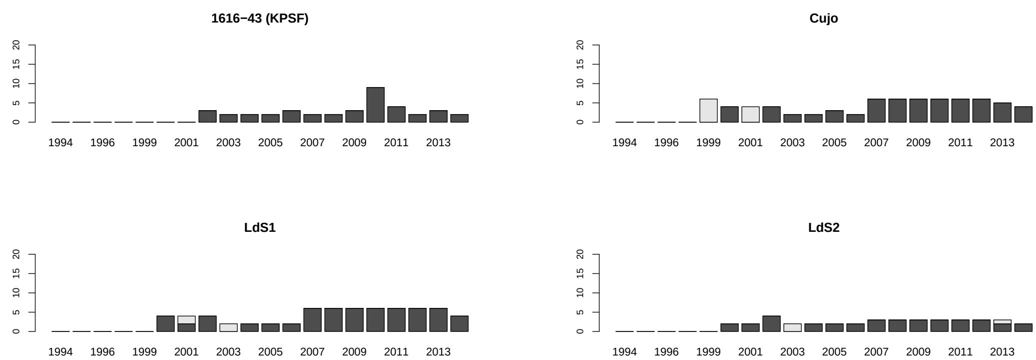
Analysis of August Total Alkalinity in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 14, 2014

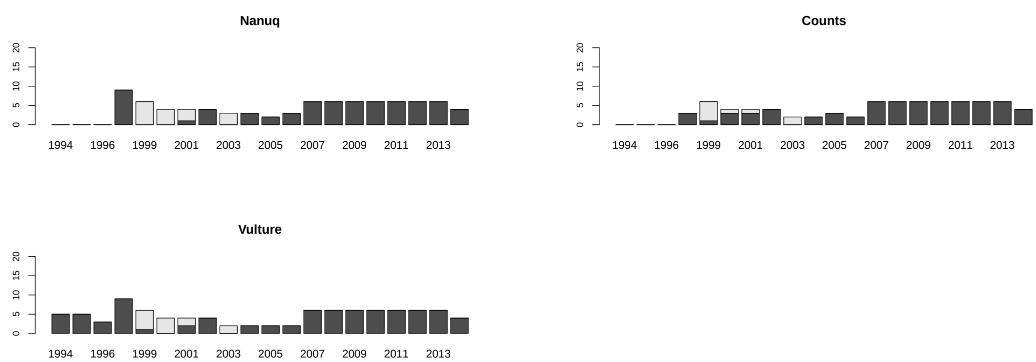
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

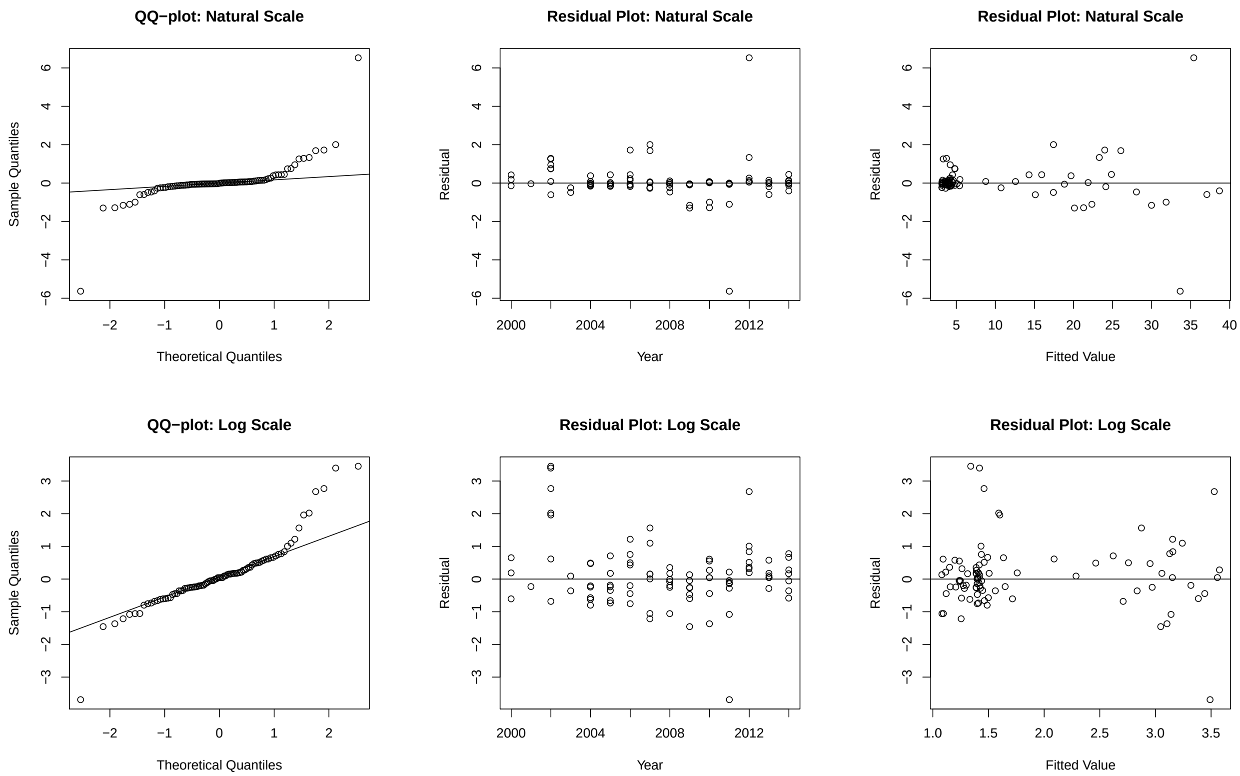


1.2 Reference



Comment:
10-60% of data in Counts, Nanuq, Vulture, and Cujo lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
18	1616-43 (KPSF)	2011	17.18	33.66	-5.63
19	1616-43 (KPSF)	2012	54.50	35.40	6.53

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
18	1616-43 (KPSF)	2011	17.18	3.49	-3.69
114	Nanuq	2002	7.00	1.34	3.45
135	Vulture	2002	7.50	1.42	3.40

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
13.33	6.00	0.04

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
2.41	4.00	0.66

- Conclusions:
  The slopes do not differ significantly among reference lakes.

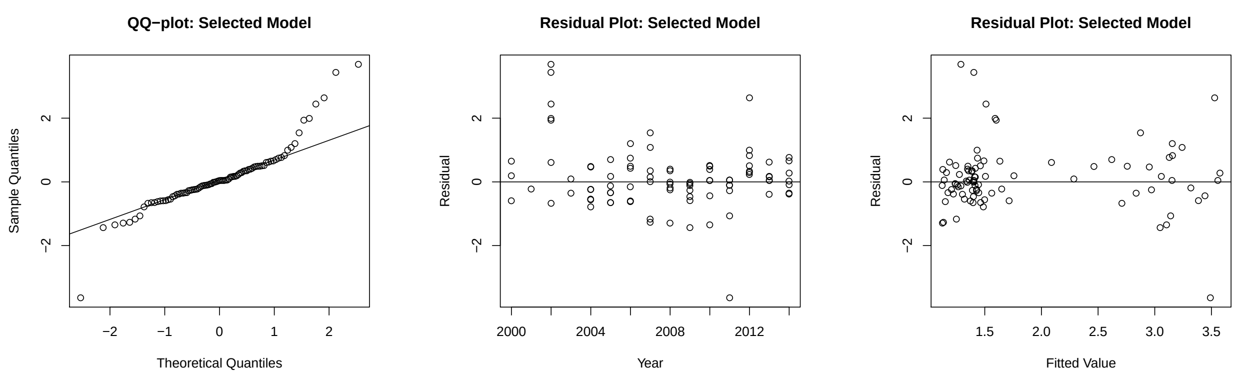
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.055	0.901	0.045	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
18	1616-43 (KPSF)	2011	17.18	3.49	-3.64
114	Nanuq	2002	7.00	1.29	3.69
135	Vulture	2002	7.50	1.40	3.44

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	32.3187	2	0.0000
Cujo	121.0089	2	0.0000
LdS1	0.3056	2	0.8583
LdS2	0.0673	2	0.9669

- Conclusions:
  1616-43 (KPSF) and Cujo Lake show significant deviation from the common slope of reference lakes.

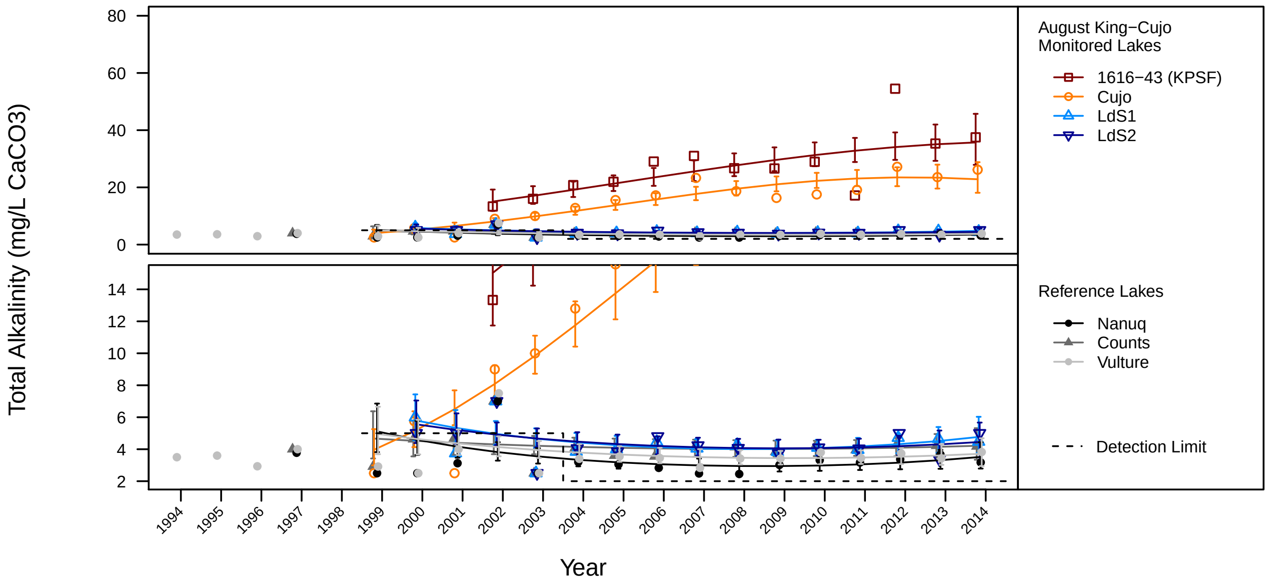
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.2510
Monitored Lake	1616-43 (KPSF)	0.5640
Monitored Lake	Cujo	0.7840
Monitored Lake	LdS1	0.2300
Monitored Lake	LdS2	0.1790

- Conclusions:
  Model fit for pooled reference lakes and LdS1 is weak. Model fit for LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total alkalinity for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	3.75E+01	3.57E+01	4.50E+00	2.79E+01	4.57E+01	1.32E+01
Cujo	2.62E+01	2.28E+01	2.70E+00	1.81E+01	2.88E+01	7.92E+00
LdS2	5.00E+00	4.45E+00	5.48E-01	3.50E+00	5.67E+00	1.61E+00
LdS1	4.47E+00	4.77E+00	5.71E-01	3.77E+00	6.03E+00	1.67E+00
Nanuq	3.17E+00	3.52E+00	4.15E-01	2.79E+00	4.43E+00	
Counts	4.17E+00	4.22E+00	4.99E-01	3.34E+00	5.32E+00	
Vulture	3.83E+00	3.72E+00	4.39E-01	2.95E+00	4.68E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Alkalinity	August	King-Cujo	Lake	Water	none	log e	Tobit regression	#2 shared slopes	NA	1616-43 (KPSF) Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

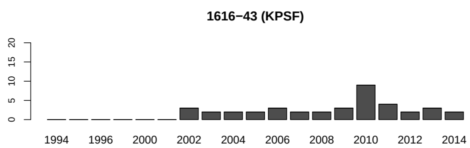
Analysis of August Total Alkalinity in King-Cujo Watershed Streams

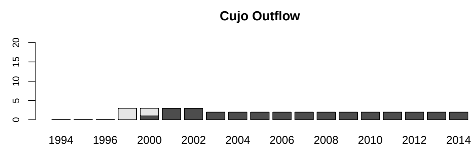
November 14, 2014

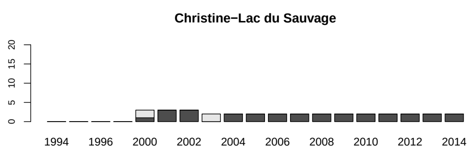
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

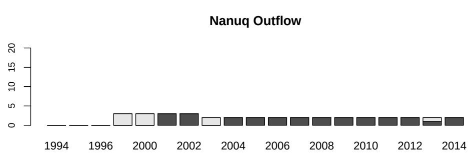
1.1 Monitored

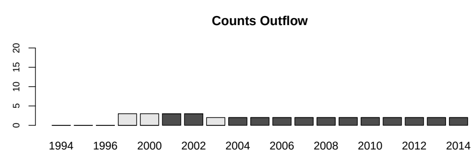


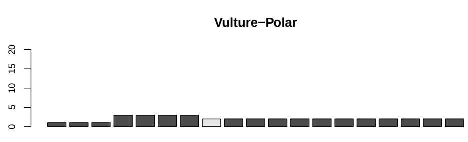




1.2 Reference

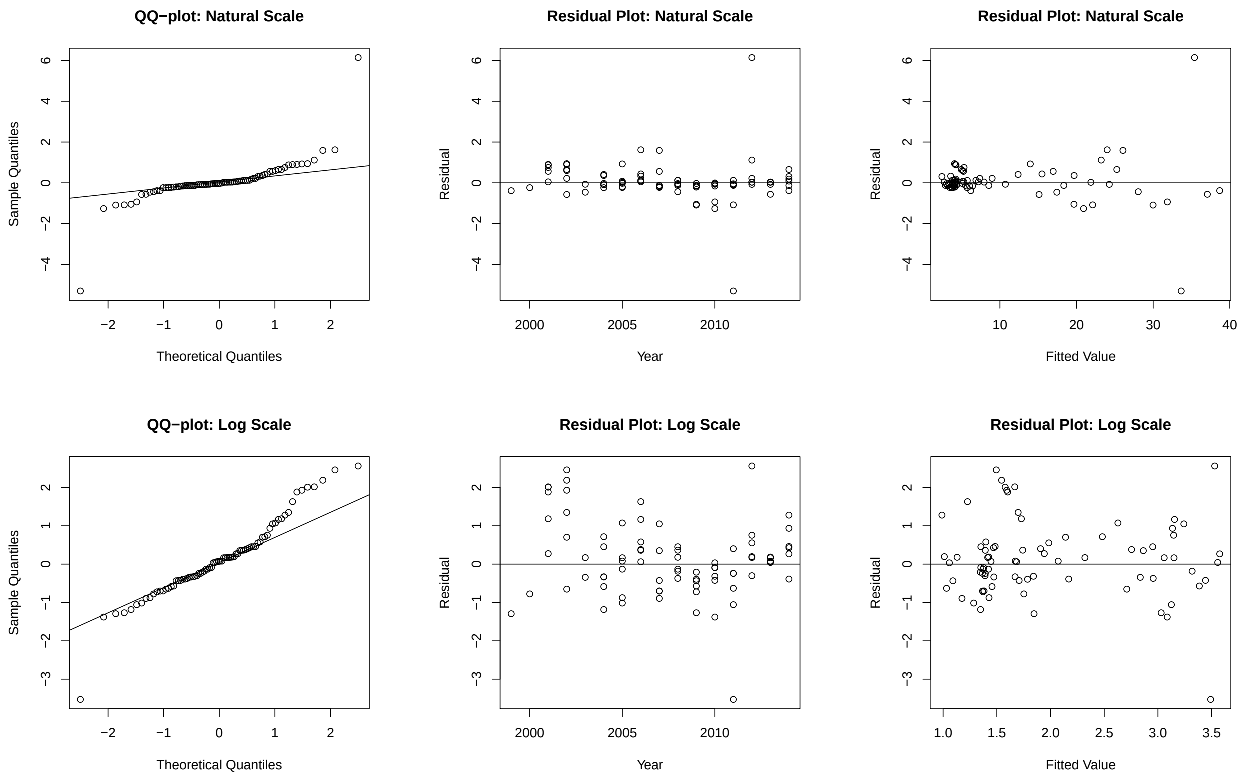






Comment:
10-60% of data in Counts Outflow, Nanuq Outflow, Cujo Outflow, and Christine-Lac du Sauvage was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
18	1616-43 (KPSF)	2011	17.18	33.66	-5.30
19	1616-43 (KPSF)	2012	54.50	35.40	6.14

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
18	1616-43 (KPSF)	2011	17.18	3.49	-3.53

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
20.13	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
6.10	4.00	0.19

- Conclusions:
  The slopes do not differ significantly among reference streams.

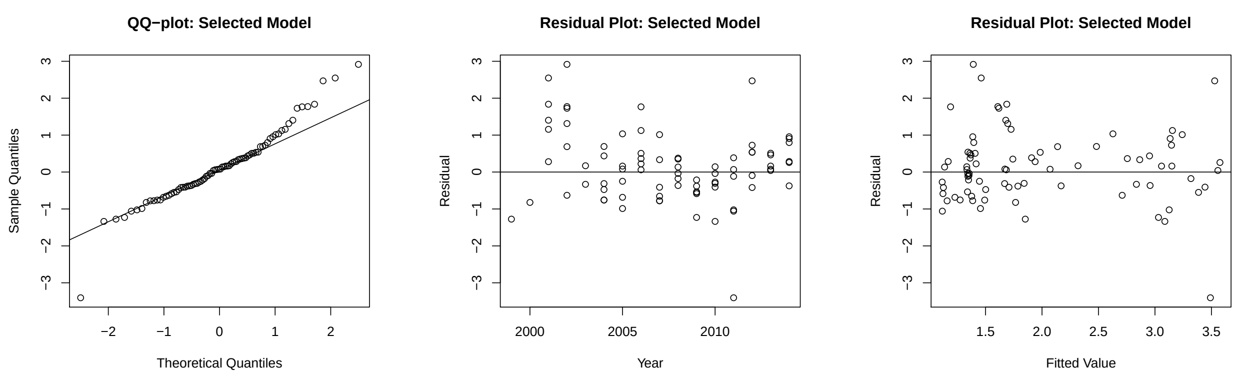
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.257	0.732	0.010	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
18	1616-43 (KPSF)	2011	17.18	3.49	-3.41

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	38.2611	2	0.0000
Cujo Outflow	126.5898	2	0.0000
Christine-Lac du Sauvage	17.1868	2	0.0002

- Conclusions:
  All monitored streams show significant deviation from the common slope of reference streams.

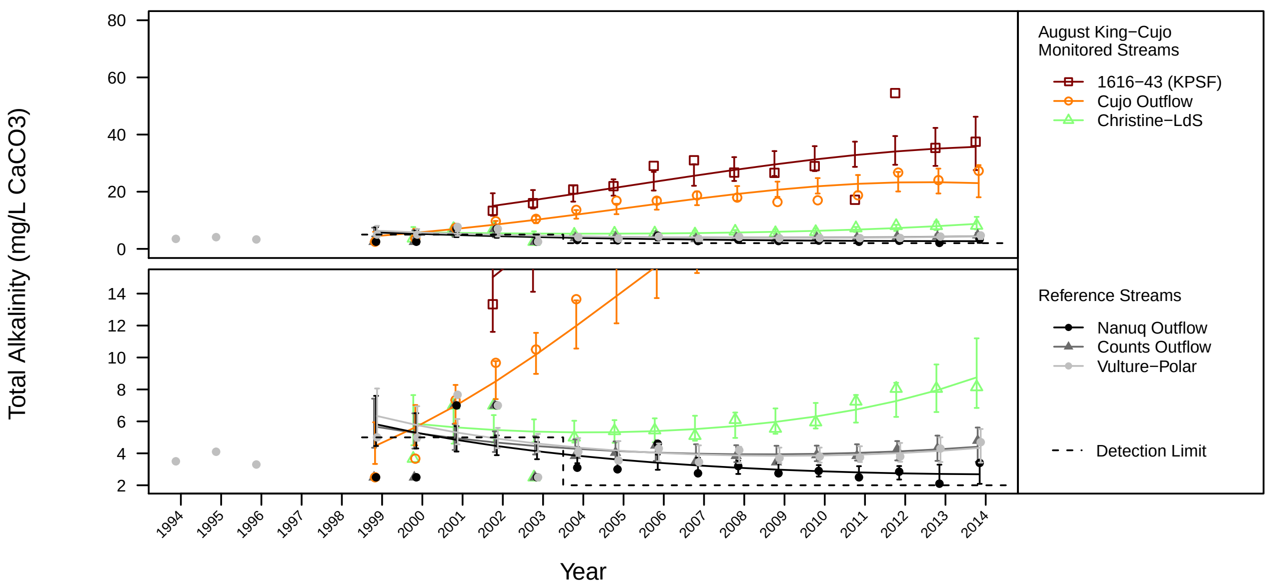
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.2860
Monitored Stream	1616-43 (KPSF)	0.5640
Monitored Stream	Christine-Lac du Sauvage	0.2920
Monitored Stream	Cujo Outflow	0.8510

- Conclusions:
  Model fit for pooled reference streams and Christine-Lac du Sauvage is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total alkalinity for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	3.75E+01	3.57E+01	4.71E+00	2.76E+01	4.62E+01	1.38E+01
Cujo Outflow	2.73E+01	2.30E+01	2.84E+00	1.81E+01	2.93E+01	8.31E+00
Christine-Lac du Sauvage	8.15E+00	8.75E+00	1.10E+00	6.84E+00	1.12E+01	3.22E+00
Nanuq Outflow	3.40E+00	2.69E+00	3.45E-01	2.09E+00	3.46E+00	
Counts Outflow	4.80E+00	4.41E+00	5.43E-01	3.47E+00	5.61E+00	
Vulture-Polar	4.70E+00	4.35E+00	5.32E-01	3.42E+00	5.52E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Alkalinity	August	King-Cujo	Stream	Water	none	log e	Tobit regression	#2 shared slopes	NA	1616-43 (KPSF) Cujo Outflow Christine-Lac du Sauvage

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

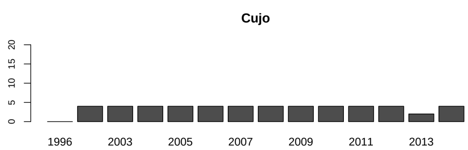
Analysis of April Hardness in Lakes of the King-Cujo Watershed and Lac du Sauvage

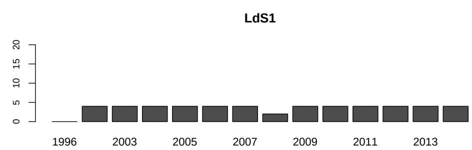
November 14, 2014

1 Censored Values:

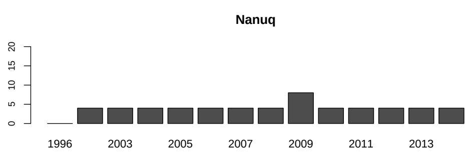
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

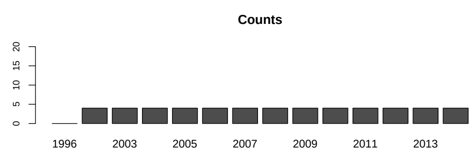
1.1 Monitored

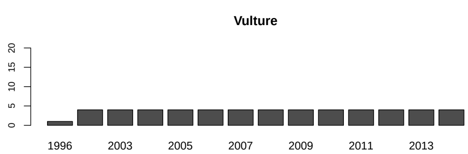




1.2 Reference

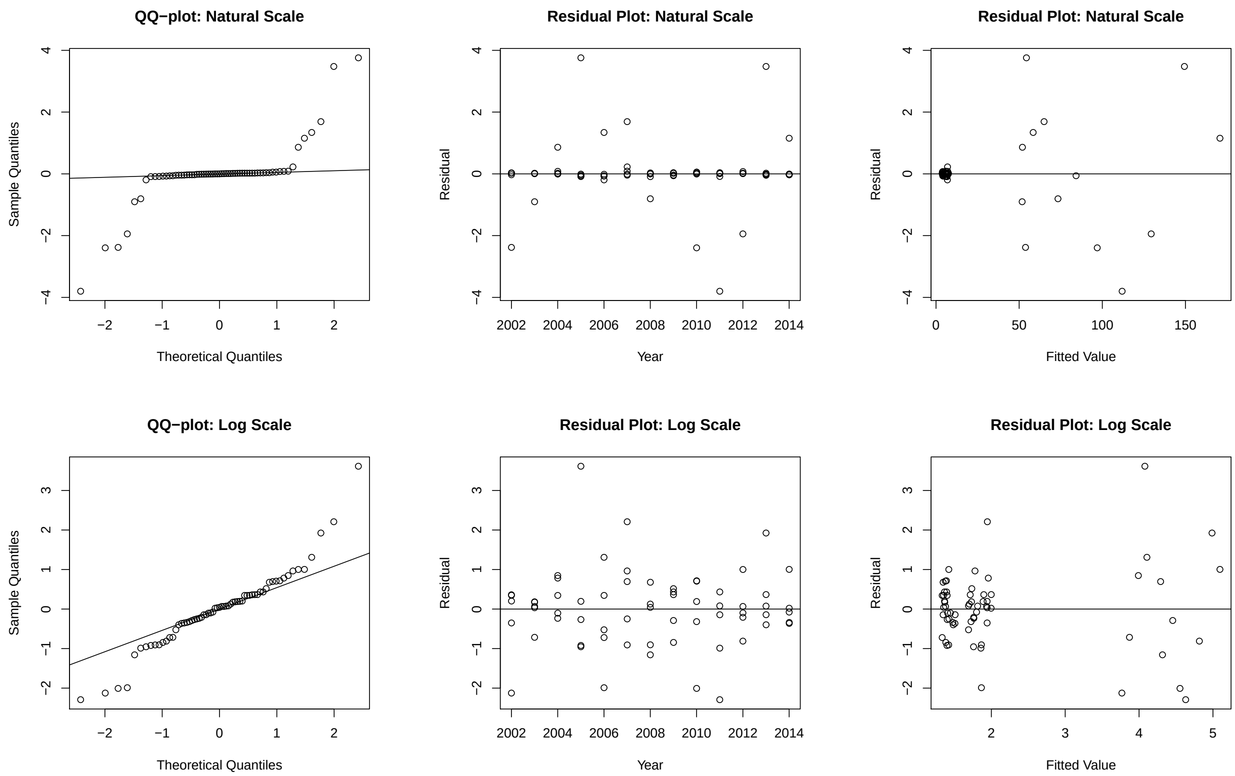






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	83.67	54.36	3.76
60	Cujo	2011	82.28	111.92	-3.80
62	Cujo	2013	176.50	149.37	3.48

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	83.67	4.08	3.61

AIC weights and model comparison:

Natural Model	Log Model	Best Model
7.00E-123	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
1545.20	6.00	0.00

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.21	4.00	0.99

- Conclusions:
  The slopes do not differ significantly among reference lakes.

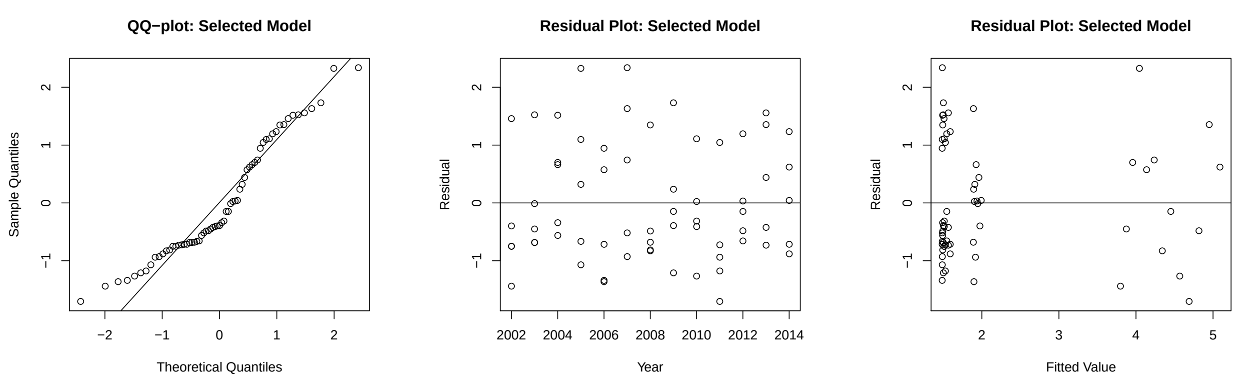
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	29.42	2.00	0.00
LdS1	0.11	2.00	0.94

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

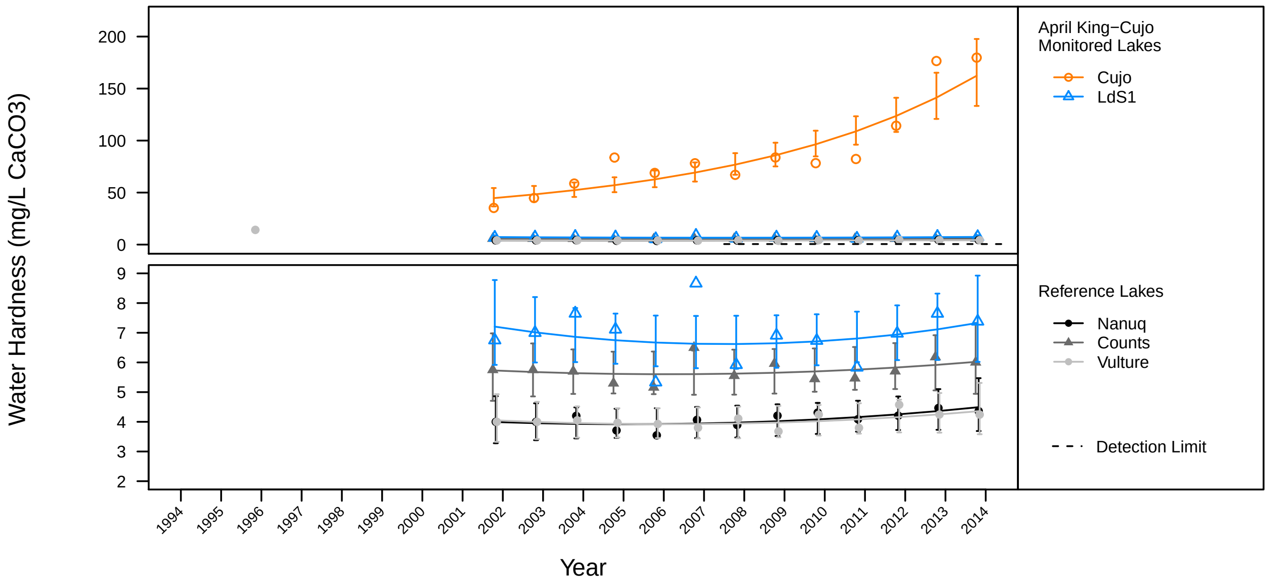
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0340
Monitored Lake	Cujo	0.8250
Monitored Lake	LdS1	0.0700

- Conclusions:
  Model fit for pooled reference lakes and site LdS1 is poor.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean hardness for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.80E+02	1.62E+02	1.63E+01	1.33E+02	1.98E+02	4.77E+01
LdS1	7.38E+00	7.33E+00	7.36E-01	6.02E+00	8.93E+00	2.15E+00
Nanuq	4.36E+00	4.49E+00	4.51E-01	3.69E+00	5.47E+00	
Counts	6.00E+00	6.02E+00	6.05E-01	4.94E+00	7.33E+00	
Vulture	4.24E+00	4.36E+00	4.38E-01	3.58E+00	5.31E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Hardness	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

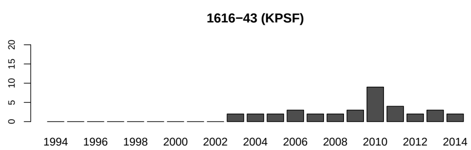
Analysis of August Hardness in Lakes of the King-Cujo Watershed and Lac du Sauvage

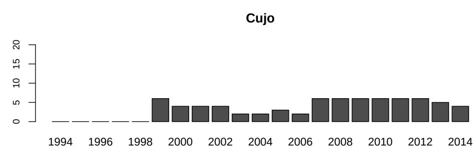
November 14, 2014

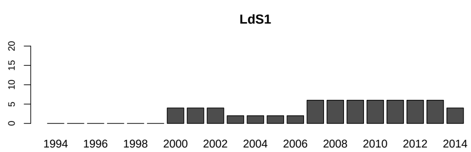
1 Censored Values:

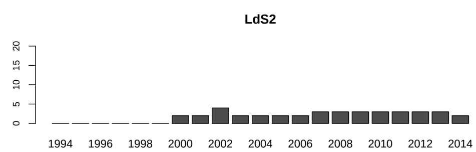
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

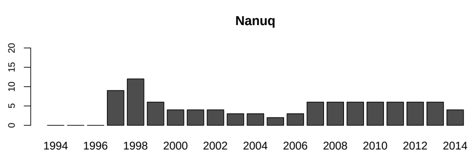


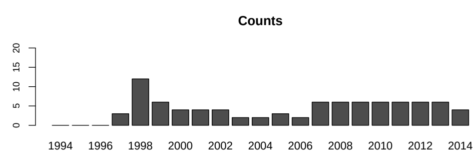


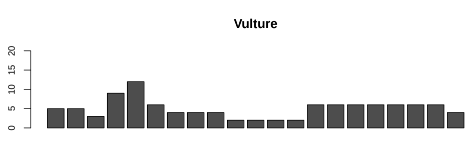




1.2 Reference

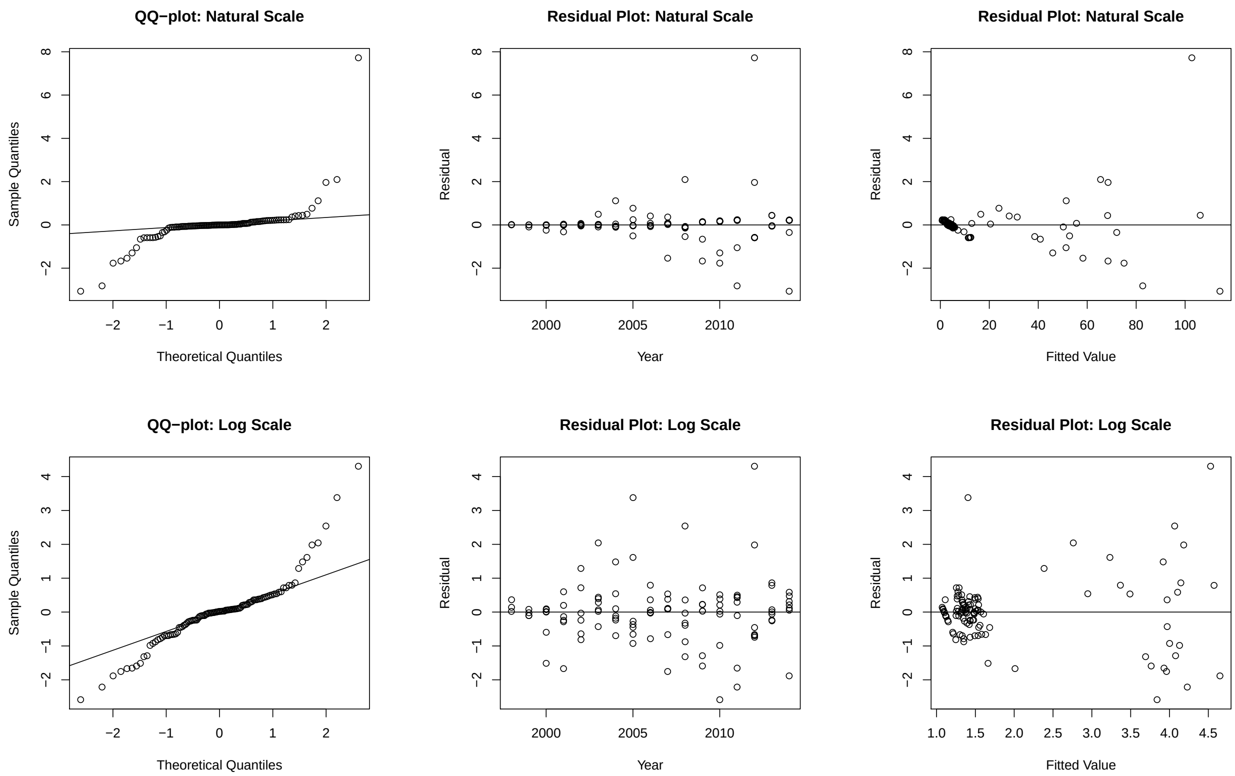






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	204.00	102.75	7.72
21	1616-43 (KPSF)	2014	74.05	114.22	-3.06

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	204.00	4.53	4.31
117	Nanuq	2005	7.57	1.40	3.38

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
1.44	6.00	0.96

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

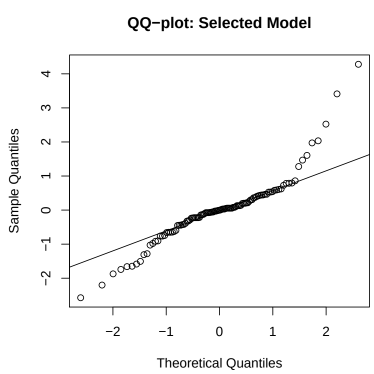
3.2 Compare Reference Models using AIC Weights

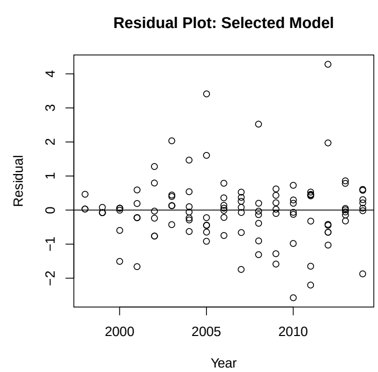
- Results:

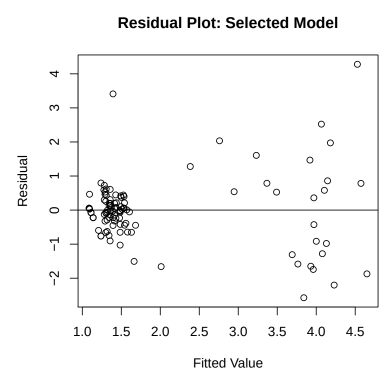
	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.005	0.000	0.995	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model







Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	204.00	4.53	4.28
117	Nanuq	2005	7.57	1.39	3.41

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	571.5280	3	0.0000
Cujo	1465.7754	3	0.0000
LdS1	8.8397	3	0.0315
LdS2	11.0345	3	0.0115

- Conclusions:
  All monitored lakes show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	4.0197	2	0.1340
Cujo	228.6939	2	0.0000
LdS1	0.3466	2	0.8409
LdS2	0.2305	2	0.8911

- Conclusions:
  When allowing for differences in intercept, Cujo Lake shows significant deviation from the common slope of reference lakes.

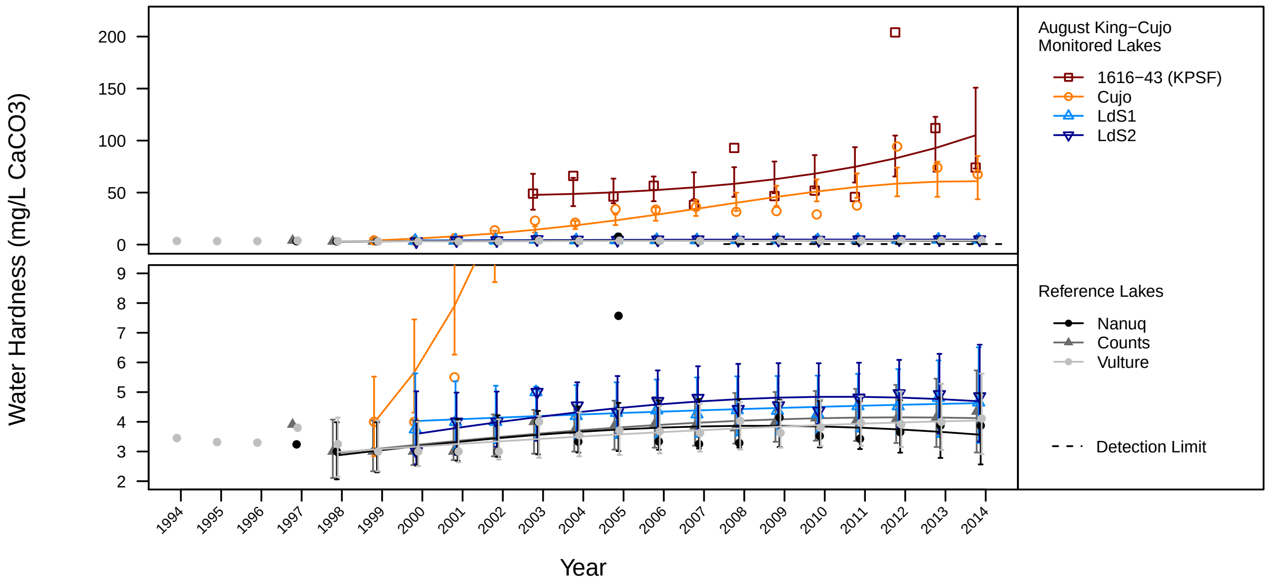
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3600
Monitored Lake	1616-43 (KPSF)	0.2960
Monitored Lake	Cujo	0.8800
Monitored Lake	LdS1	0.3900
Monitored Lake	LdS2	0.5770

- Conclusions:
  Model fit for pooled reference lakes, 1616-43 (KPSF), LdS1 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean hardness for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	7.41E+01	1.05E+02	1.94E+01	7.32E+01	1.51E+02	5.67E+01
Cujo	6.75E+01	6.09E+01	1.04E+01	4.36E+01	8.51E+01	3.05E+01
LdS2	4.86E+00	4.69E+00	8.16E-01	3.34E+00	6.60E+00	2.39E+00
LdS1	4.66E+00	4.63E+00	8.05E-01	3.29E+00	6.51E+00	2.36E+00
Nanuq	3.87E+00	3.57E+00	5.99E-01	2.57E+00	4.96E+00	
Counts	4.35E+00	4.12E+00	6.93E-01	2.97E+00	5.73E+00	
Vulture	4.11E+00	4.05E+00	6.80E-01	2.91E+00	5.62E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Hardness	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	1616-43 (KPSF) Cujo LdS1 LdS2

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

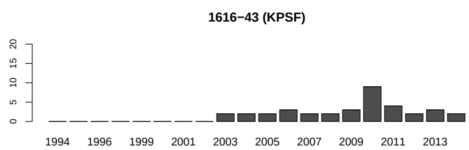
Analysis of August Hardness in King-Cujo Watershed Streams

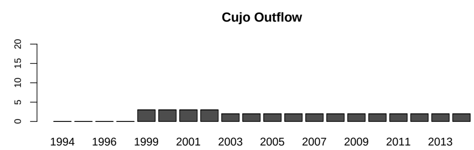
November 17, 2014

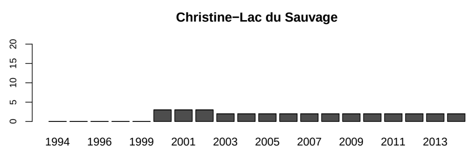
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

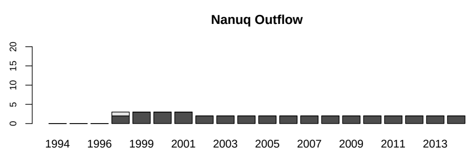
1.1 Monitored

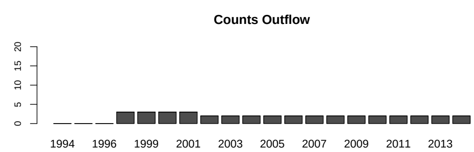


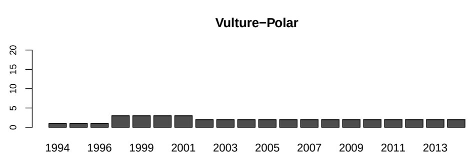




1.2 Reference

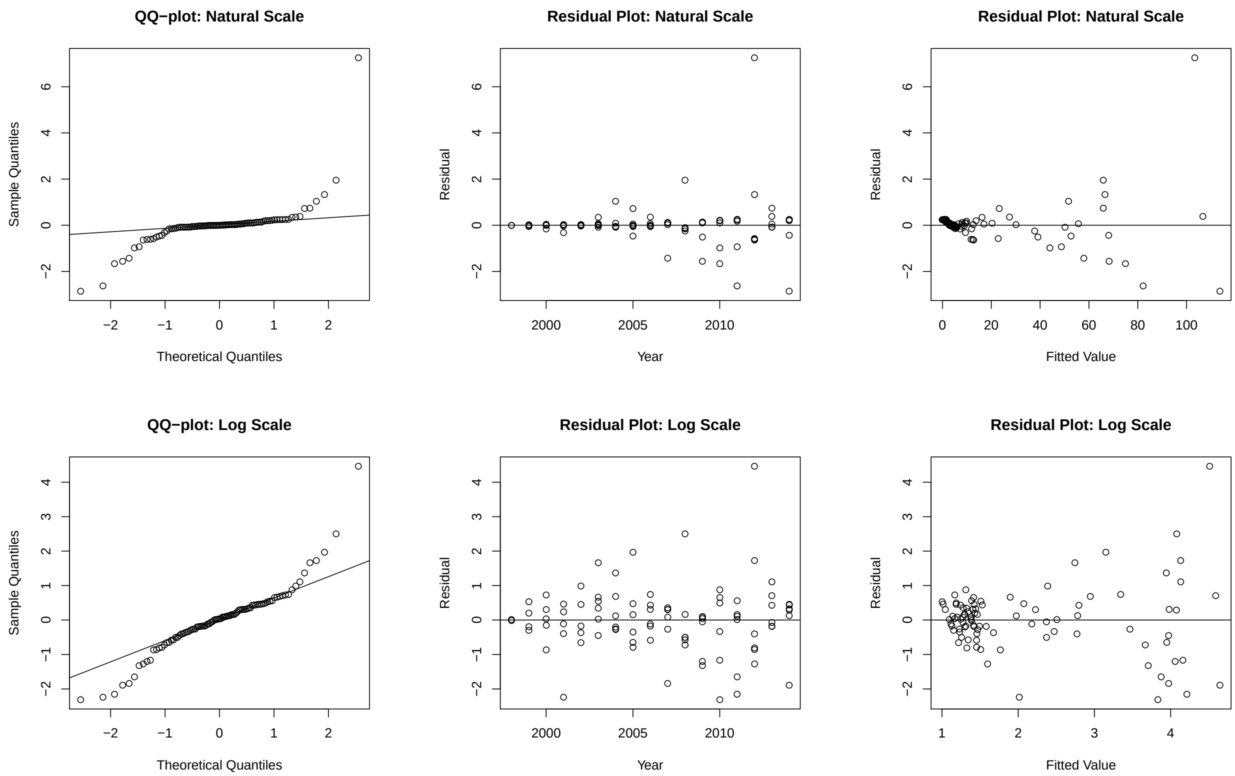






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	204.00	103.37	7.25

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	204.00	4.51	4.46

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
26.76	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
5.65	4.00	0.23

- Conclusions:
  The slopes do not differ significantly among reference streams.

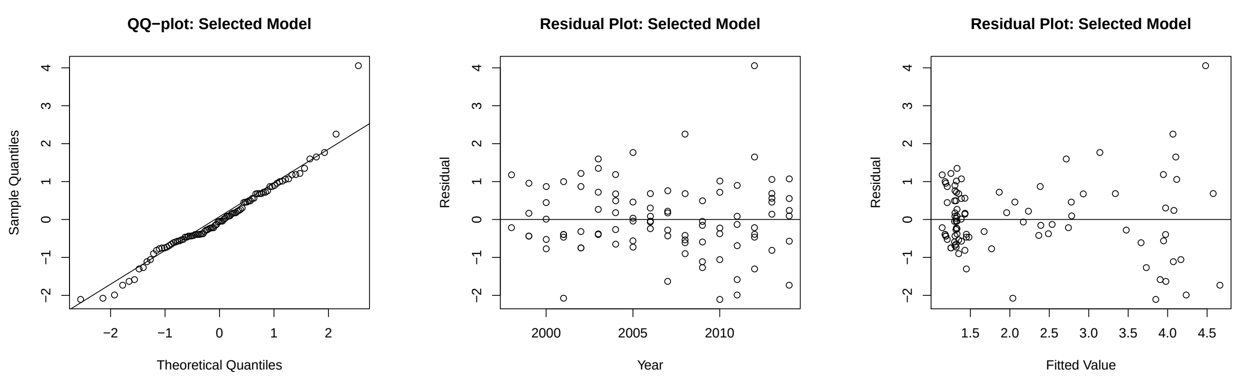
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.986	0.000	0.014	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference streams are best modeled using separate slopes and intercepts, contrasts suggest that reference streams share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference streams) to avoid defaulting to comparing trends in monitored streams against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	204.00	4.48	4.06

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	2.8841	2	0.2364
Cujo Outflow	179.8307	2	0.0000
Christine-Lac du Sauvage	40.1213	2	0.0000

- Conclusions:
  Cujo Outflow and Christine-Lac du Sauvage show significant deviation from the common slope of reference streams.

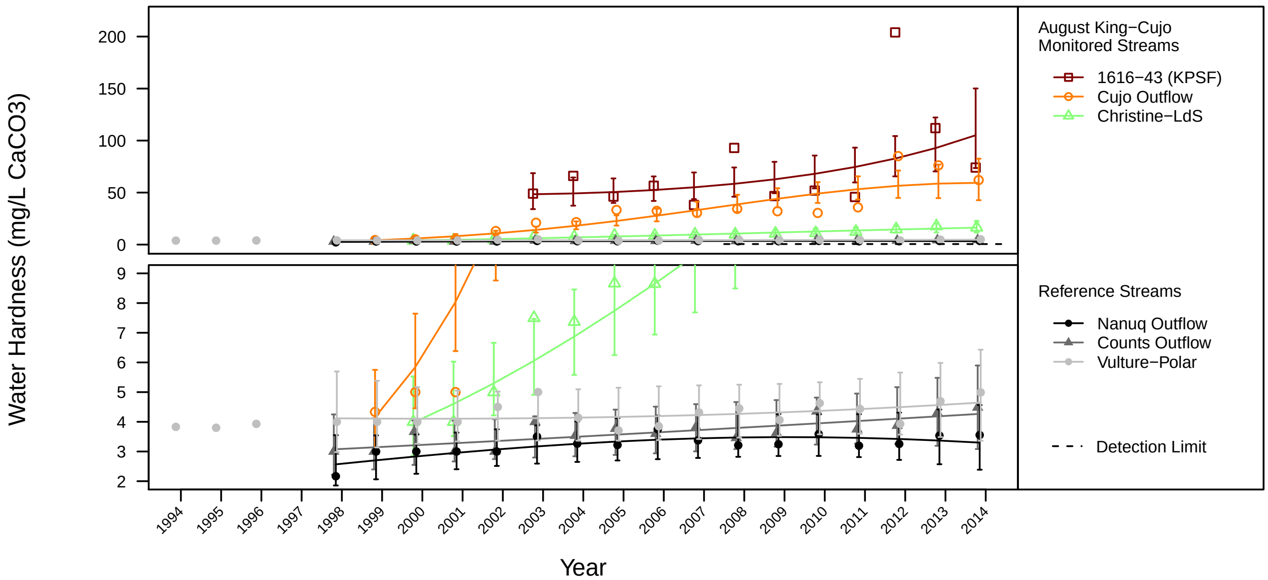
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.2020
Monitored Stream	1616-43 (KPSF)	0.2900
Monitored Stream	Christine-Lac du Sauvage	0.9520
Monitored Stream	Cujo Outflow	0.8920

- Conclusions:
  Model fit for pooled reference streams and 1616-43 (KPSF) is weak.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean hardness for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	7.41E+01	1.05E+02	1.91E+01	7.36E+01	1.50E+02	5.59E+01
Cujo Outflow	6.20E+01	5.94E+01	9.99E+00	4.27E+01	8.26E+01	2.92E+01
Christine-Lac du Sauvage	1.65E+01	1.63E+01	2.79E+00	1.16E+01	2.27E+01	8.15E+00
Nanuq Outflow	3.55E+00	3.30E+00	5.46E-01	2.39E+00	4.56E+00	
Counts Outflow	4.48E+00	4.26E+00	7.05E-01	3.08E+00	5.90E+00	
Vulture-Polar	4.99E+00	4.65E+00	7.69E-01	3.36E+00	6.43E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Hardness	August	King-Cujo	Stream	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	Cujo Outflow Christine-Lac du Sauvage

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

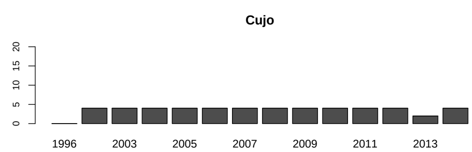
Analysis of April Chloride in Lakes of the King-Cujo Watershed and Lac du Sauvage

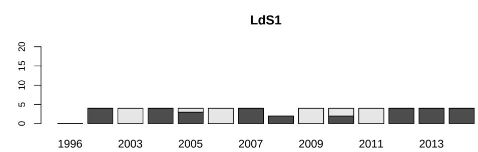
November 14, 2014

1 Censored Values:

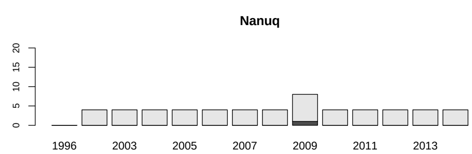
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

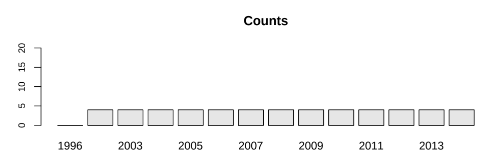
1.1 Monitored

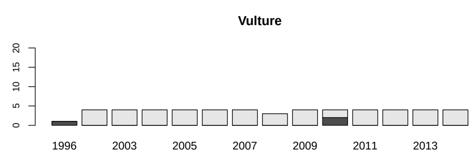




1.2 Reference

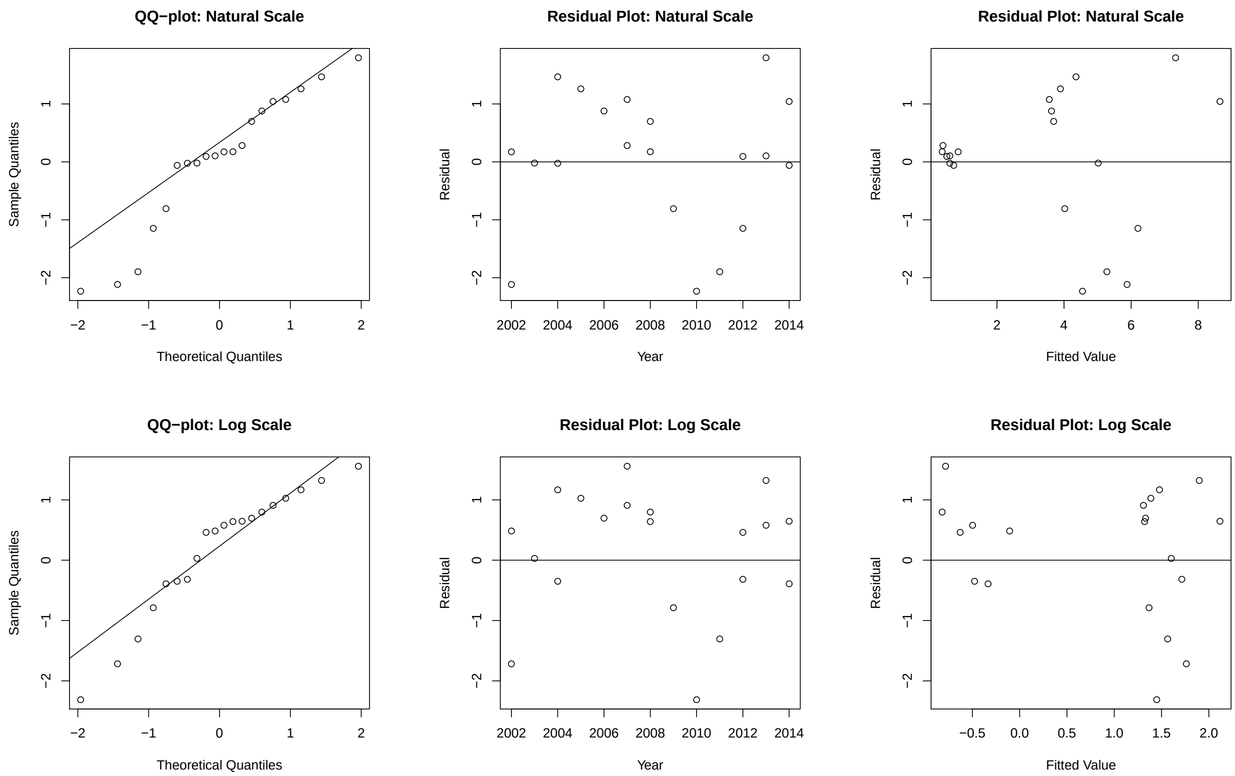






Comment:
Greater than 60% of data in Counts, Nanuq, and Vulture lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in LdS1 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
2.15E-17	1.00E+00	log model

Conclusion:
AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	15.6487	2	0.0004
LdS1	10.2240	2	0.0060

- Conclusions:
  Cujo Lake and LdS1 show significant deviation from a slope of zero.

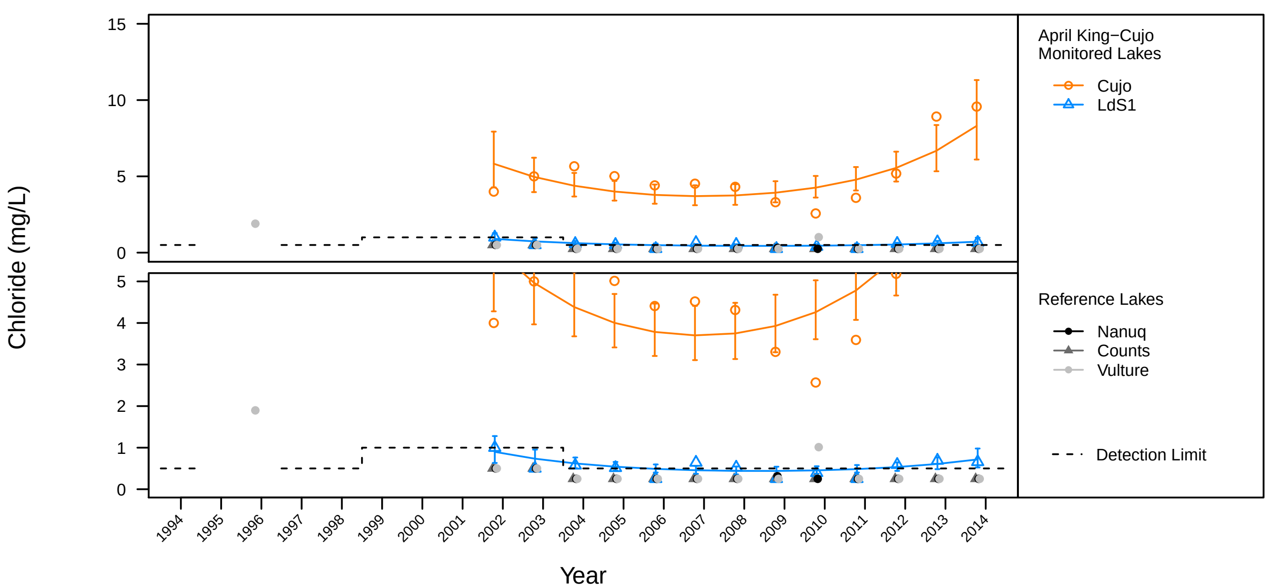
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Cujo	0.4790
Monitored Lake	LdS1	0.3550

- Conclusions:
  Model fit for Cujo Lake and LdS1 Lake is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean chloride for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	9.57E+00	8.31E+00	1.31E+00	6.10E+00	1.13E+01	3.83E+00
LdS1	6.57E-01	7.16E-01	1.14E-01	5.24E-01	9.79E-01	3.35E-01
Nanuq	2.50E-01					
Counts	2.50E-01					
Vulture	2.50E-01					

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Chloride	April	King-Cujo	Lake	Water	Counts Nanuq Vulture	log e	Tobit regression	#1a slope of zero	hardness-dependent	Cujo LdS1

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

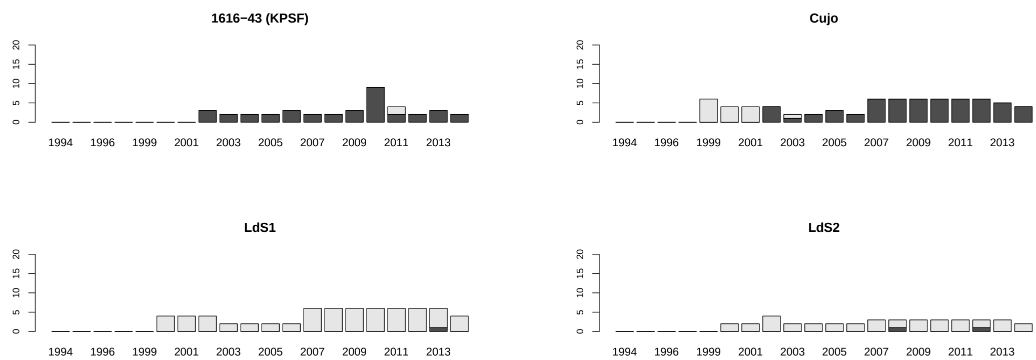
Analysis of August Chloride in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 17, 2014

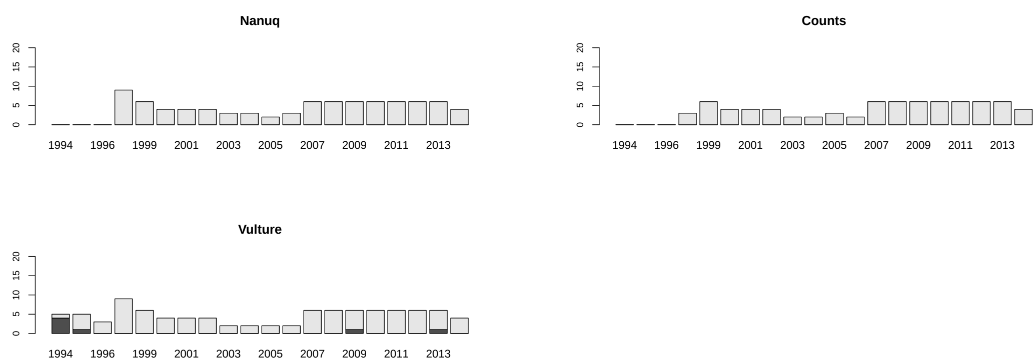
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

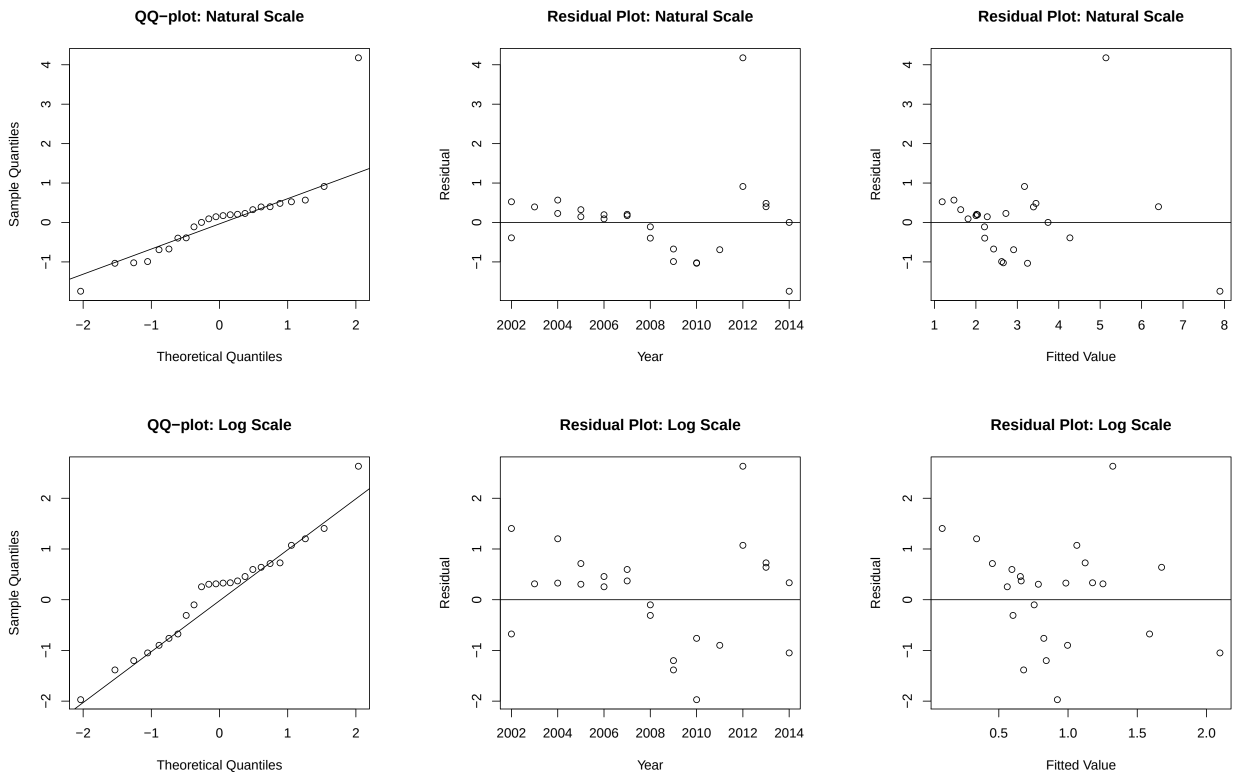


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, LdS1, and LdS2 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Cujo Lake was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	11.60	5.14	4.18

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. AIC reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	14.7207	2	0.0006
Cujo	13.2019	2	0.0014

- Conclusions:
  1616-43 (KPSF) and Cujo Lake show significant deviation from a slope of zero.

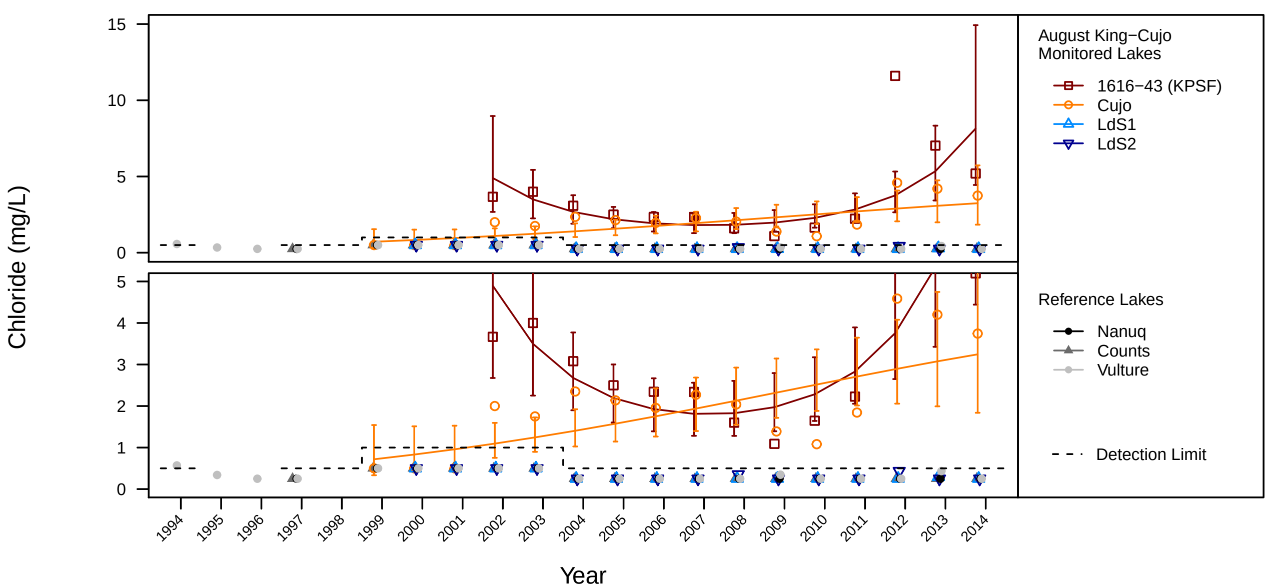
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-43 (KPSF)	0.5380
Monitored Lake	Cujo	0.5280

- Conclusions:
  Models provide a good fit for all monitored lakes.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean chloride for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.20E+00	8.14E+00	2.52E+00	4.44E+00	1.49E+01	7.37E+00
Cujo	3.75E+00	3.24E+00	9.41E-01	1.84E+00	5.73E+00	2.75E+00
LdS2	2.50E-01					
LdS1	2.50E-01					
Nanuq	2.50E-01					
Counts	2.50E-01					
Vulture	2.50E-01					

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Chloride	August	King-Cujo	Lake	Water	Nanuq Counts Vulture LdS1 LdS2	log e	Tobit regression	#1a slope of zero	hardness-dependent	1616-43 (KPSF) Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

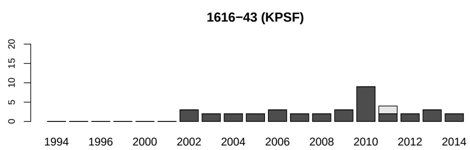
Analysis of August Chloride in King-Cujo Watershed Streams

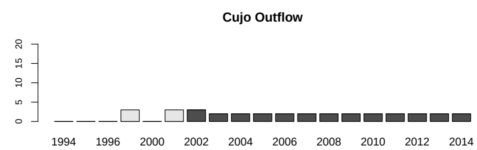
November 14, 2014

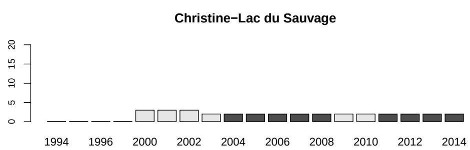
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

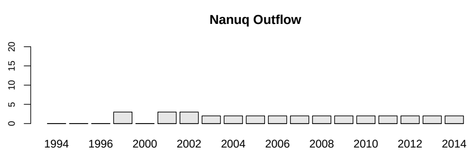
1.1 Monitored

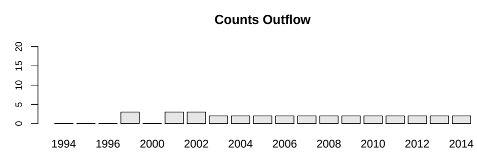


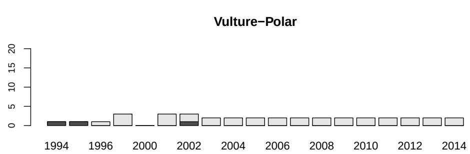




1.2 Reference

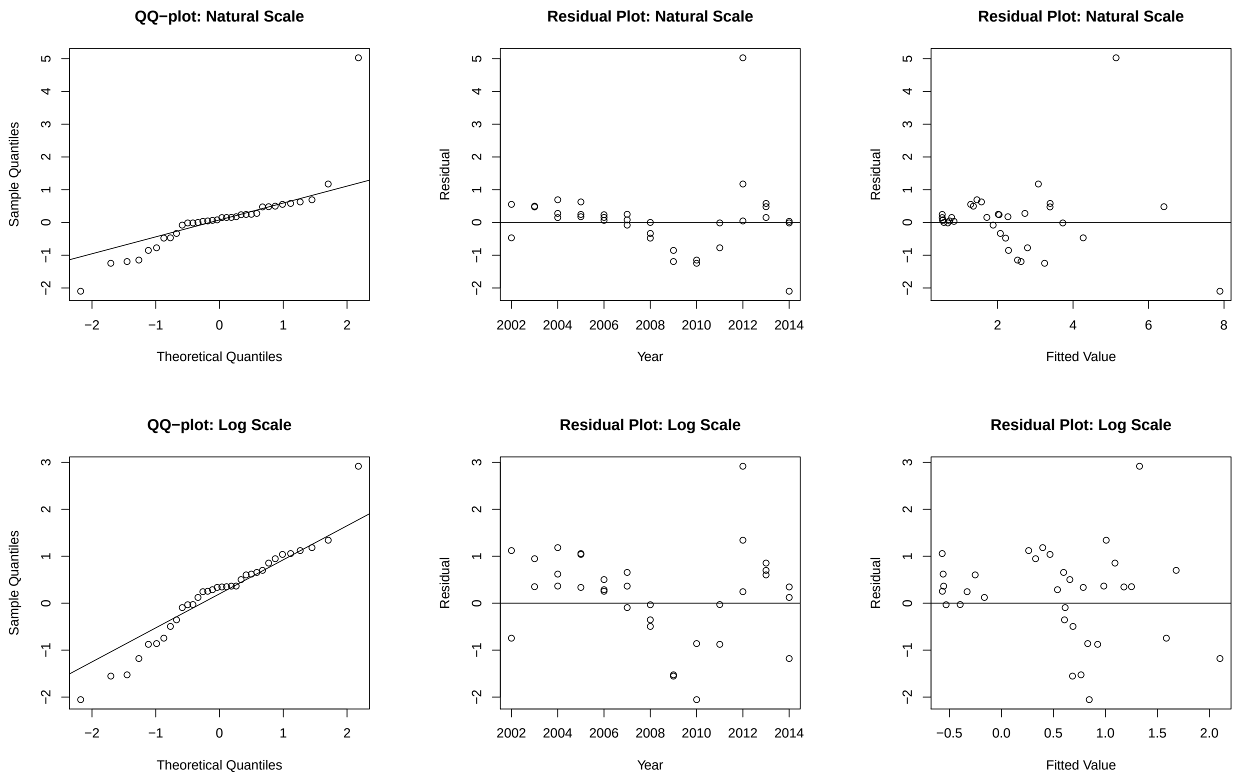






Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, and Vulture-Polar was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Cujo Outflow and Christine-Lac du Sauvage was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	11.60	5.14	5.03

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	18.2206	2	0.0001
Cujo Outflow	9.8602	2	0.0072
Christine-Lac du Sauvage	1.3582	2	0.5071

- Conclusions:
  1616-43 (KPSF) and Cujo Outflow show significant deviation from a slope of zero.

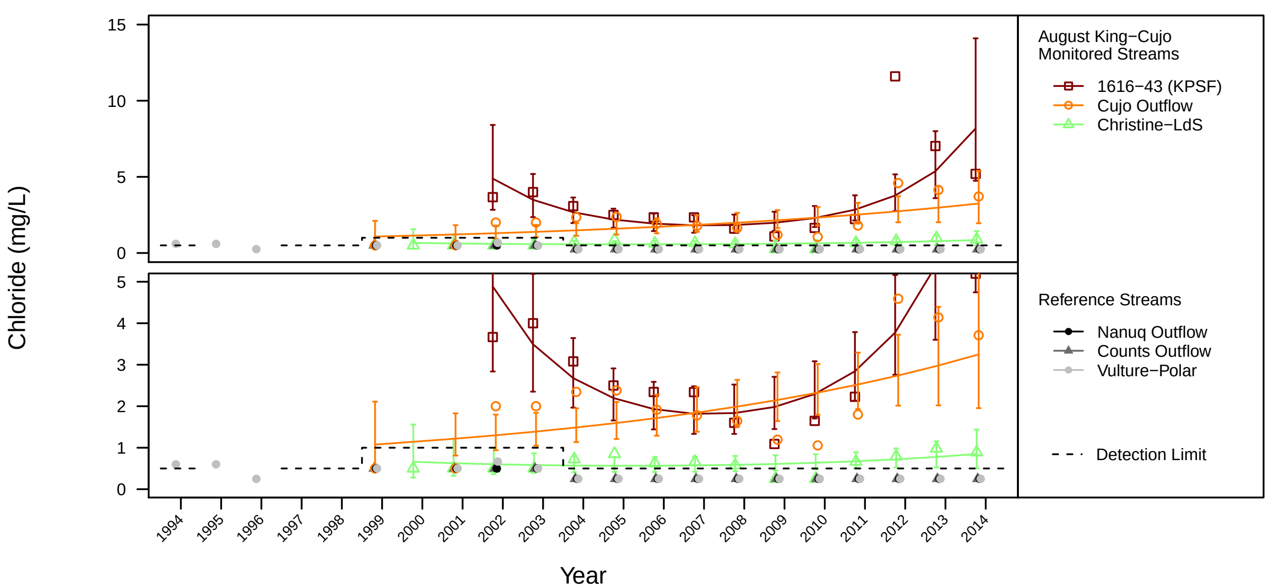
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-43 (KPSF)	0.5380
Monitored Stream	Christine-Lac du Sauvage	0.1390
Monitored Stream	Cujo Outflow	0.3180

- Conclusions:
  Model fit for Cujo Outflow is weak. Model fit for Christine-Lac du Sauvage is poor.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean chloride for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.20E+00	8.18E+00	2.27E+00	4.74E+00	1.41E+01	6.65E+00
Cujo Outflow	3.71E+00	3.25E+00	8.42E-01	1.95E+00	5.40E+00	2.46E+00
Christine-Lac du Sauvage	8.90E-01	8.49E-01	2.28E-01	5.02E-01	1.44E+00	6.67E-01
Nanuq Outflow	2.50E-01					
Counts Outflow	2.50E-01					
Vulture-Polar	2.50E-01					

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Chloride	August	King-Cujo	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar	log e	Tobit regression	#1a slope of zero	hardness-dependent	1616-43 (KPSF) Cujo Outflow

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

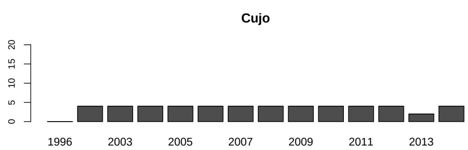
Analysis of April Sulphate in Lakes of the King-Cujo Watershed and Lac du Sauvage

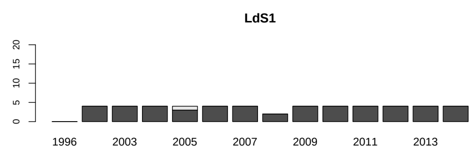
November 14, 2014

1 Censored Values:

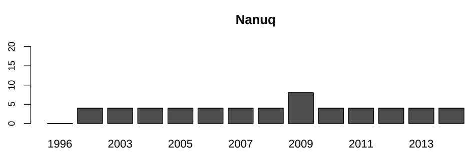
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

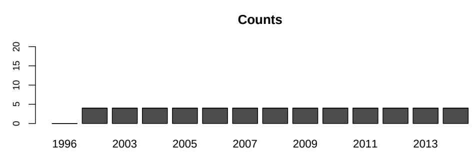
1.1 Monitored

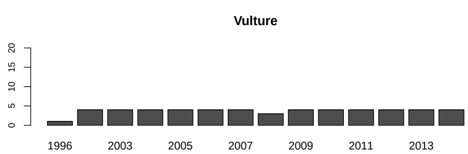




1.2 Reference

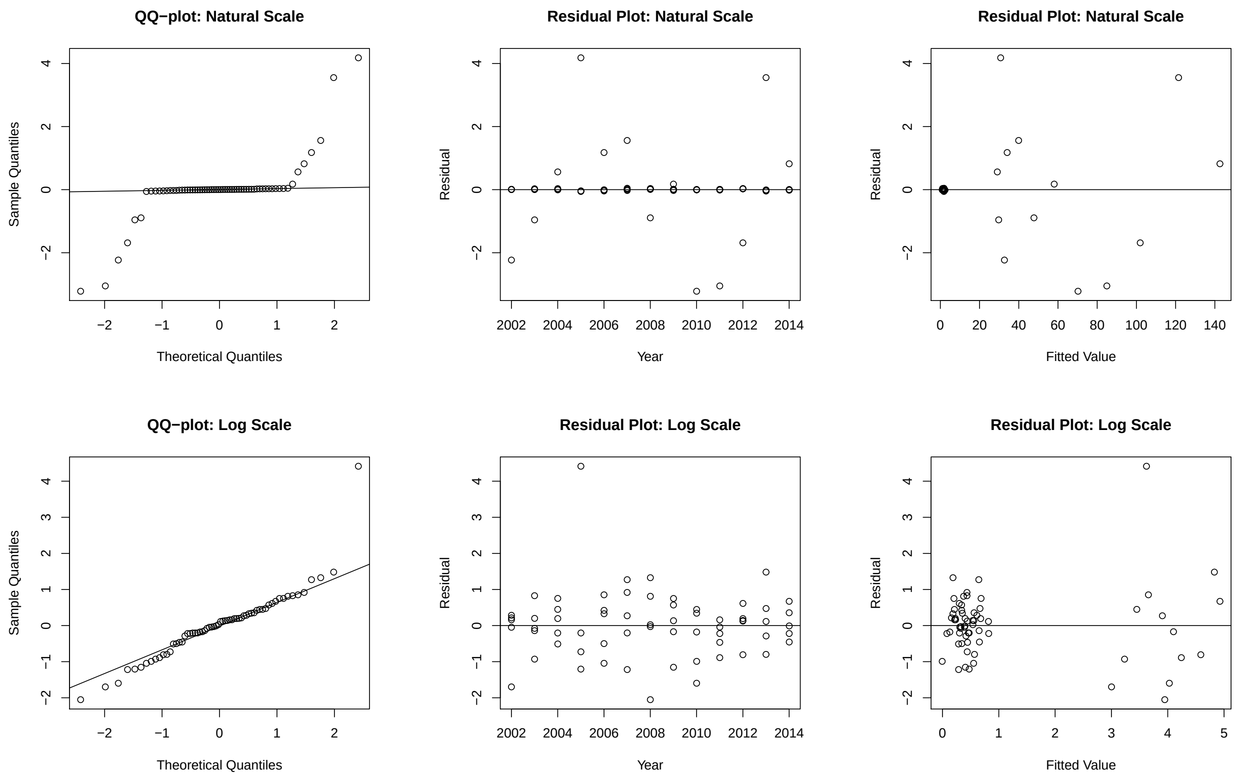






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	60.73	30.75	4.18
59	Cujo	2010	47.15	70.23	-3.22
60	Cujo	2011	63.05	84.92	-3.05
62	Cujo	2013	147.00	121.53	3.55

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	60.73	3.62	4.41

AIC weights and model comparison:

Natural Model	Log Model	Best Model
6.77E-114	1.00E+00	log model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
508.47	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
2.40	4.00	0.66

- Conclusions:
  The slopes do not differ significantly among reference lakes.

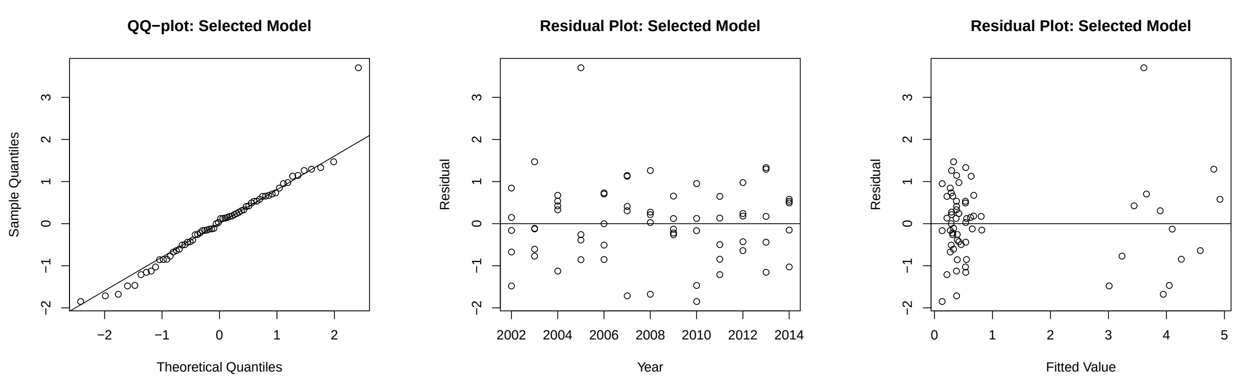
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.981	0.006	0.013	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	60.73	3.61	3.70

No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	65.85	2.00	0.00
LdS1	0.27	2.00	0.88

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

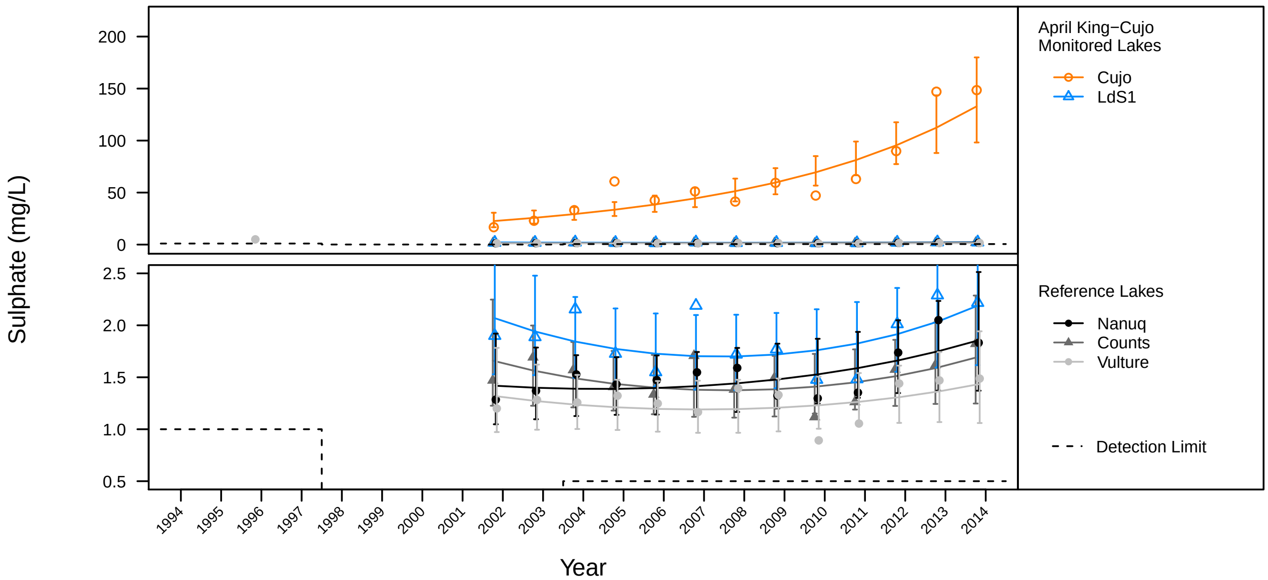
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1710
Monitored Lake	Cujo	0.8230
Monitored Lake	LdS1	0.2910

- Conclusions:
  Model fit for LdS1 Lake is weak. Model fit for pooled reference lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean sulphate for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.48E+02	1.33E+02	2.05E+01	9.82E+01	1.80E+02	6.01E+01
LdS1	2.22E+00	2.19E+00	3.38E-01	1.62E+00	2.96E+00	9.90E-01
Nanuq	1.83E+00	1.86E+00	2.87E-01	1.37E+00	2.51E+00	
Counts	1.82E+00	1.69E+00	2.61E-01	1.25E+00	2.29E+00	
Vulture	1.49E+00	1.43E+00	2.22E-01	1.06E+00	1.94E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Sulphate	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	hardness-dependent	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

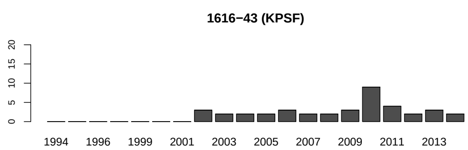
Analysis of August Sulphate in Lakes of the King-Cujo Watershed and Lac du Sauvage

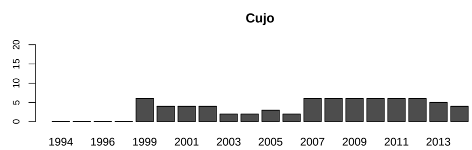
November 14, 2014

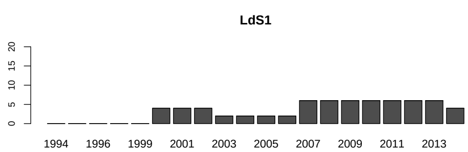
1 Censored Values:

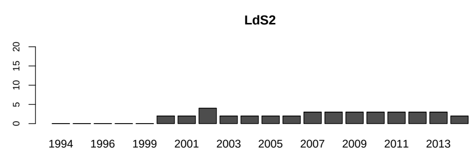
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

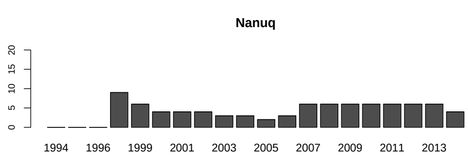


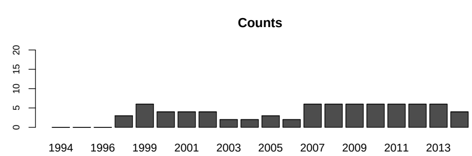


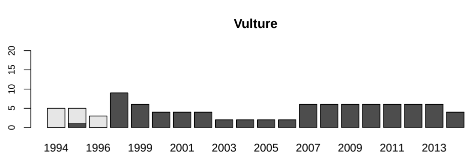




1.2 Reference

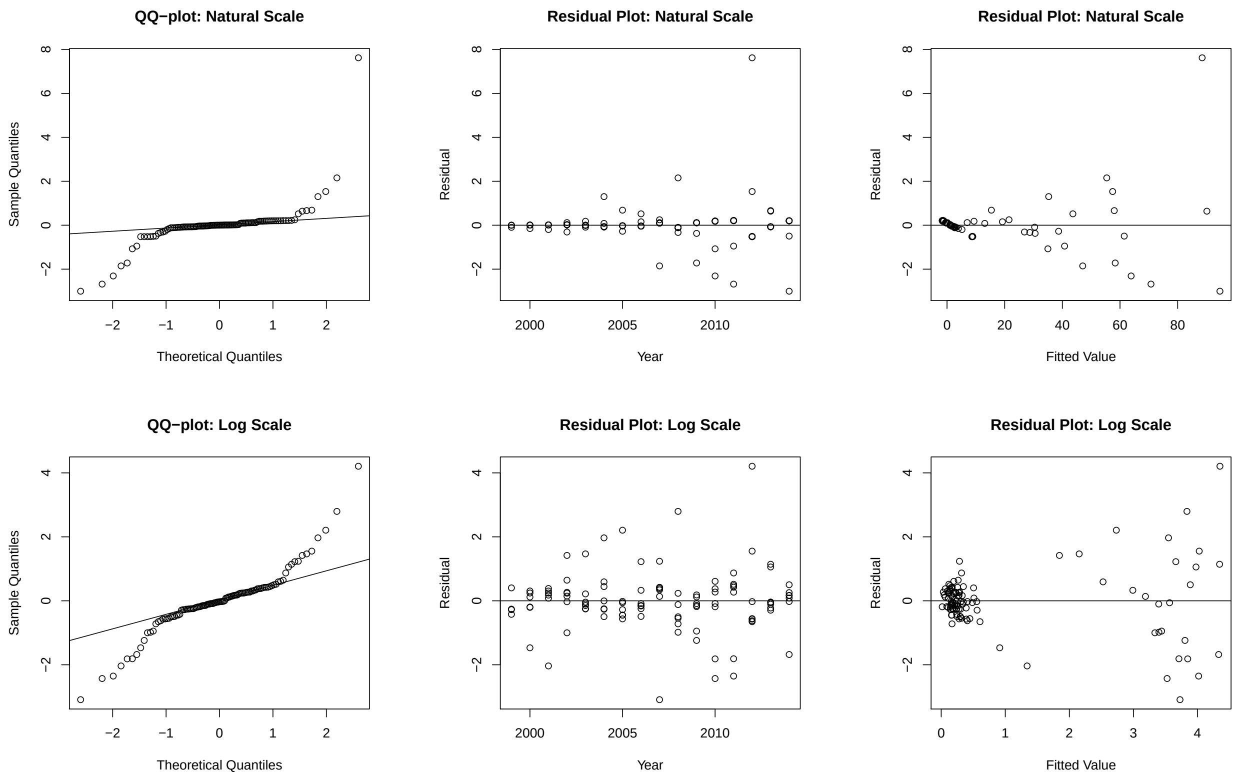






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	195.50	88.50	7.62
21	1616-43 (KPSF)	2014	52.50	94.66	-3.00

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
14	1616-43 (KPSF)	2007	21.05	3.73	-3.09
19	1616-43 (KPSF)	2012	195.50	4.35	4.21

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
3.75	6.00	0.71

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

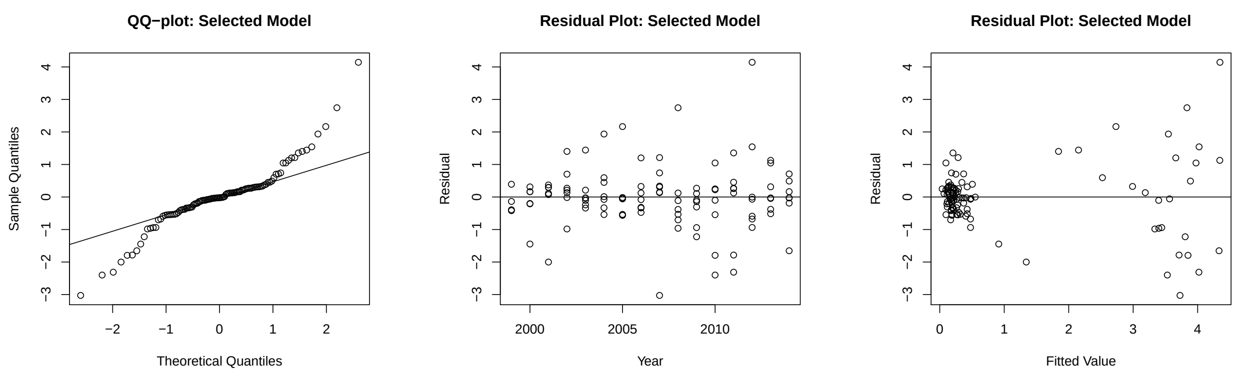
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.015	0.000	0.985	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
14	1616-43 (KPSF)	2007	21.05	3.73	-3.03
19	1616-43 (KPSF)	2012	195.50	4.35	4.14

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	197.7599	3	0.0000
Cujo	1782.4047	3	0.0000
LdS1	0.5994	3	0.8966
LdS2	1.3709	3	0.7124

- Conclusions:
  1616-43 (KPSF) and Cujo Lake show significant deviation from the common slope of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	4.3240	2	0.1151
Cujo	254.7316	2	0.0000
LdS1	0.1145	2	0.9444
LdS2	0.1733	2	0.9170

- Conclusions:
  When allowing for differences in intercept, Cujo Lake shows significant deviation from the common slope of reference lakes.

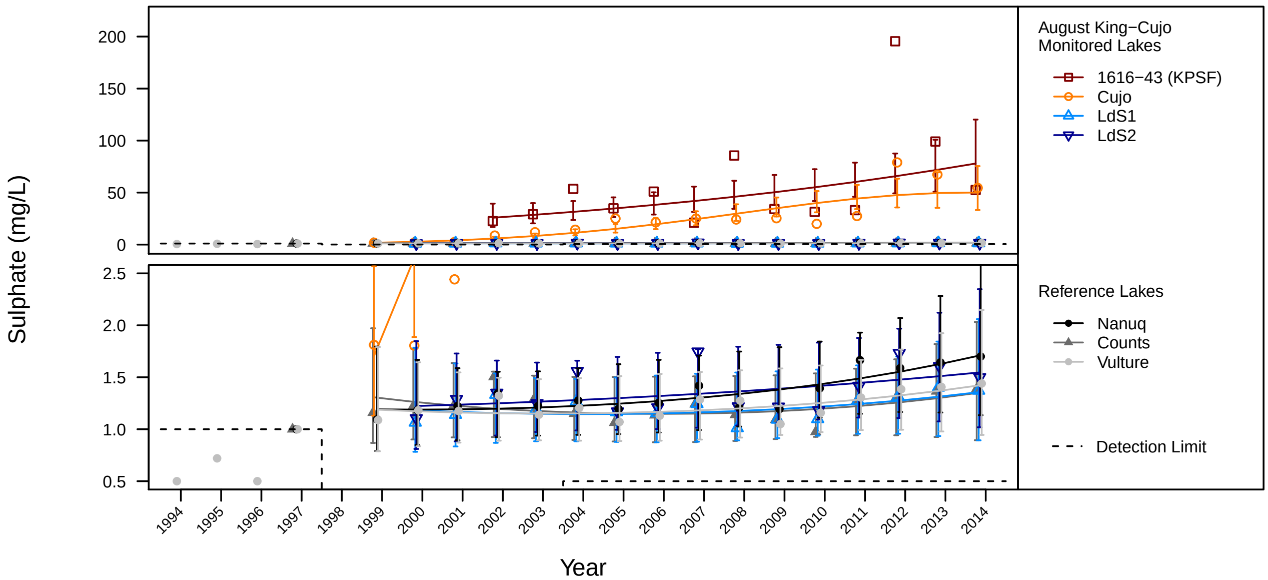
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3350
Monitored Lake	1616-43 (KPSF)	0.3040
Monitored Lake	Cujo	0.8940
Monitored Lake	LdS1	0.2980
Monitored Lake	LdS2	0.2490

- Conclusions:
  Model fit for pooled reference lakes, 1616-43 (KPSF), LdS1, and LdS2 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean sulphate for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.25E+01	7.79E+01	1.72E+01	5.05E+01	1.20E+02	5.04E+01
Cujo	5.45E+01	5.01E+01	1.05E+01	3.32E+01	7.55E+01	3.07E+01
LdS2	1.50E+00	1.55E+00	3.29E-01	1.02E+00	2.35E+00	9.64E-01
LdS1	1.37E+00	1.36E+00	2.89E-01	8.93E-01	2.06E+00	8.45E-01
Nanuq	1.70E+00	1.71E+00	3.58E-01	1.14E+00	2.58E+00	
Counts	1.39E+00	1.35E+00	2.82E-01	8.94E-01	2.03E+00	
Vulture	1.44E+00	1.42E+00	2.98E-01	9.45E-01	2.15E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Sulphate	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	hardness-dependent	1616-43 (KPSF) Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

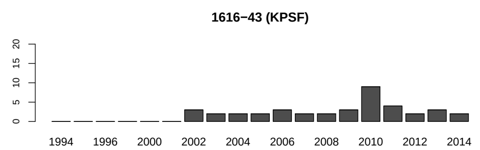
Analysis of August Sulphate in King-Cujo Watershed Streams

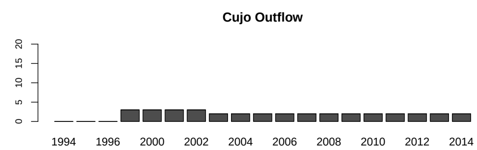
November 14, 2014

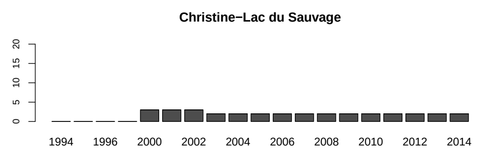
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

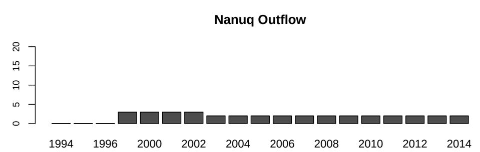
1.1 Monitored

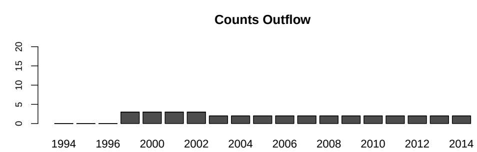


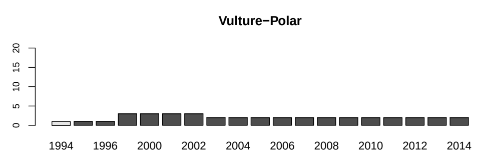




1.2 Reference

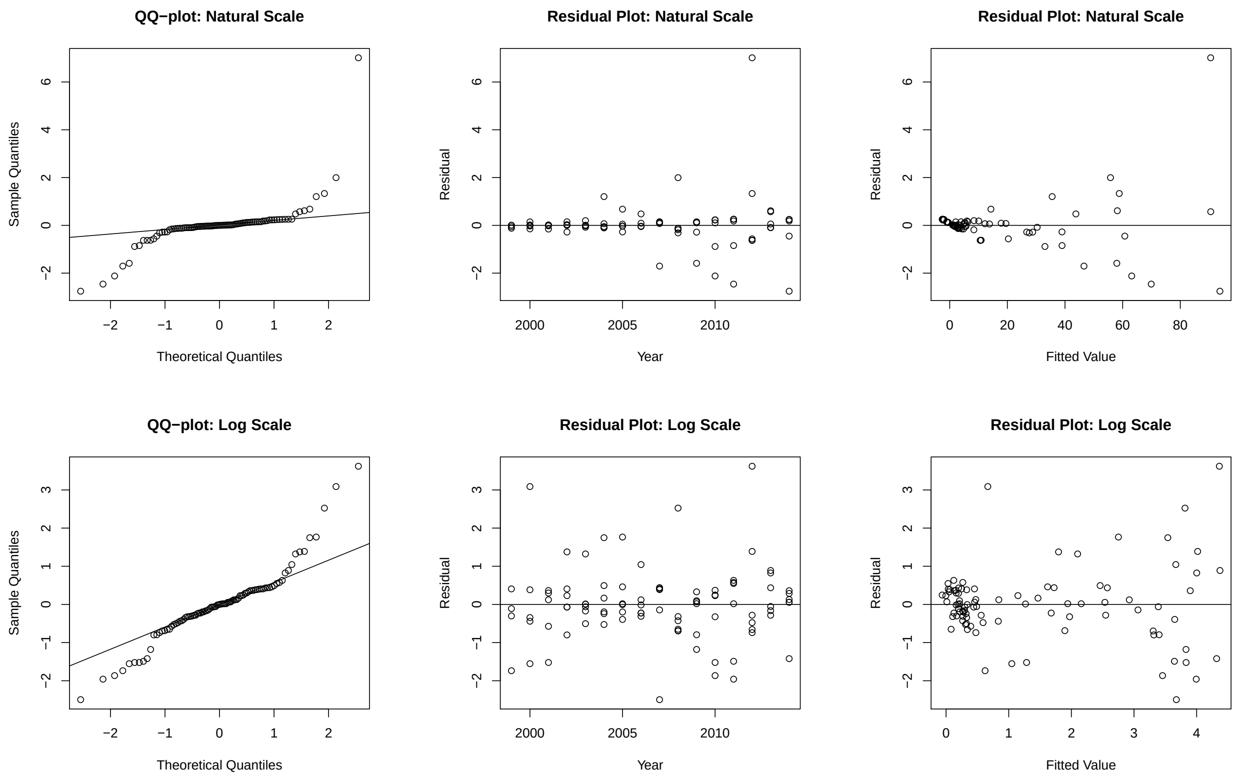






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	195.50	90.53	7.01

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	195.50	4.36	3.62
112	Vulture-Polar	2000	4.24	0.67	3.09

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
8.71	6.00	0.19

- Conclusions:
  The slopes and intercepts do not differ significantly among reference streams.

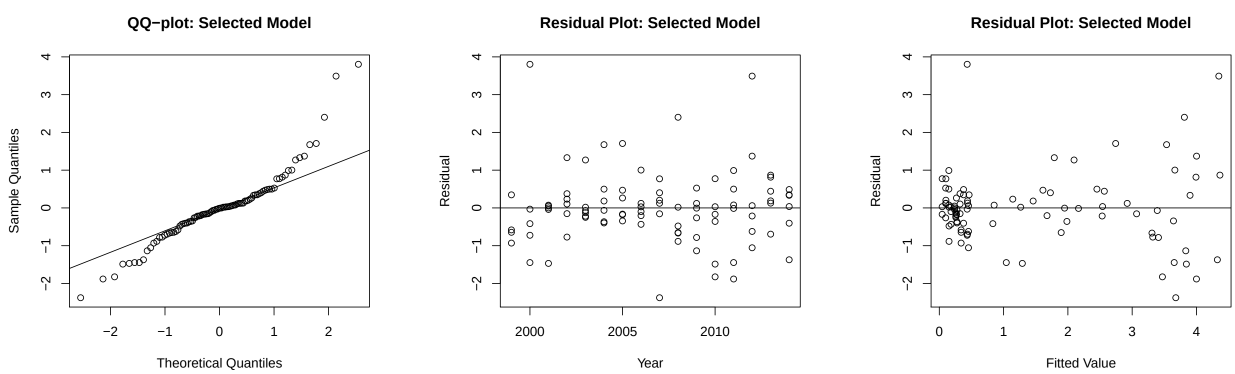
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.115	0.000	0.885	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	195.50	4.35	3.49
112	Vulture-Polar	2000	4.24	0.43	3.80

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the slope and intercept of each monitored stream compared to a common slope and intercept fitted for all reference streams together (reference model 3).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	113.5852	3	0.0000
Cujo Outflow	1240.6048	3	0.0000
Christine-Lac du Sauvage	405.1716	3	0.0000

- Conclusions:
  All monitored streams show significant deviation from the common slope and intercept of reference streams.

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	3.7735	2	0.1516
Cujo Outflow	205.9766	2	0.0000
Christine-Lac du Sauvage	51.1917	2	0.0000

- Conclusions:
  When allowing for differences in intercept, Cujo Outflow and Christine-Lac du Sauvage show significant deviation from the common slope of reference streams.

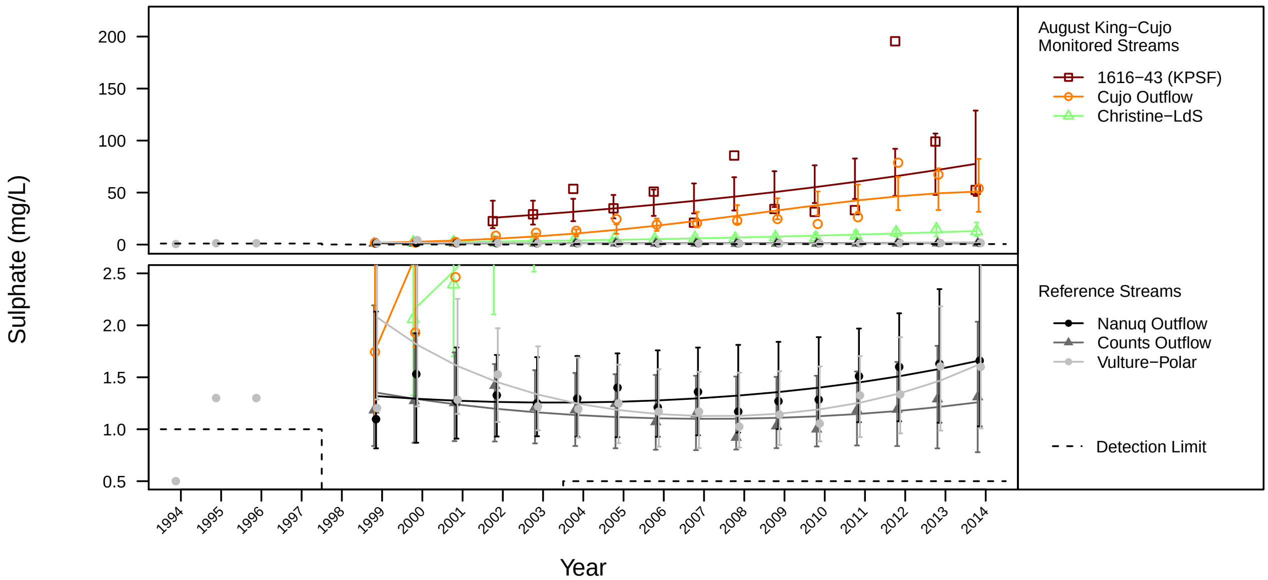
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.1690
Monitored Stream	1616-43 (KPSF)	0.3020
Monitored Stream	Christine-Lac du Sauvage	0.9460
Monitored Stream	Cujo Outflow	0.8950

- Conclusions:
  Model fit for 1616-43 (KPSF) is weak. Model fit for pooled reference streams is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean sulphate for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.25E+01	7.76E+01	2.01E+01	4.68E+01	1.29E+02	5.87E+01
Cujo Outflow	5.40E+01	5.10E+01	1.25E+01	3.15E+01	8.24E+01	3.65E+01
Christine-Lac du Sauvage	1.28E+01	1.30E+01	3.25E+00	8.01E+00	2.13E+01	9.51E+00
Nanuq Outflow	1.66E+00	1.66E+00	4.07E-01	1.03E+00	2.68E+00	
Counts Outflow	1.31E+00	1.26E+00	3.08E-01	7.79E-01	2.03E+00	
Vulture-Polar	1.60E+00	1.63E+00	3.99E-01	1.01E+00	2.63E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Sulphate	August	King-Cujo	Stream	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	hardness-dependent	1616-43 (KPSF) Cujo Outflow Christine-Lac du Sauvage

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

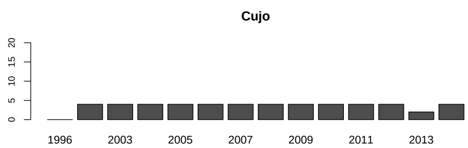
Analysis of April Potassium in Lakes of the King-Cujo Watershed and Lac du Sauvage

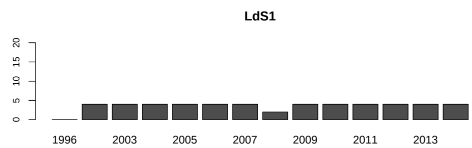
November 17, 2014

1 Censored Values:

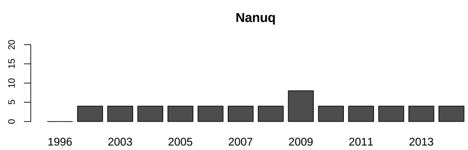
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

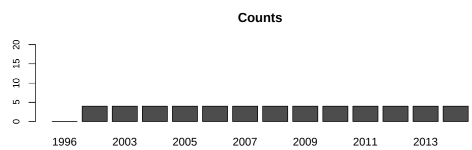
1.1 Monitored

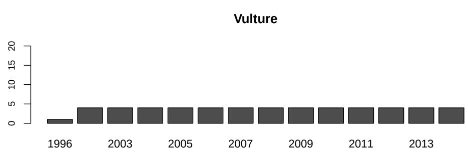




1.2 Reference

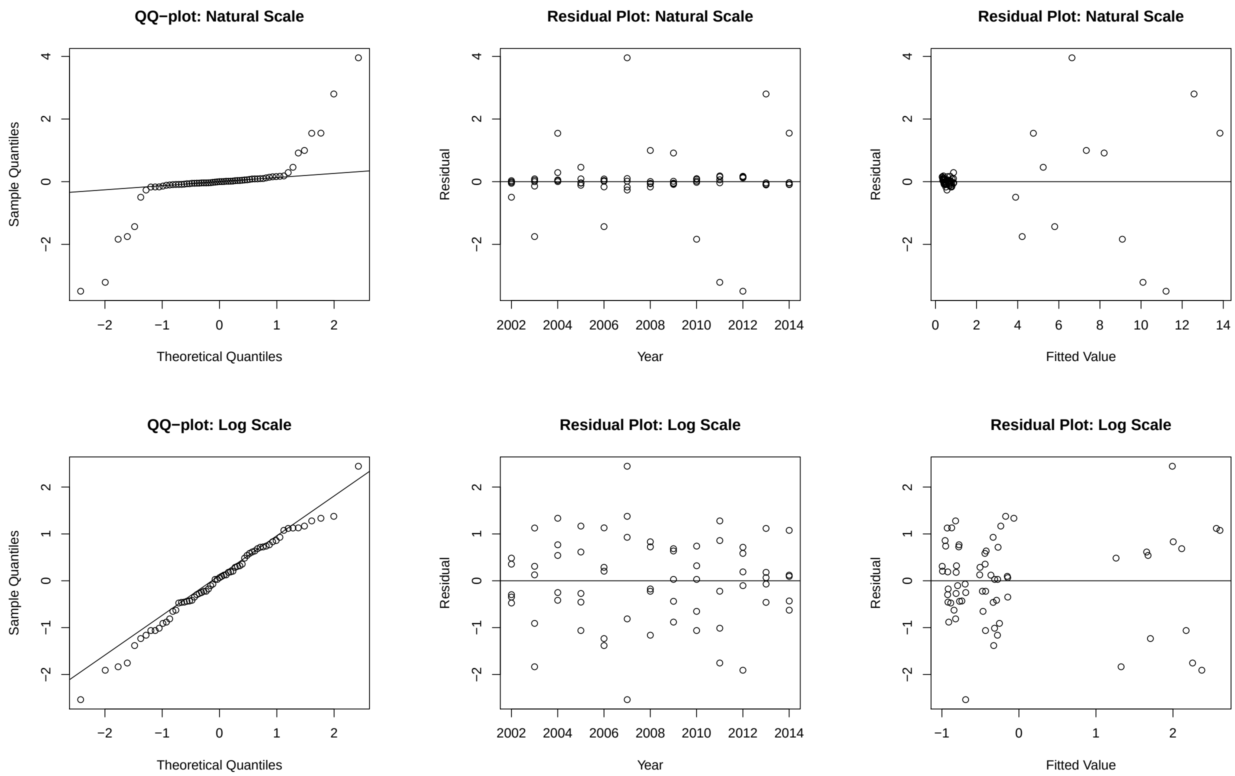






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
56	Cujo	2007	8.65	6.64	3.96
60	Cujo	2011	8.46	10.09	-3.21
61	Cujo	2012	9.44	11.21	-3.50

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
4.49E-53	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
14.02	6.00	0.03

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
1.38	4.00	0.85

- Conclusions:
  The slopes do not differ significantly among reference lakes.

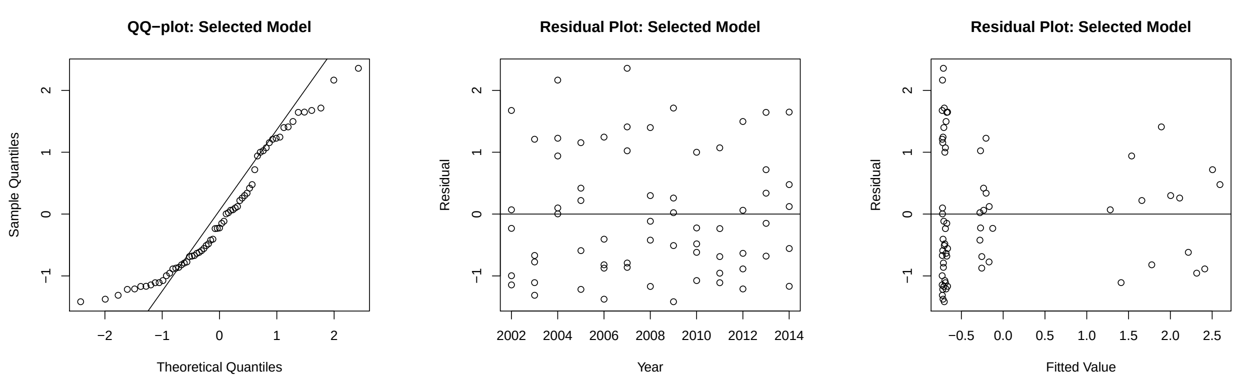
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
The reduced model shows some dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	23.98	2.00	0.00
LdS1	0.44	2.00	0.80

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

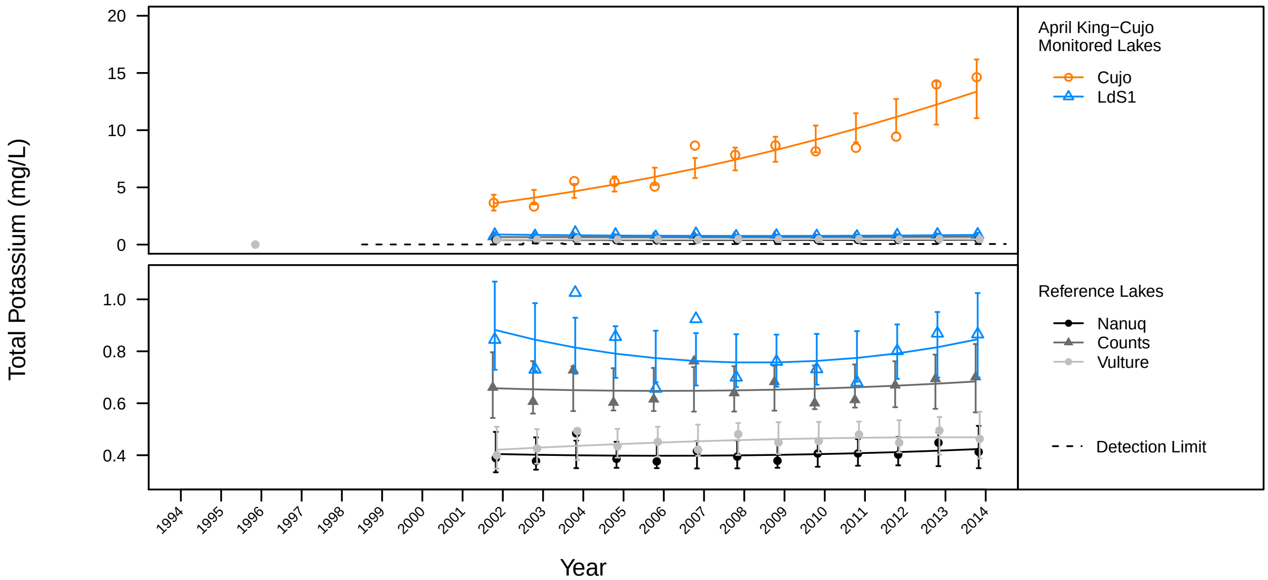
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0090
Monitored Lake	Cujo	0.8880
Monitored Lake	LdS1	0.1420

- Conclusions:
  Model fit for pooled reference lakes and LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean potassium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.46E+01	1.34E+01	1.30E+00	1.10E+01	1.62E+01	3.81E+00
LdS1	8.66E-01	8.46E-01	8.25E-02	6.99E-01	1.02E+00	2.41E-01
Nanuq	4.13E-01	4.24E-01	4.13E-02	3.50E-01	5.13E-01	
Counts	7.01E-01	6.84E-01	6.67E-02	5.65E-01	8.28E-01	
Vulture	4.63E-01	4.69E-01	4.57E-02	3.87E-01	5.68E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Potassium	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	41	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

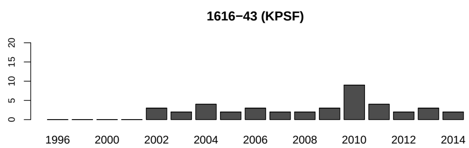
Analysis of August Potassium in Lakes of the King-Cujo Watershed and Lac du Sauvage

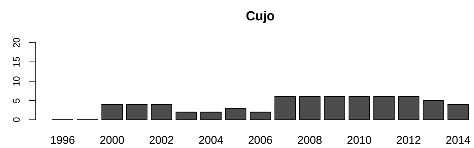
November 17, 2014

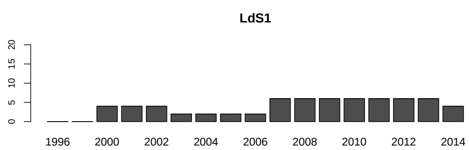
1 Censored Values:

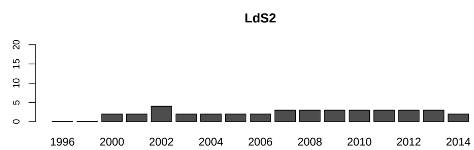
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

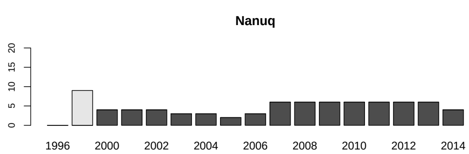


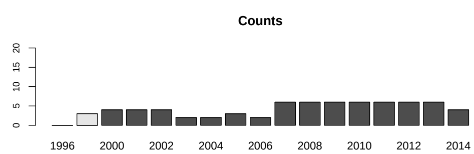


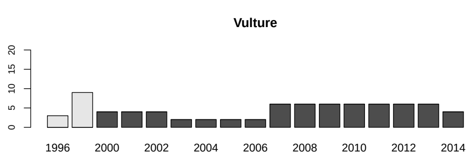




1.2 Reference

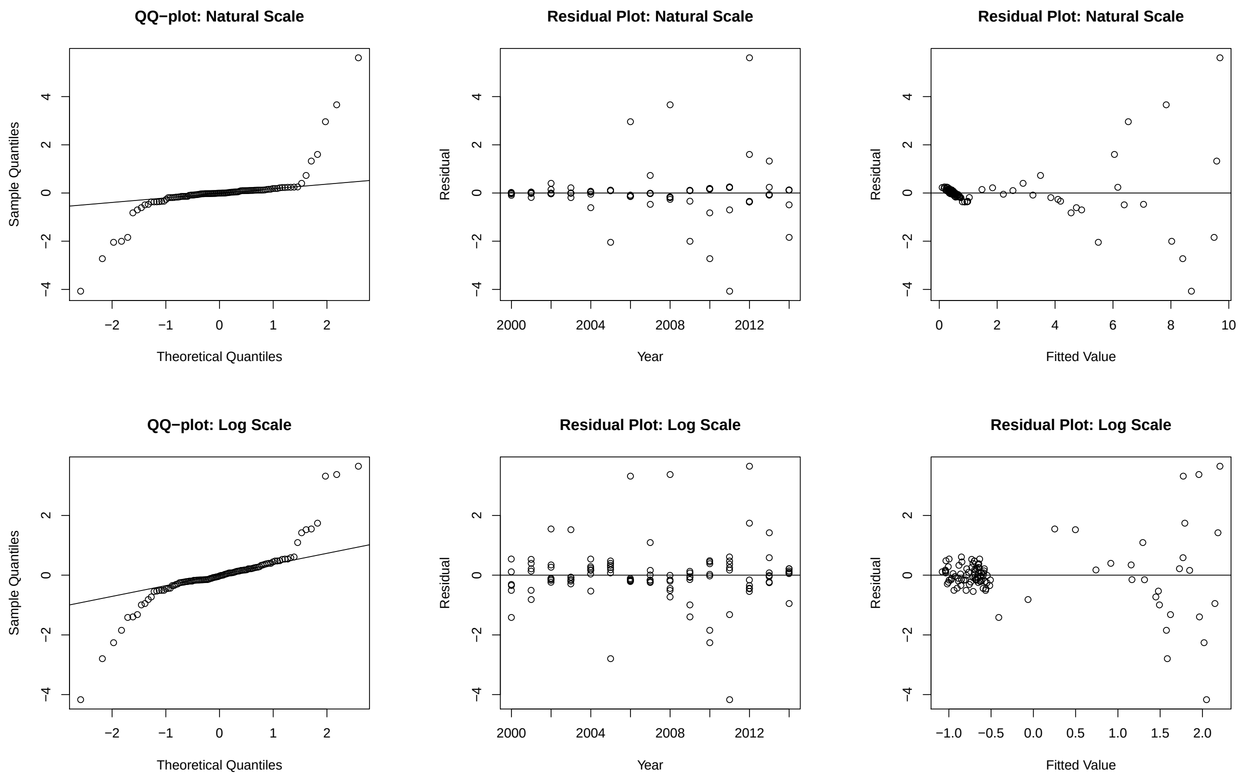






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
15	1616-43 (KPSF)	2008	12.05	7.84	3.66
18	1616-43 (KPSF)	2011	4.02	8.71	-4.08
19	1616-43 (KPSF)	2012	16.15	9.69	5.61

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
13	1616-43 (KPSF)	2006	9.93	1.77	3.32
15	1616-43 (KPSF)	2008	12.05	1.96	3.37
18	1616-43 (KPSF)	2011	4.02	2.05	-4.17
19	1616-43 (KPSF)	2012	16.15	2.21	3.65

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
36.24	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
0.87	4.00	0.93

- Conclusions:
  The slopes do not differ significantly among reference lakes.

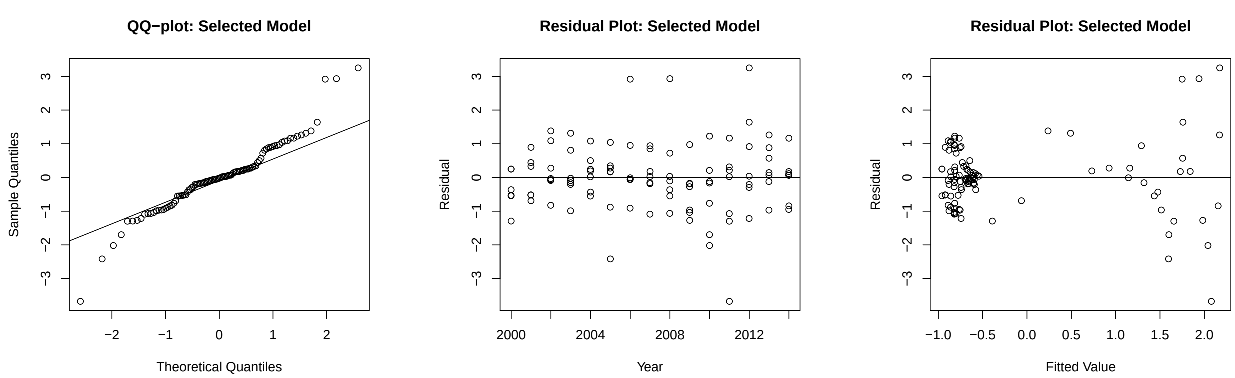
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
18	1616-43 (KPSF)	2011	4.02	2.08	-3.67
19	1616-43 (KPSF)	2012	16.15	2.17	3.25

Conclusion:
The reduced model shows some dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	7.0741	2	0.0291
Cujo	125.5948	2	0.0000
LdS1	0.1643	2	0.9211
LdS2	0.0583	2	0.9712

- Conclusions:
  1616-43 (KPSF) and Cujo Lake show significant deviation from the common slope of reference lakes.

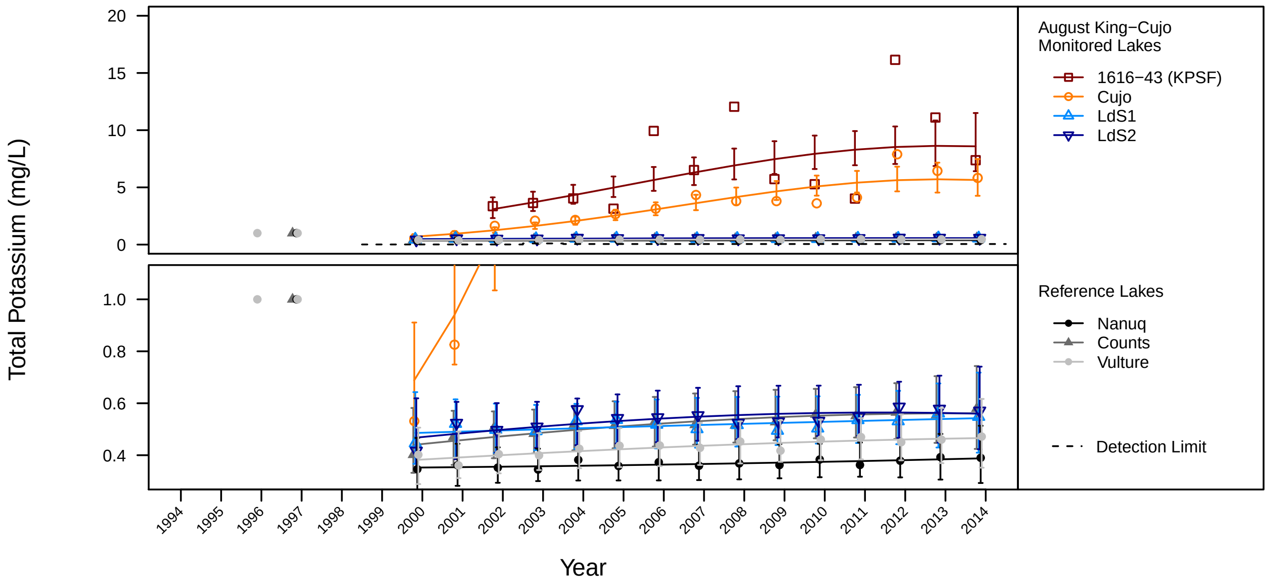
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1300
Monitored Lake	1616-43 (KPSF)	0.4010
Monitored Lake	Cujo	0.9170
Monitored Lake	LdS1	0.4070
Monitored Lake	LdS2	0.5540

- Conclusions:
  Model fit for 1616-43 (KPSF) and LdS1 is weak. Model fit for pooled reference lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean potassium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	7.38E+00	8.59E+00	1.28E+00	6.41E+00	1.15E+01	3.74E+00
Cujo	5.83E+00	5.65E+00	8.07E-01	4.27E+00	7.47E+00	2.36E+00
LdS2	5.71E-01	5.60E-01	8.01E-02	4.23E-01	7.41E-01	2.34E-01
LdS1	5.48E-01	5.42E-01	7.76E-02	4.10E-01	7.18E-01	2.27E-01
Nanuq	3.90E-01	3.88E-01	5.55E-02	2.93E-01	5.13E-01	
Counts	5.79E-01	5.62E-01	8.03E-02	4.24E-01	7.43E-01	
Vulture	4.72E-01	4.66E-01	6.66E-02	3.52E-01	6.17E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Potassium	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	41	1616-43 (KPSF) Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

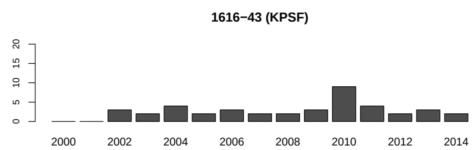
Analysis of August Potassium in King-Cujo Watershed Streams

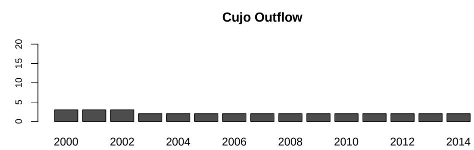
November 17, 2014

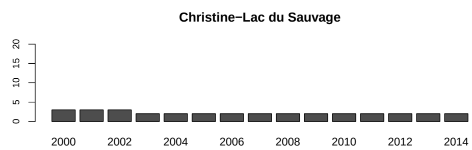
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

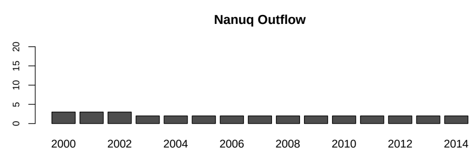
1.1 Monitored

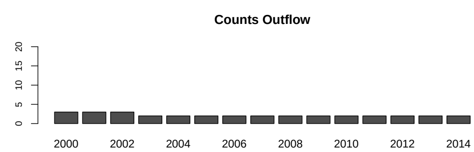


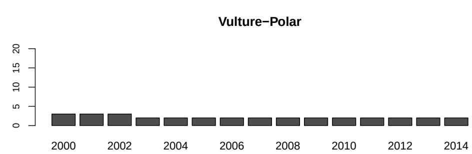




1.2 Reference

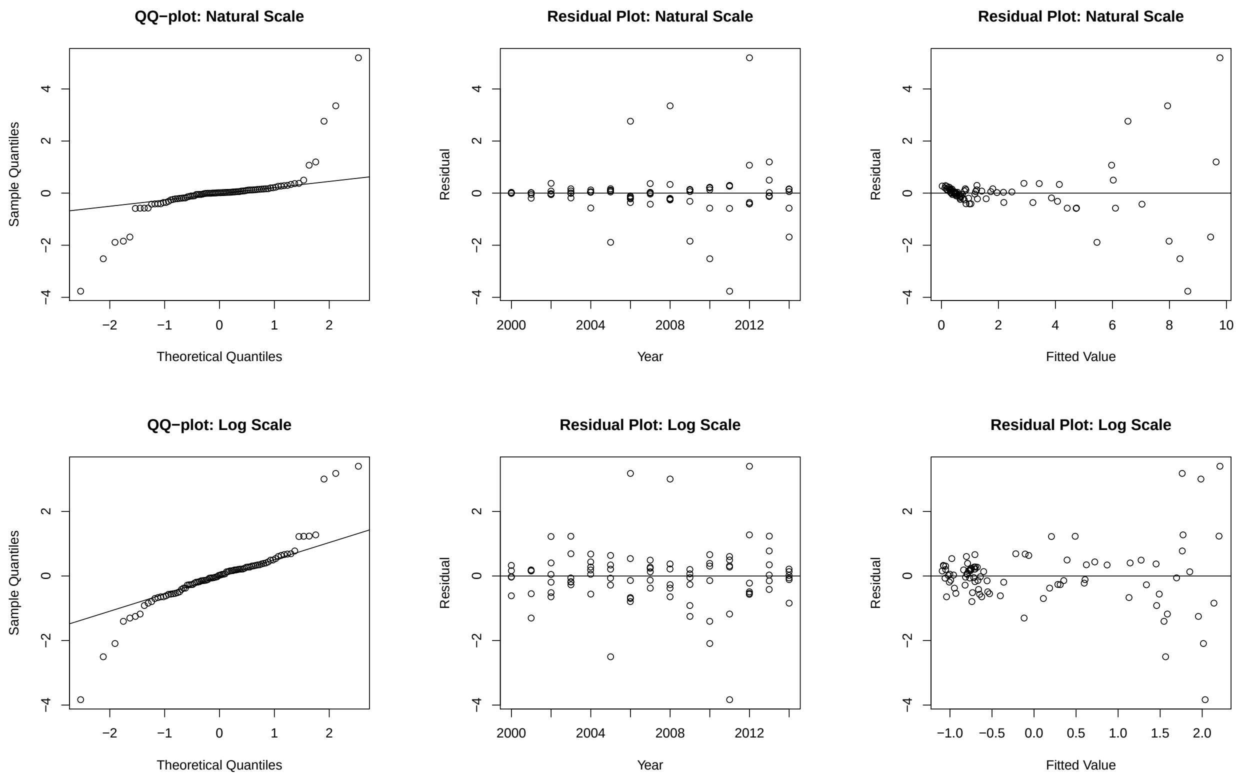






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
15	1616-43 (KPSF)	2008	12.05	7.93	3.35
18	1616-43 (KPSF)	2011	4.02	8.64	-3.77
19	1616-43 (KPSF)	2012	16.15	9.77	5.20

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
13	1616-43 (KPSF)	2006	9.93	1.76	3.18
15	1616-43 (KPSF)	2008	12.05	1.98	3.00
18	1616-43 (KPSF)	2011	4.02	2.03	-3.83
19	1616-43 (KPSF)	2012	16.15	2.21	3.40

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
27.98	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
9.87	4.00	0.04

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	45.5807	2	0.0000
Cujo Outflow	70.7335	2	0.0000
Christine-Lac du Sauvage	26.3705	2	0.0000

- Conclusions:
  All monitored streams show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)-vs-Nanuq Outflow	43.2058	3	0.0000
1616-43 (KPSF)-vs-Counts Outflow	26.7280	3	0.0000
1616-43 (KPSF)-vs-Vulture-Polar	29.7126	3	0.0000
Cujo Outflow-vs-Nanuq Outflow	1230.6104	3	0.0000
Cujo Outflow-vs-Counts Outflow	885.5935	3	0.0000
Cujo Outflow-vs-Vulture-Polar	962.4413	3	0.0000
Christine-Lac du Sauvage-vs-Nanuq Outflow	371.0454	3	0.0000
Christine-Lac du Sauvage-vs-Counts Outflow	194.9619	3	0.0000
Christine-Lac du Sauvage-vs-Vulture-Polar	231.6529	3	0.0000

- Conclusions:
  All monitored streams show significant deviation from the slopes of individual reference streams.

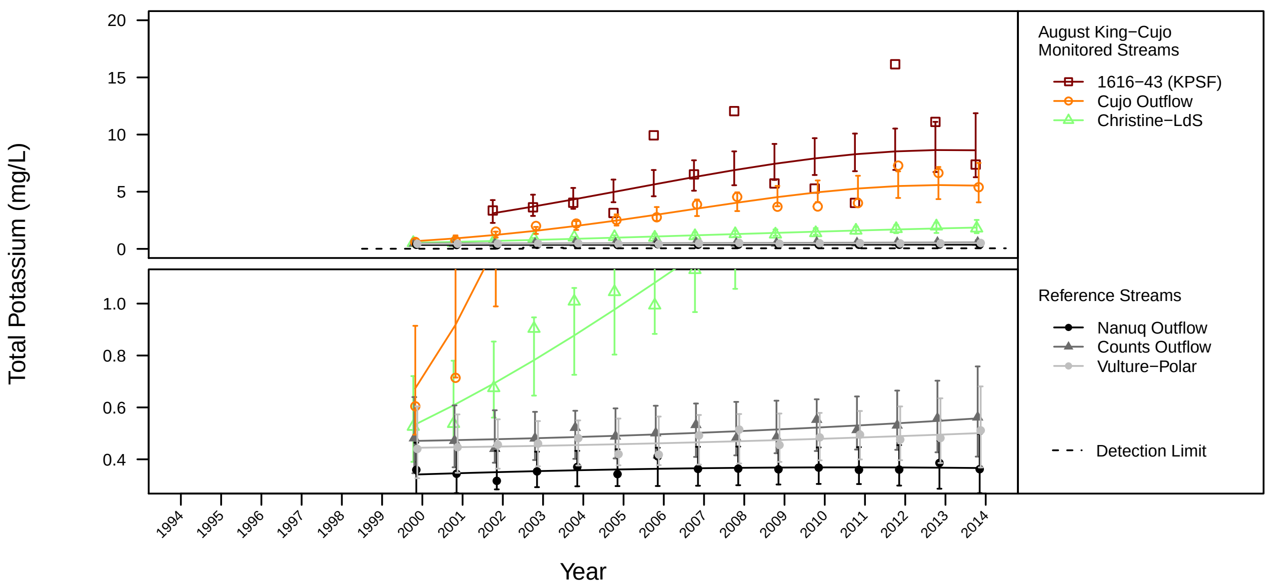
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.6050
Reference Stream	Nanuq Outflow	0.1980
Reference Stream	Vulture-Polar	0.3600
Monitored Stream	1616-43 (KPSF)	0.4060
Monitored Stream	Christine-Lac du Sauvage	0.9590
Monitored Stream	Cujo Outflow	0.9300

- Conclusions:
  Model fit for Vulture-Polar and 1616-43 (KPSF) is weak. Model fit for Nanuq Outflow is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean potassium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	7.38E+00	8.63E+00	1.40E+00	6.27E+00	1.19E+01	4.11E+00
Cujo Outflow	5.39E+00	5.53E+00	8.66E-01	4.07E+00	7.52E+00	2.53E+00
Christine-Lac du Sauvage	1.80E+00	1.86E+00	2.91E-01	1.37E+00	2.53E+00	8.53E-01
Nanuq Outflow	3.62E-01	3.66E-01	5.73E-02	2.70E-01	4.98E-01	
Counts Outflow	5.62E-01	5.58E-01	8.73E-02	4.10E-01	7.58E-01	
Vulture-Polar	5.12E-01	5.01E-01	7.84E-02	3.69E-01	6.81E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Potassium	August	King-Cujo	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	41	1616-43 (KPSF) Cujo Outflow Christine-Lac du Sauvager

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

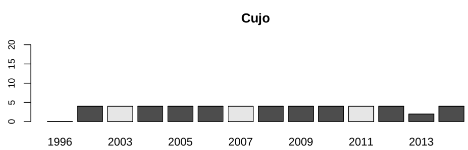
Analysis of April Total Ammonia-N in Lakes of the King-Cujo Watershed and Lac du Sauvage

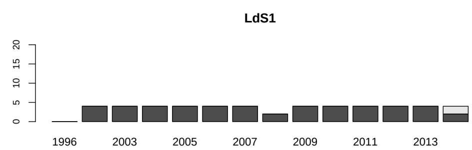
November 19, 2014

1 Censored Values:

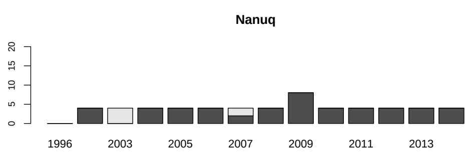
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

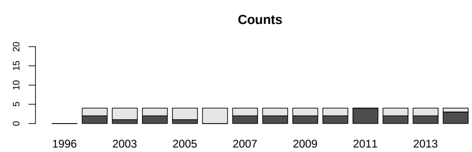
1.1 Monitored

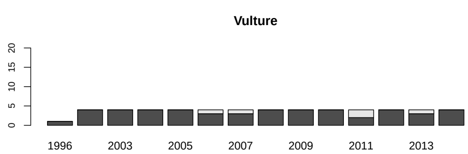




1.2 Reference

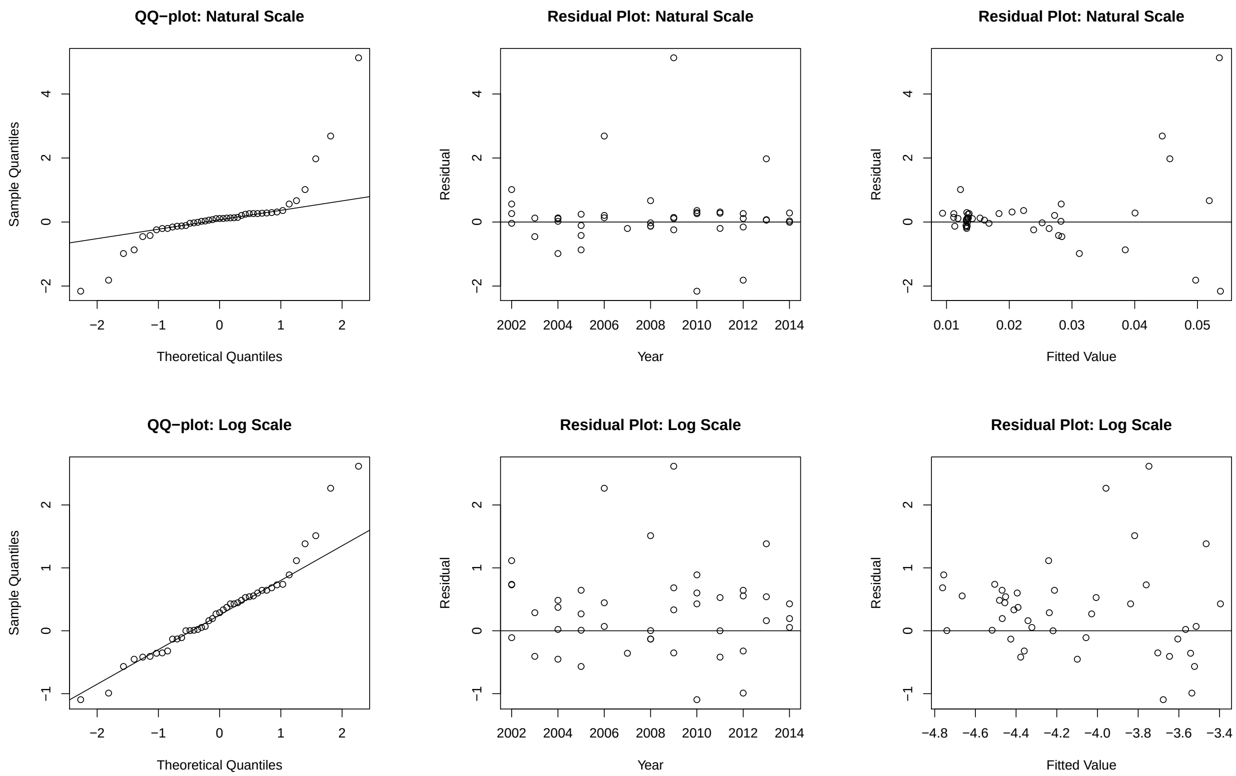






Comment:
10-60% of data in Counts, Nanuq, and Cujo lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
58	Cujo	2009	0.15	0.05	5.13

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.22E-39	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
142639.42	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
142764.14	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.563	0.435	0.001	Indistinguishable support for 1 & 2; choose Model 2.

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled with a common slope, results of contrasts suggest that slopes and intercepts differ among reference lakes. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	1.7120	2	0.4249
LdS1	3.1126	2	0.2109

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

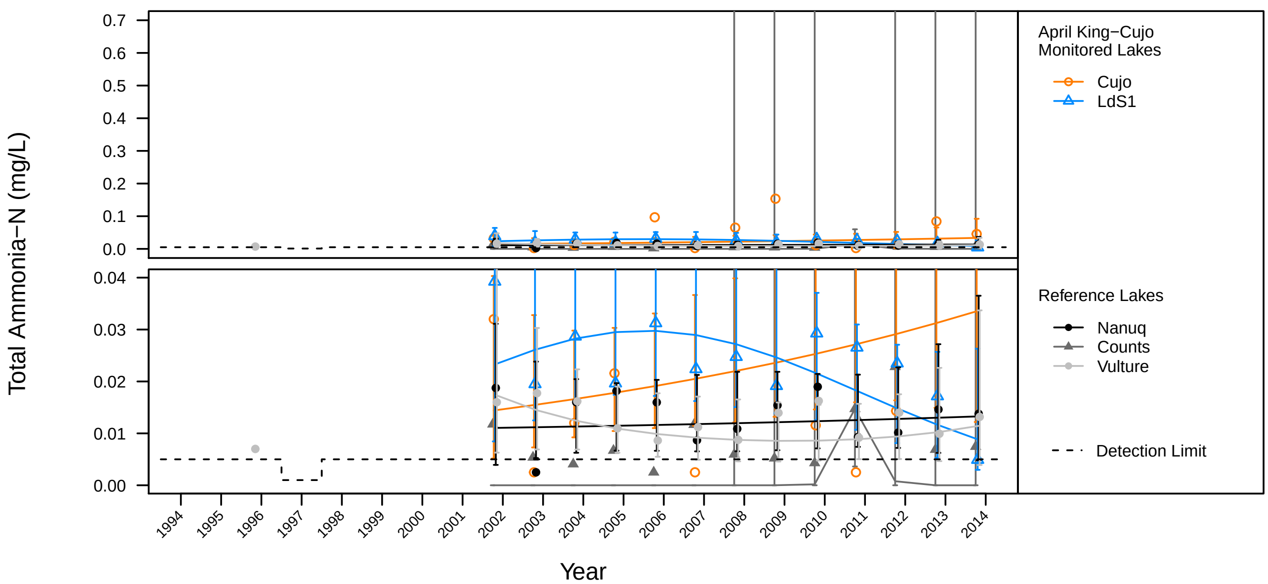
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.5000
Reference Lake	Nanuq	0.0120
Reference Lake	Vulture	0.4780
Monitored Lake	Cujo	0.0410
Monitored Lake	LdS1	0.5310

- Conclusions:
  Model fit for Vulture Lake is weak. Model fit for Nanuq and Cujo lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total ammonia for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	4.56e-02	3.35e-02	1.73e-02	1.22e-02	9.22e-02	5.06e-02
LdS1	4.92e-03	8.85e-03	4.92e-03	2.98e-03	2.63e-02	1.44e-02
Nanuq	1.38e-02	1.33e-02	6.85e-03	4.82e-03	3.65e-02	NA
Counts	7.45e-03	5.94e-16	2.18e-13	0.00e+00	2.24e+296	NA
Vulture	1.32e-02	1.15e-02	6.31e-03	3.90e-03	3.37e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
AmmoniaN	April	King-Cujo	Lake	Water	none	log e	Tobit regression	#1b separate slopes & intercepts	pH- and temperature-dependent	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

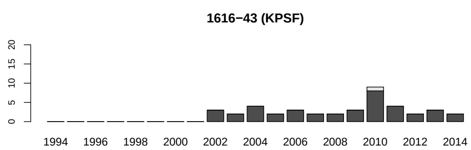
Analysis of August Total Ammonia-N in Lakes of the King-Cujo Watershed and Lac du Sauvage

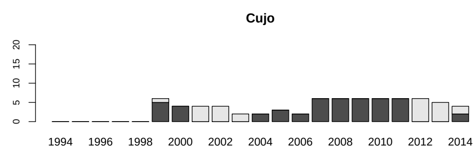
November 19, 2014

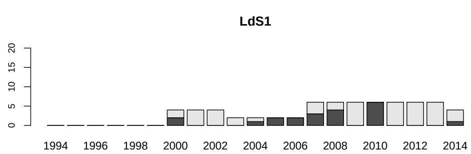
1 Censored Values:

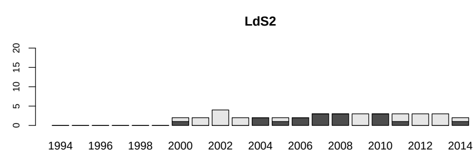
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

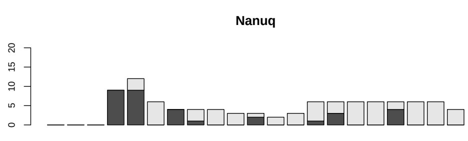


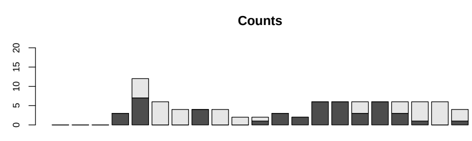


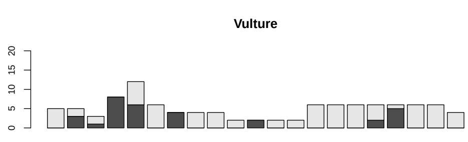




1.2 Reference

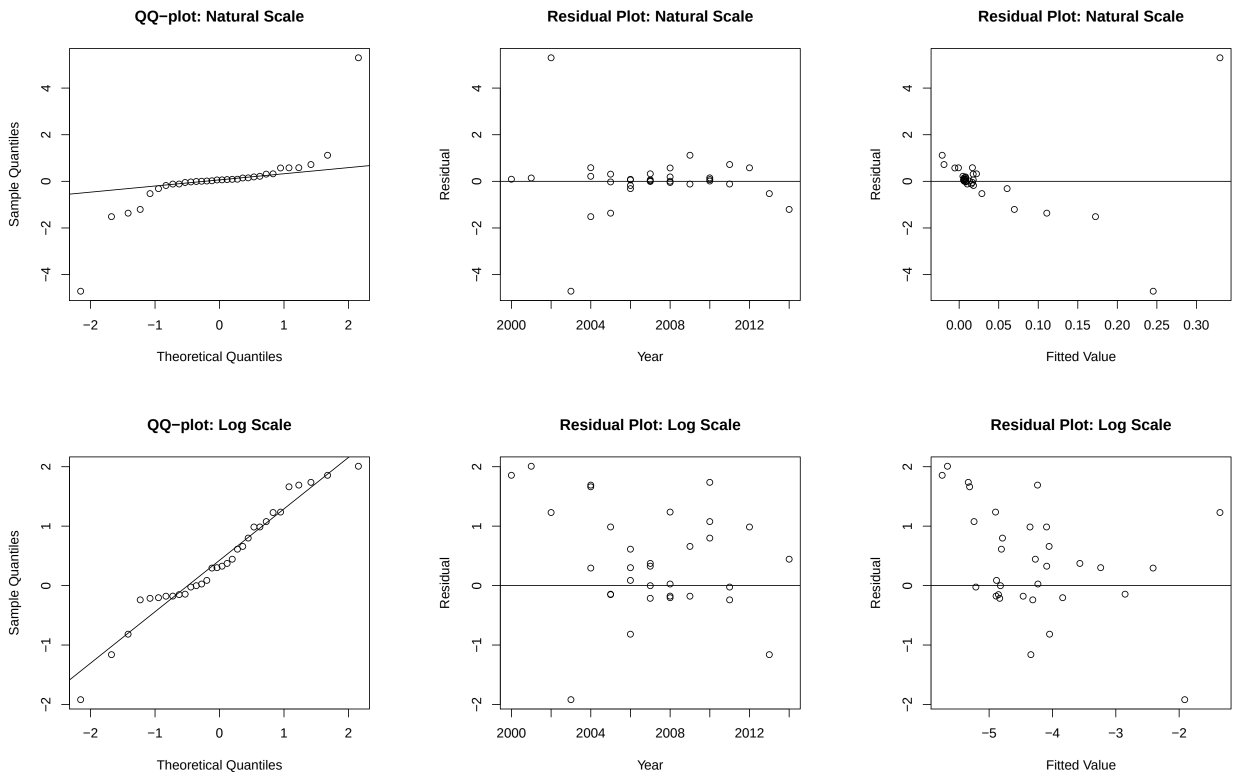






Comment:
Greater than 60% of data in Nanuq, Vulture, and LdS1 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Counts, Cujo and LdS2 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
9	1616-43 (KPSF)	2002	0.56	0.33	5.30
10	1616-43 (KPSF)	2003	0.04	0.25	-4.71

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

Two of three reference lakes were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Lakes

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	30.9133	2	0.0000
Cujo	12.0091	2	0.0025
LdS2	3.4321	2	0.1798

- Conclusions:
  1616-43 (KPSF) and Cujo Lake show significant deviation from a slope of zero.

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of the remaining reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)-vs-Counts	72.7076	3	0.0000
Cujo-vs-Counts	4.9339	3	0.1767
LdS2-vs-Counts	1.2407	3	0.7433

- Conclusions:
  1616-43 (KPSF) shows significant deviation from the common slope of reference lakes.

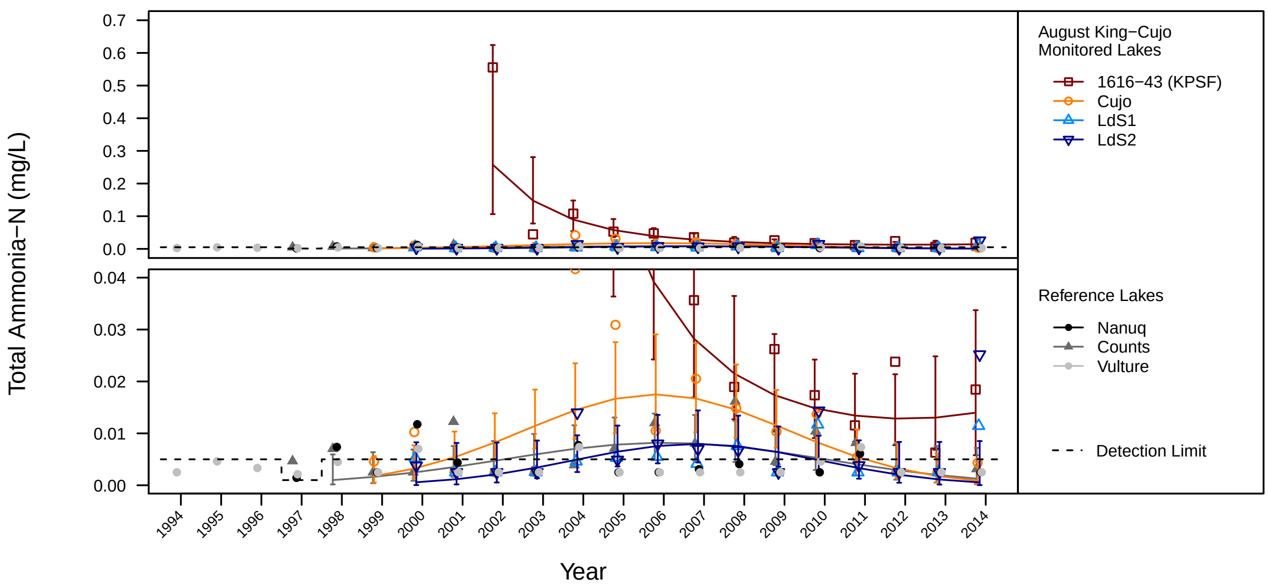
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4770
Monitored Lake	1616-43 (KPSF)	0.7860
Monitored Lake	Cujo	0.5430
Monitored Lake	LdS2	0.4200

- Conclusions:
  Model fit for Counts Lake and LdS2 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total ammonia for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.85e-02	1.40e-02	6.28e-03	5.79e-03	3.37e-02	1.84e-02
Cujo	4.32e-03	8.84e-04	7.31e-04	1.75e-04	4.47e-03	2.14e-03
LdS2	2.52e-02	5.52e-04	7.71e-04	3.58e-05	8.52e-03	2.26e-03
LdS1	1.14e-02	NA	NA	NA	NA	NA
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	3.15e-03	1.28e-03	1.13e-03	2.28e-04	7.20e-03	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
AmmoniaN	August	King-Cujo	Lake	Water	Nanuq Vulture LdS1	log e	Tobit regression	#1b separate intercepts & slopes	pH- and temperature-dependent	1616-43 (KPSF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

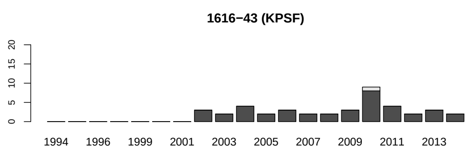
Analysis of August Total Ammonia-N in King-Cujo Watershed Streams

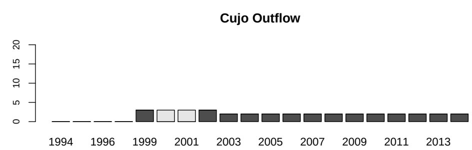
November 17, 2014

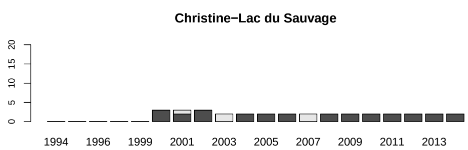
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

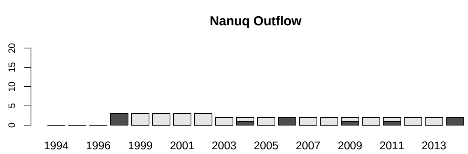
1.1 Monitored

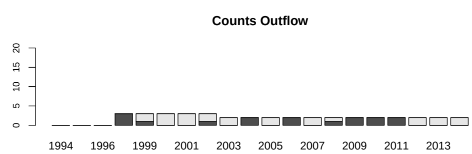


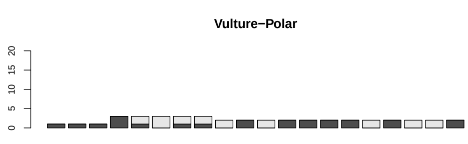




1.2 Reference

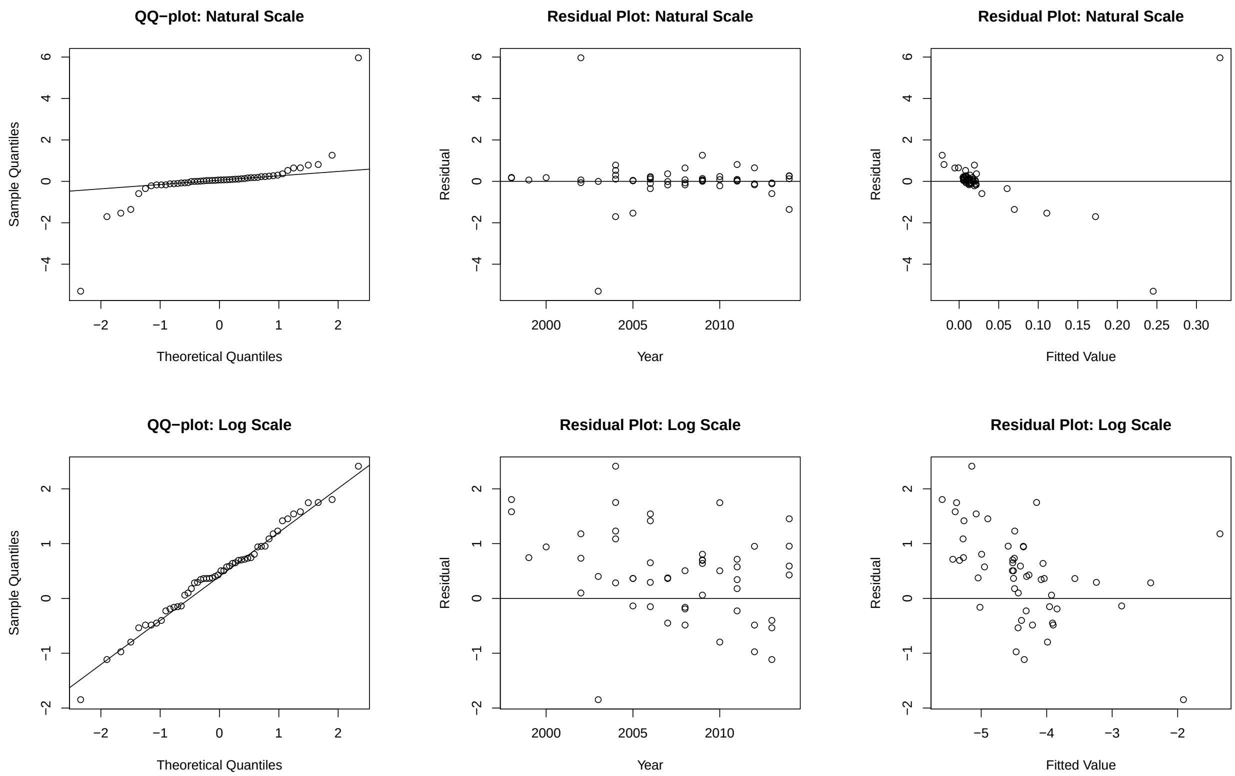






Comment:
Greater than 60% of data in Nanuq Outflow was less than the detection limit. This streams was excluded from further analyses. 10-60% of data in Counts Outflow, Vulture-Polar, Cujo Outflow, and Christine-Lac du Sauvage was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
9	1616-43 (KPSF)	2002	0.56	0.33	5.96
10	1616-43 (KPSF)	2003	0.04	0.25	-5.30

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
1.96	3.00	0.58

- Conclusions:
  The slopes and intercepts do not differ significantly among reference streams.

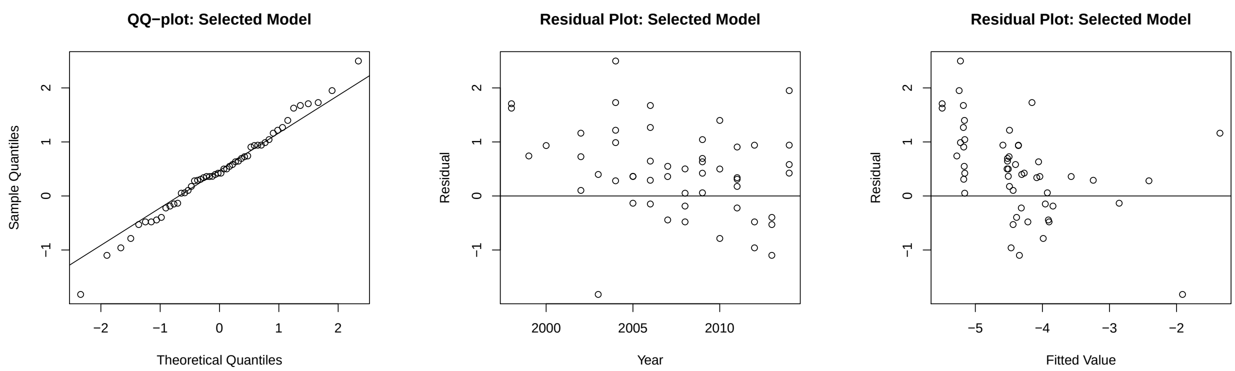
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.096	0.195	0.709	Ref. Model 3

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
The reduced model shows some dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the slope and intercept of each monitored stream compared to a common slope and intercept fitted for all reference streams together (reference model 3).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	85.2867	3	0.0000
Cujo Outflow	21.4553	3	0.0001
Christine-Lac du Sauvage	12.1327	3	0.0069

- Conclusions:
  All monitored streams show significant deviation from the common slope and intercept of reference streams.

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	22.9592	2	0.0000
Cujo Outflow	2.6189	2	0.2700
Christine-Lac du Sauvage	0.3419	2	0.8429

- Conclusions:
  When allowing for differences in intercept, 1616-43 (KPSF) shows significant deviation from the common slope of reference streams.

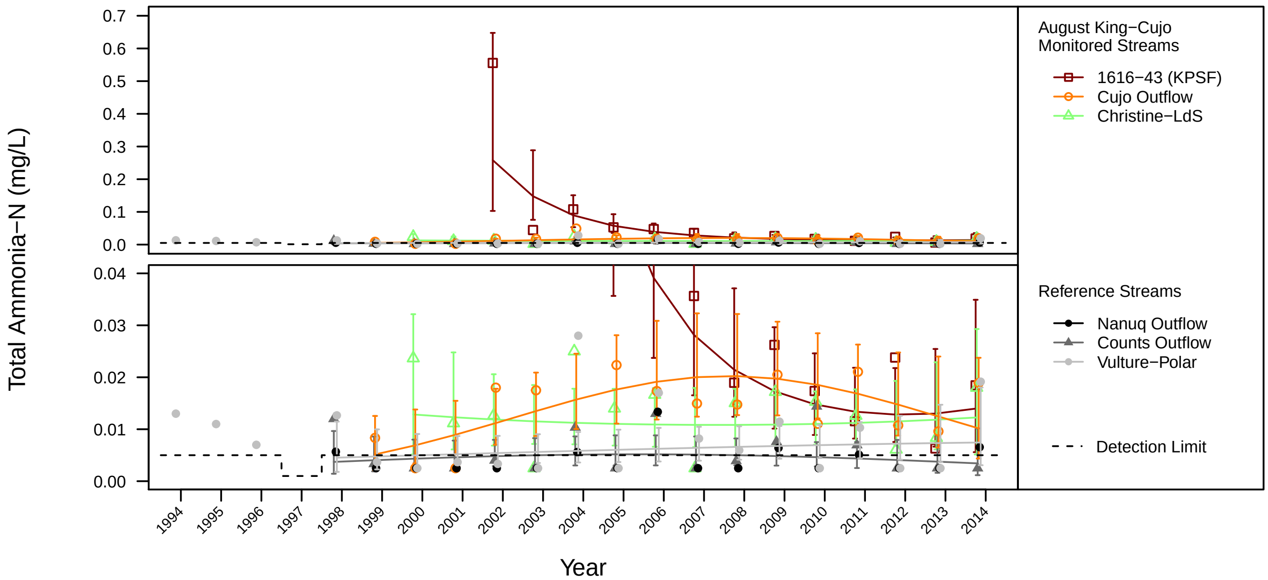
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.0200
Monitored Stream	1616-43 (KPSF)	0.7860
Monitored Stream	Christine-Lac du Sauvage	0.0070
Monitored Stream	Cujo Outflow	0.3130

- Conclusions:
  Model fit for Cujo Outflow is weak. Model fit for pooled reference streams and Christine-Lac du Sauvage is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total ammonia for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.85e-02	1.40e-02	6.53e-03	5.59e-03	3.49e-02	1.91e-02
Cujo Outflow	1.89e-02	1.02e-02	4.40e-03	4.36e-03	2.38e-02	1.29e-02
Christine-Lac du Sauvage	1.80e-02	1.23e-02	5.45e-03	5.13e-03	2.93e-02	1.59e-02
Nanuq Outflow	6.55e-03	NA	NA	NA	NA	NA
Counts Outflow	2.50e-03	3.43e-03	1.90e-03	1.16e-03	1.02e-02	NA
Vulture-Polar	1.92e-02	7.45e-03	3.36e-03	3.08e-03	1.80e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
AmmoniaN	August	King-Cujo	Stream	Water	Nanuq Outflow	log e	Tobit regression	#3 shared intercept & slope	pH- and temperature-dependent	1616-43 (KPSF) Cujo Outflow Christine-Lac du Sauvage

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

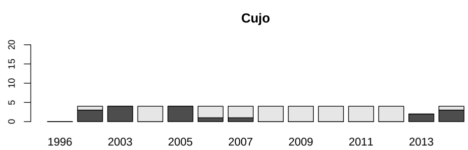
Analysis of April Nitrite in Lakes of the King-Cujo Watershed and Lac du Sauvage

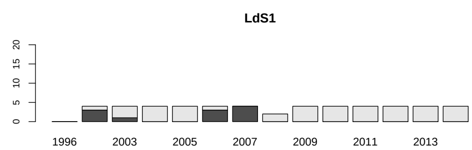
November 17, 2014

1 Censored Values:

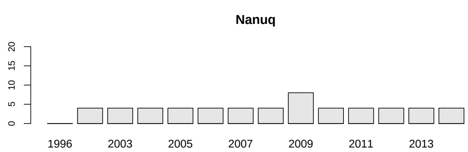
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

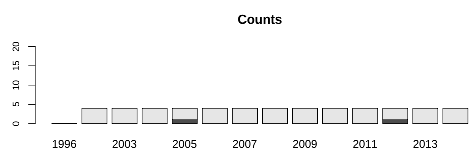
1.1 Monitored

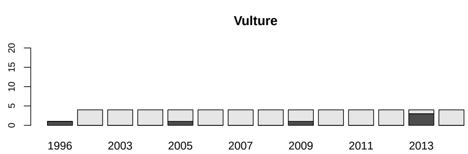




1.2 Reference

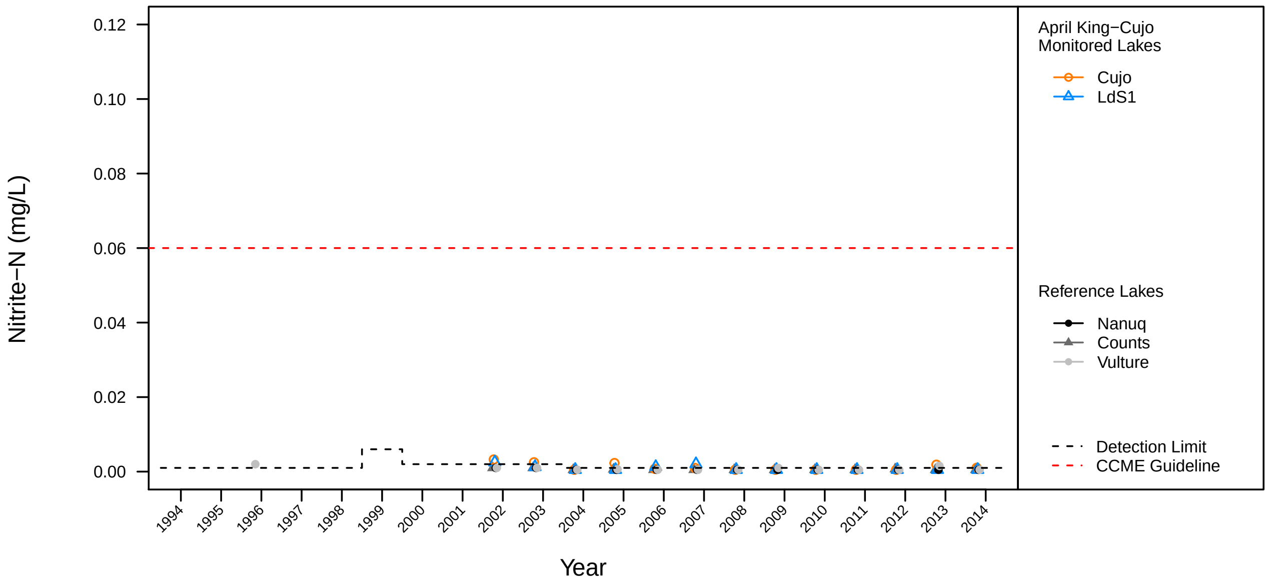






Comment:
Greater than 60% of data in all reference and monitored lakes was less than the detection limit. All lakes were excluded from further analyses. No statistical tests performed. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
NitriteN	April	King-Cujo	Lake	Water	ALL	NA	NA	NA	0.06	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

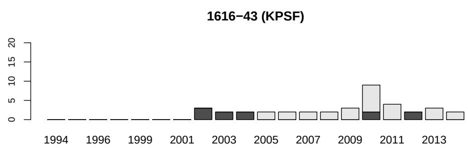
Analysis of August Nitrite in Lakes of the King-Cujo Watershed and Lac du Sauvage

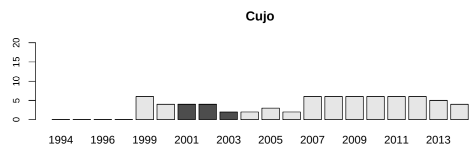
November 17, 2014

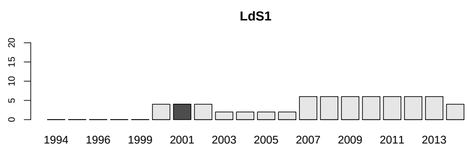
1 Censored Values:

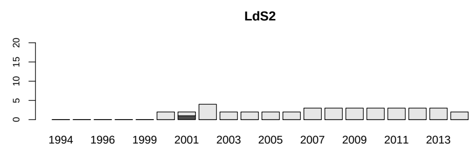
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

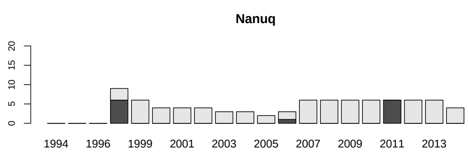


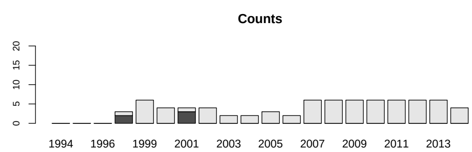


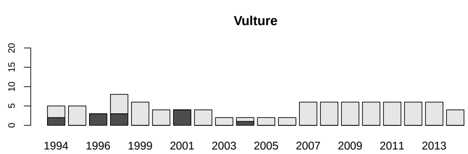




1.2 Reference

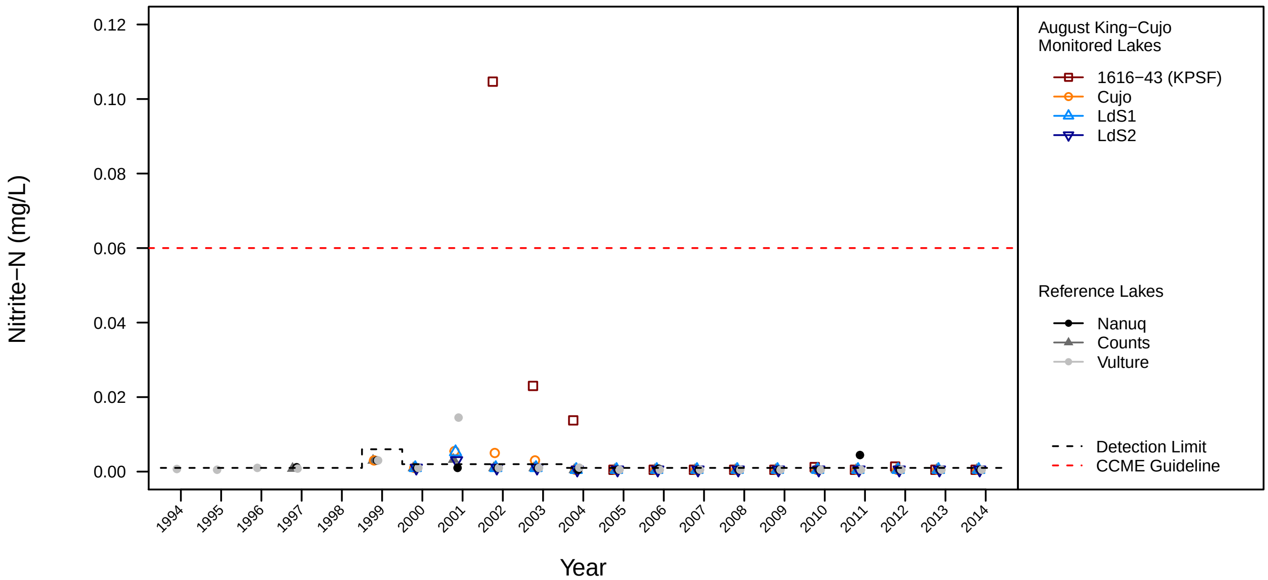






Comment:
Greater than 60% of data in all monitored and reference lakes was less than the detection limit. All lakes were excluded from further analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
NitriteN	August	King-Cujo	Lake	Water	ALL	NA	NA	NA	0.06	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

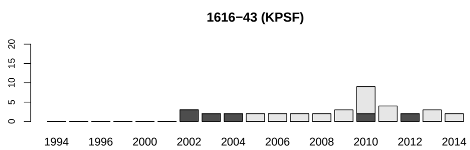
Analysis of August Nitrite in King-Cujo Watershed Streams

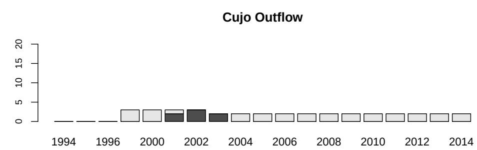
November 17, 2014

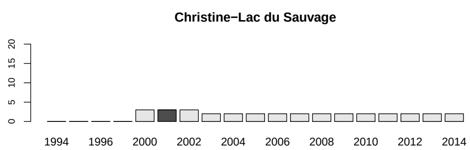
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

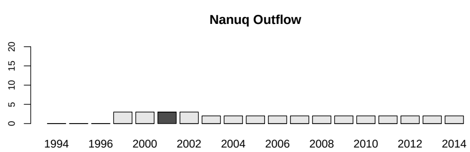
1.1 Monitored

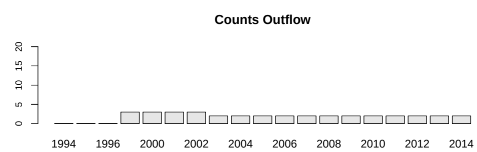


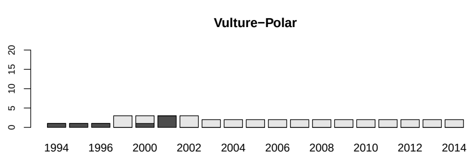




1.2 Reference

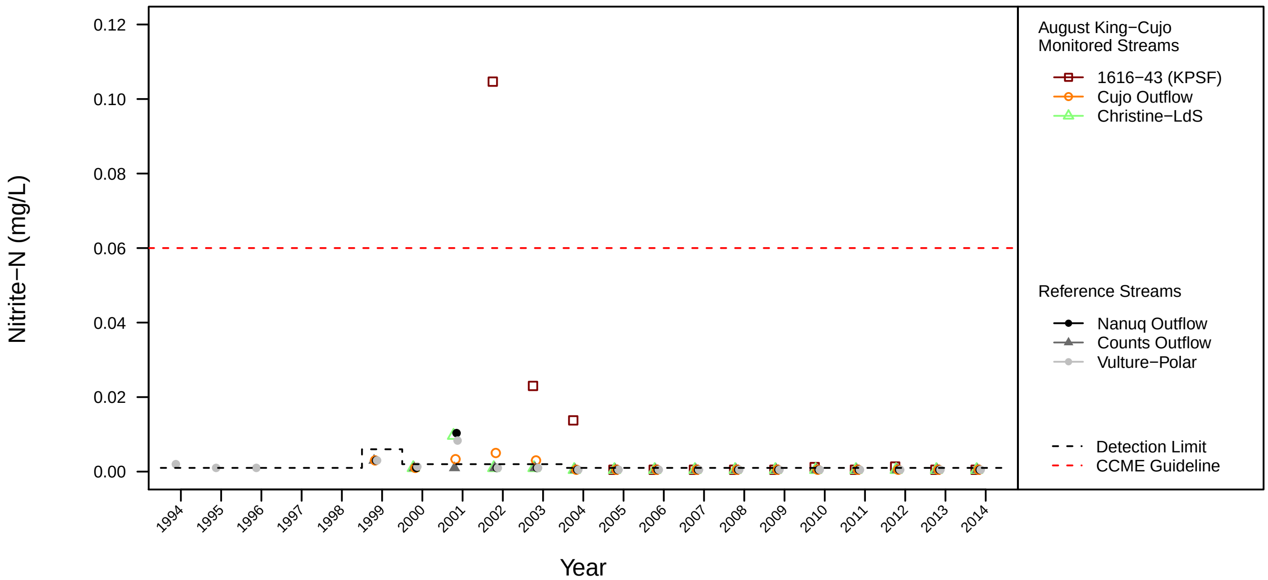






Comment:
Greater than 60% of data in all reference and monitored streams was less than the detection limit. All streams were excluded from further analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
NitriteN	August	King-Cujo	Stream	Water	ALL	NA	NA	NA	0.06	NA

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

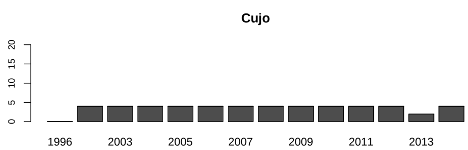
Analysis of April Nitrate in Lakes of the King-Cujo Watershed and Lac du Sauvage

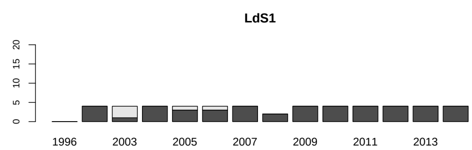
November 17, 2014

1 Censored Values:

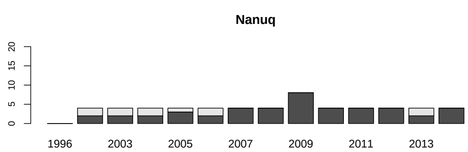
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

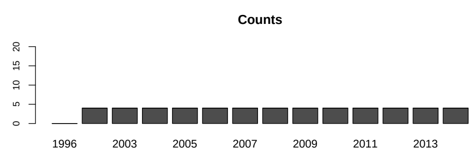
1.1 Monitored

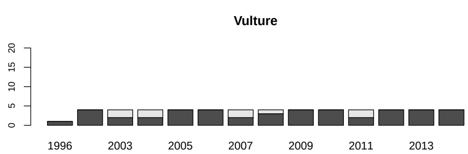




1.2 Reference

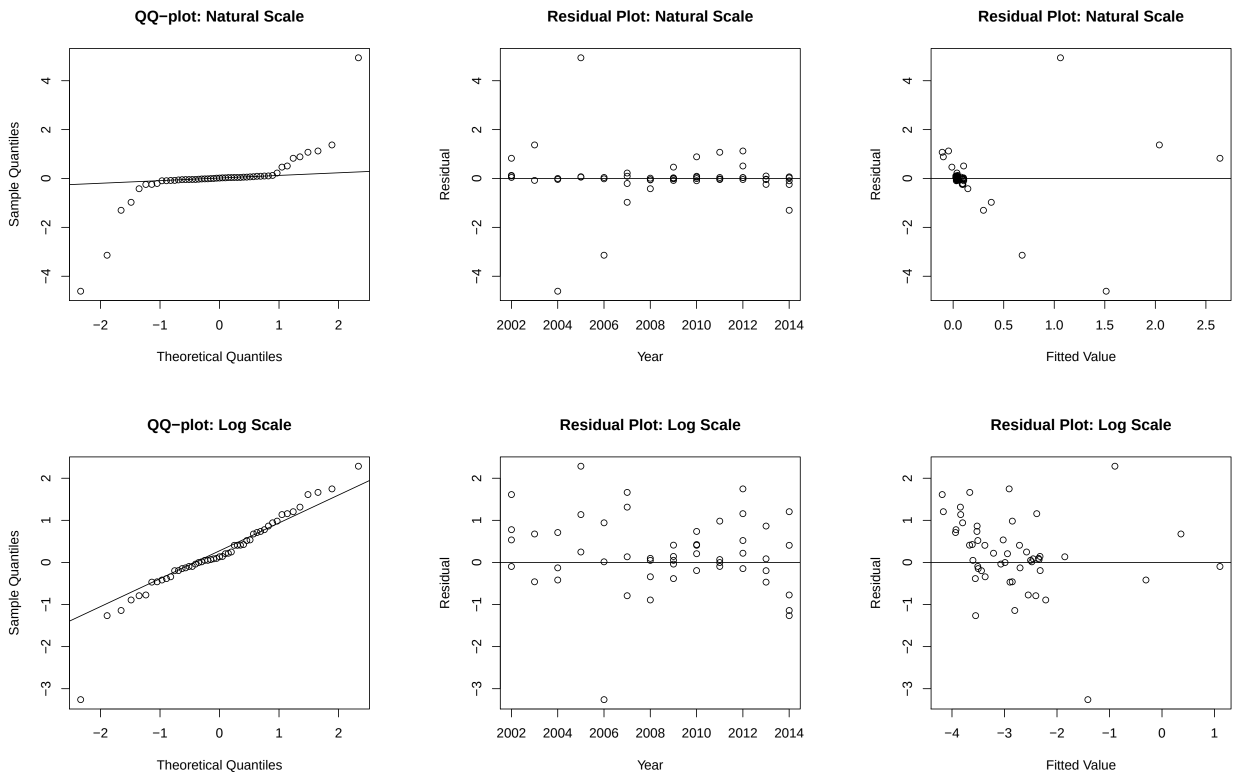






Comment:
10-60% of data in Nanuq and Vulture lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
53	Cujo	2004	0.55	1.51	-4.61
54	Cujo	2005	2.10	1.06	4.94
55	Cujo	2006	0.02	0.68	-3.14

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
55	Cujo	2006	0.02	-1.41	-3.26

AIC weights and model comparison:

Natural Model	Log Model	Best Model
2.78E-06	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
25.15	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
5.59	4.00	0.23

- Conclusions:
  The slopes do not differ significantly among reference lakes.

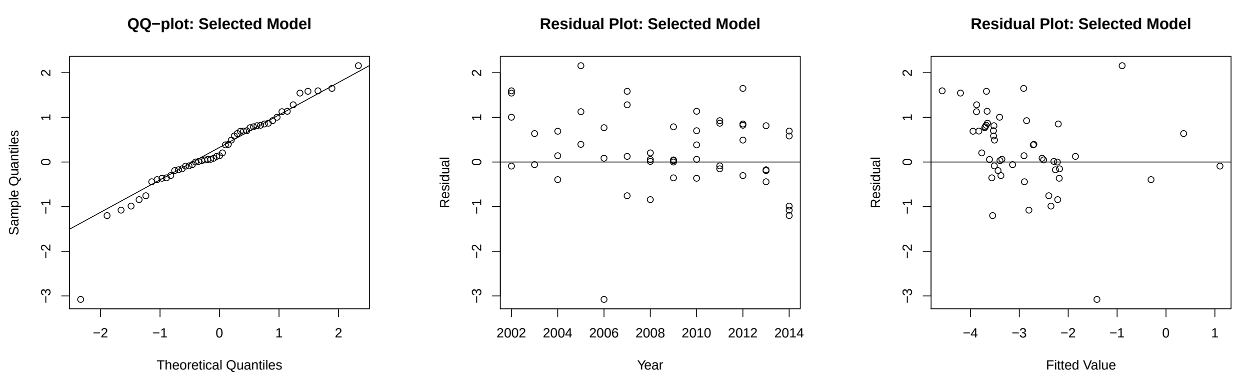
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.827	0.173	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
55	Cujo	2006	0.02	-1.41	-3.08

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	45.7126	2	0.0000
LdS1	0.4243	2	0.8088

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

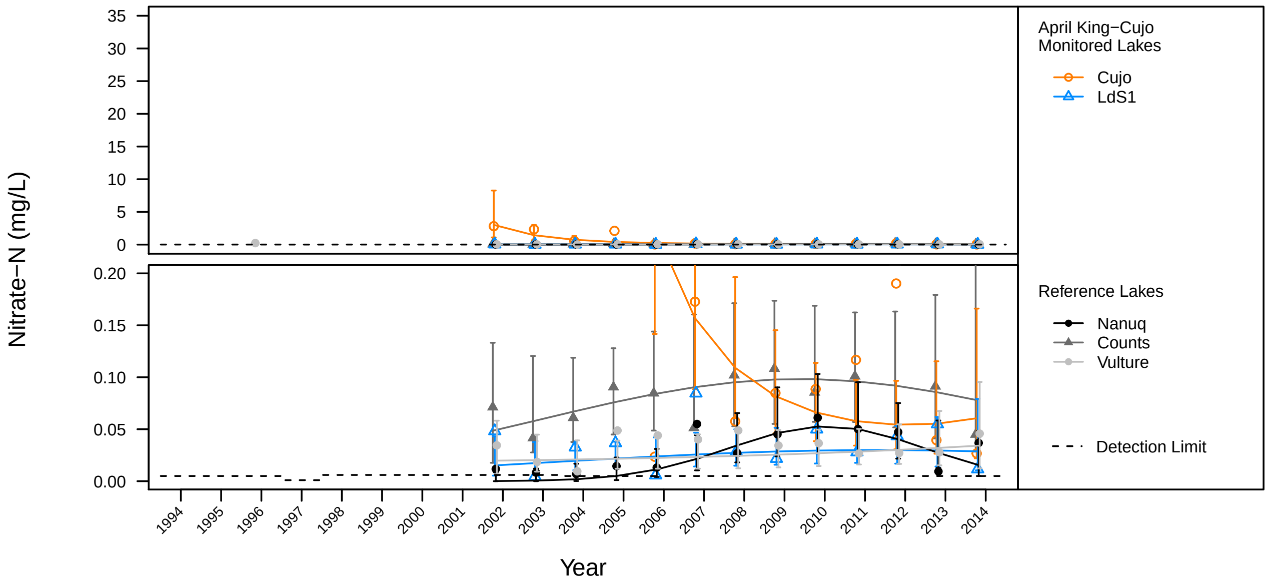
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.6810
Monitored Lake	Cujo	0.6520
Monitored Lake	LdS1	0.0760

- Conclusions:
  Model fit for LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrate for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	2.67e-02	6.05e-02	3.12e-02	2.21e-02	1.66e-01	9.12e-02
LdS1	1.16e-02	2.87e-02	1.49e-02	1.04e-02	7.92e-02	4.35e-02
Nanuq	3.68e-02	1.55e-02	8.99e-03	4.99e-03	4.83e-02	NA
Counts	4.49e-02	7.83e-02	4.03e-02	2.85e-02	2.15e-01	NA
Vulture	4.58e-02	3.42e-02	1.79e-02	1.23e-02	9.55e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
NitrateN	April	King-Cujo	Lake	Water	none	log e	Tobit regression	#2 shared slopes	hardness-dependent	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

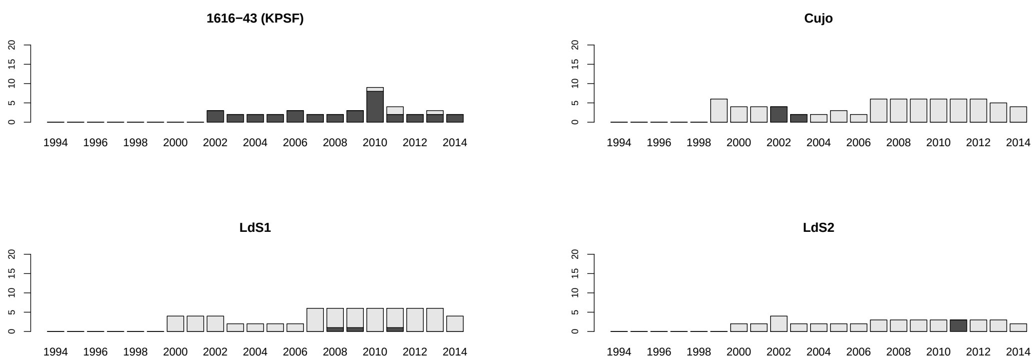
Analysis of August Nitrate in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 19, 2014

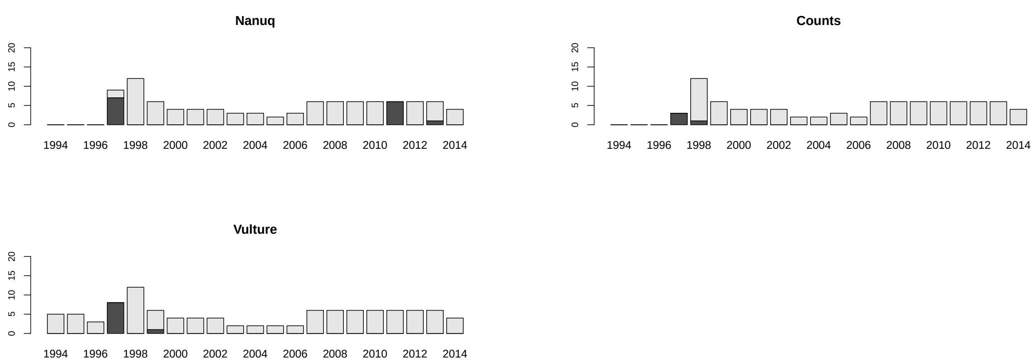
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

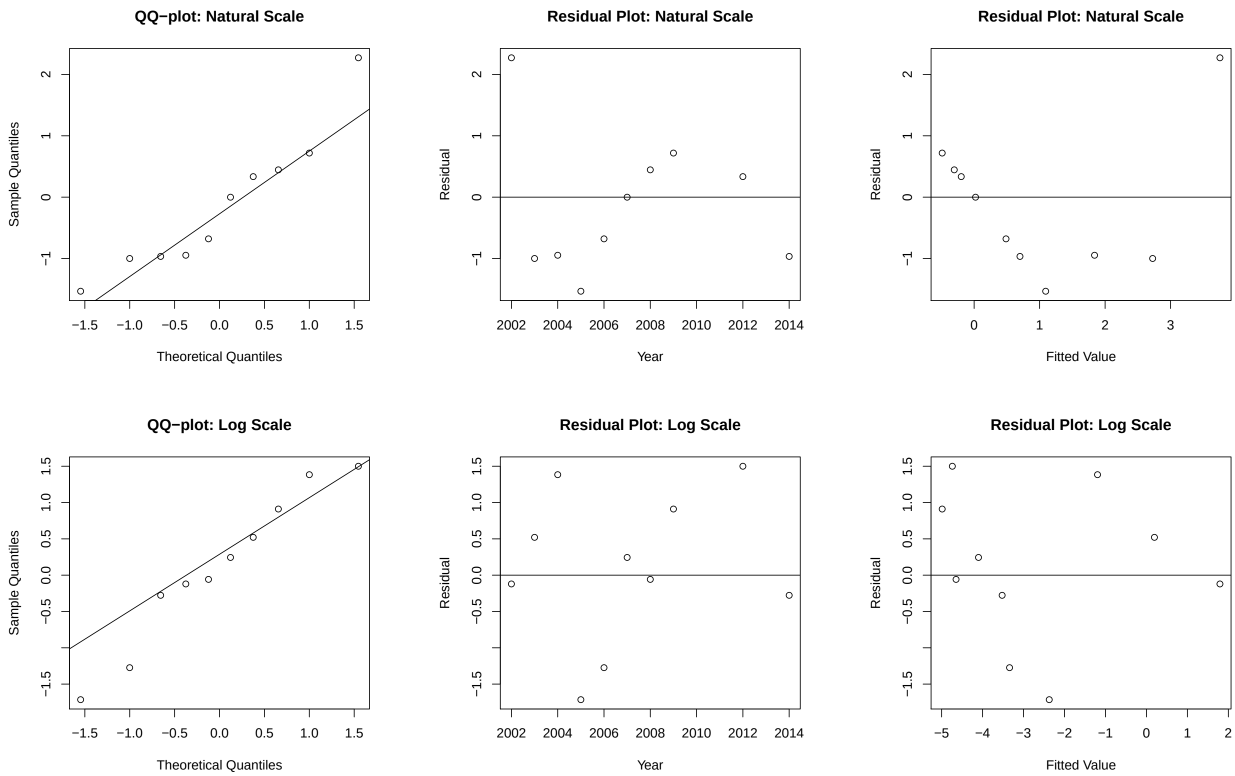


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Cujo, LdS1 and LdS2 was less than the detection limit. These lakes were excluded from further analyses. 1616-43 (KPSF) did not exhibit greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. 1616-43 (KPSF) is the only site remaining in the analysis. Linear mixed model regression cannot be performed when only one site remains in the analyis. Proceeding with Tobit regression for the remainder of the analyses. Results for LME and Tobit are comparable when all or most of the data is above detection limit.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	51.8303	2	0.0000

- Conclusions:
  1616-43 (KPSF) shows significant deviation from a slope of zero.

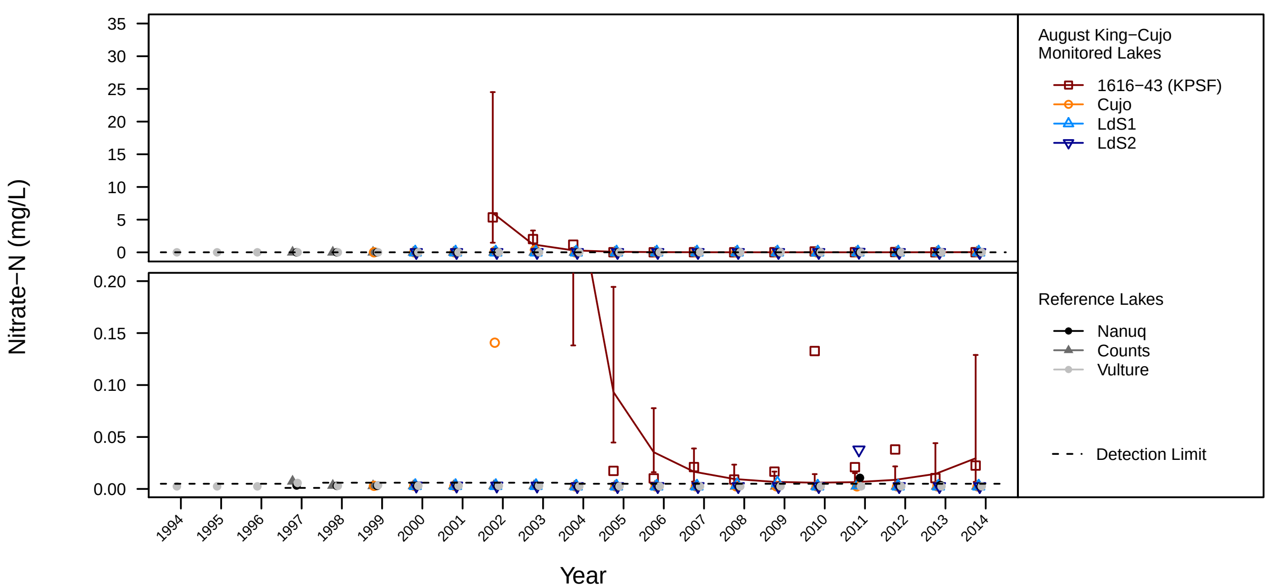
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-43 (KPSF)	0.7440

- Conclusions:
  Model provides a good fit for 1616-43 (KPSF).

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrate for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	2.25e-02	2.95e-02	2.22e-02	6.76e-03	1.29e-01	6.5e-02
Cujo	2.50e-03	NA	NA	NA	NA	NA
LdS2	2.50e-03	NA	NA	NA	NA	NA
LdS1	2.50e-03	NA	NA	NA	NA	NA
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	2.50e-03	NA	NA	NA	NA	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
NitrateN	August	King-Cujo	Lake	Water	Counts Nanuq Vulture Cujo LdS1 LdS2	log e	Tobit regression	#1a slope of zero	NA	1616-43 (KPSF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

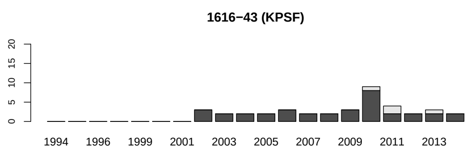
Analysis of August Nitrate in King-Cujo Watershed Streams

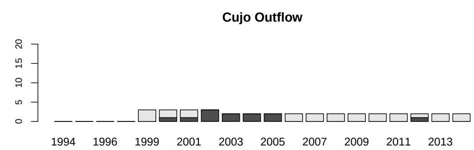
November 18, 2014

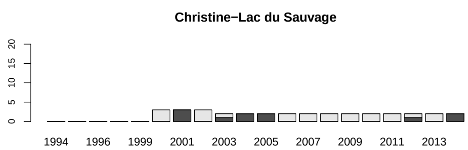
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

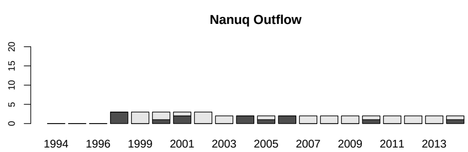
1.1 Monitored

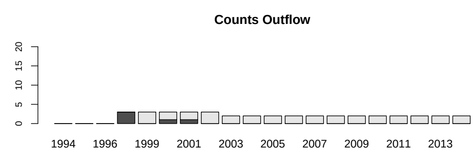


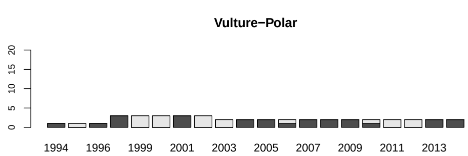




1.2 Reference

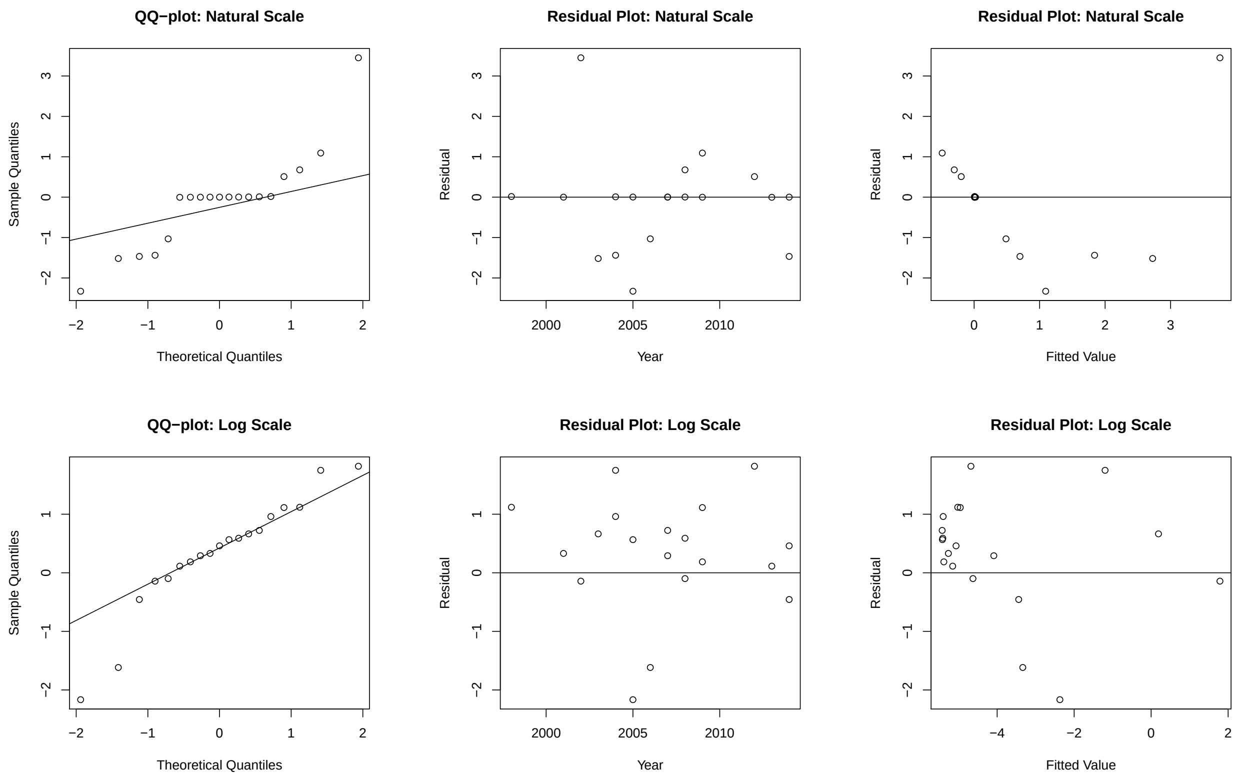






Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Cujo Outflow, and Christine-Lac du Sauvage was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Vulture-Polar was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
9	1616-43 (KPSF)	2002	5.35	3.75	3.45

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Streams

Two of three reference streams were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	80.8353	2	0.0000

- Conclusions:
  1616-43 (KPSF) shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of the remaining reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)-vs-Vulture-Polar	132.1920	3	0.0000

- Conclusions:
  1616-43 (KPSF) shows significant deviation from the slope of the reference stream.

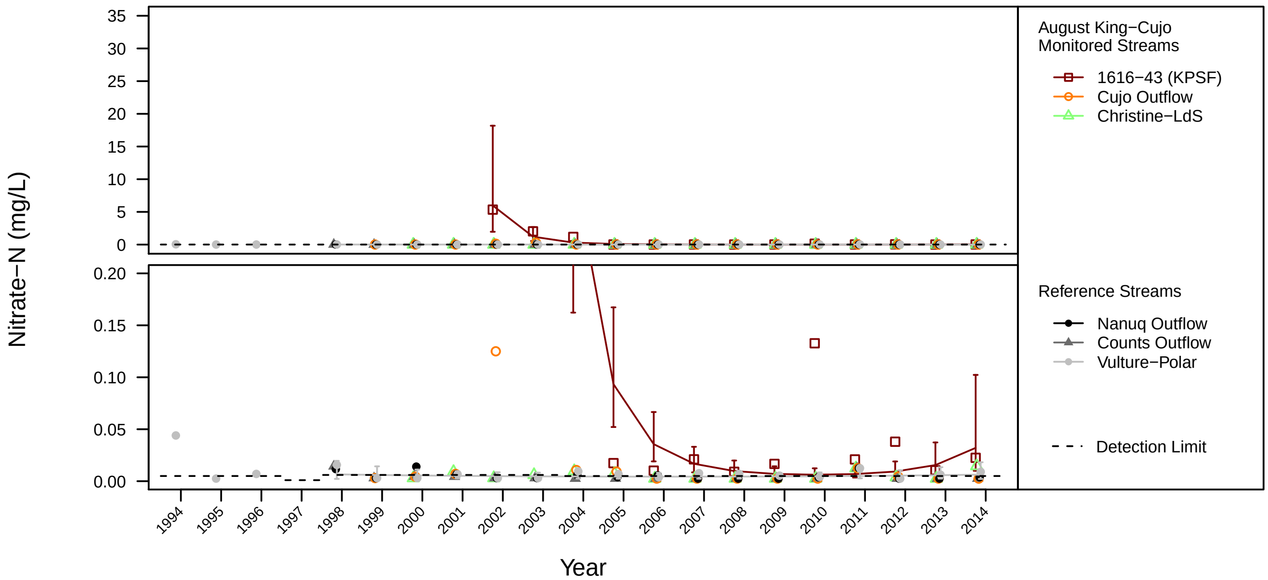
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Vulture-Polar	0.0790
Monitored Stream	1616-43 (KPSF)	0.7440

- Conclusions:
  Model fit for Vulture-Polar is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nitrate for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	2.25e-02	3.2e-02	1.90e-02	1.00e-02	1.02e-01	5.55e-02
Cujo Outflow	2.50e-03	NA	NA	NA	NA	NA
Christine-Lac du Sauvage	1.46e-02	NA	NA	NA	NA	NA
Nanuq Outflow	3.90e-03	NA	NA	NA	NA	NA
Counts Outflow	2.50e-03	NA	NA	NA	NA	NA
Vulture-Polar	9.00e-03	6.3e-03	3.41e-03	2.18e-03	1.82e-02	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
NitrateN	August	King-Cujo	Stream	Water	Nanuq Outflow Counts Outflow Cujo Outflow Christine-Lac du Sauvage	log e	Tobit regression	#1b separate intercepts & slopes	hardness-dependent	1616-43 (KPSF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

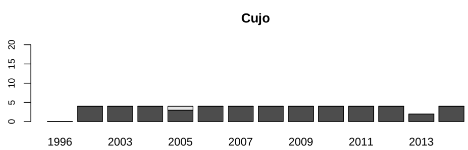
Analysis of April Total Phosphate-P in Lakes of the King-Cujo Watershed and Lac du Sauvage

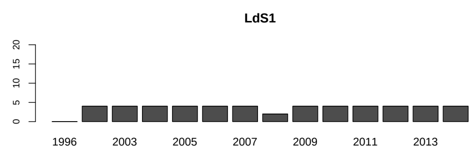
November 19, 2014

1 Censored Values:

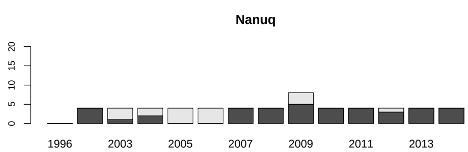
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

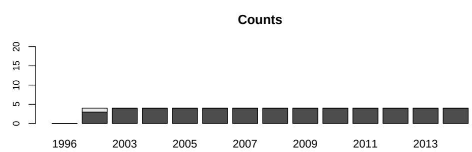
1.1 Monitored

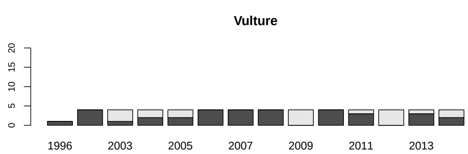




1.2 Reference

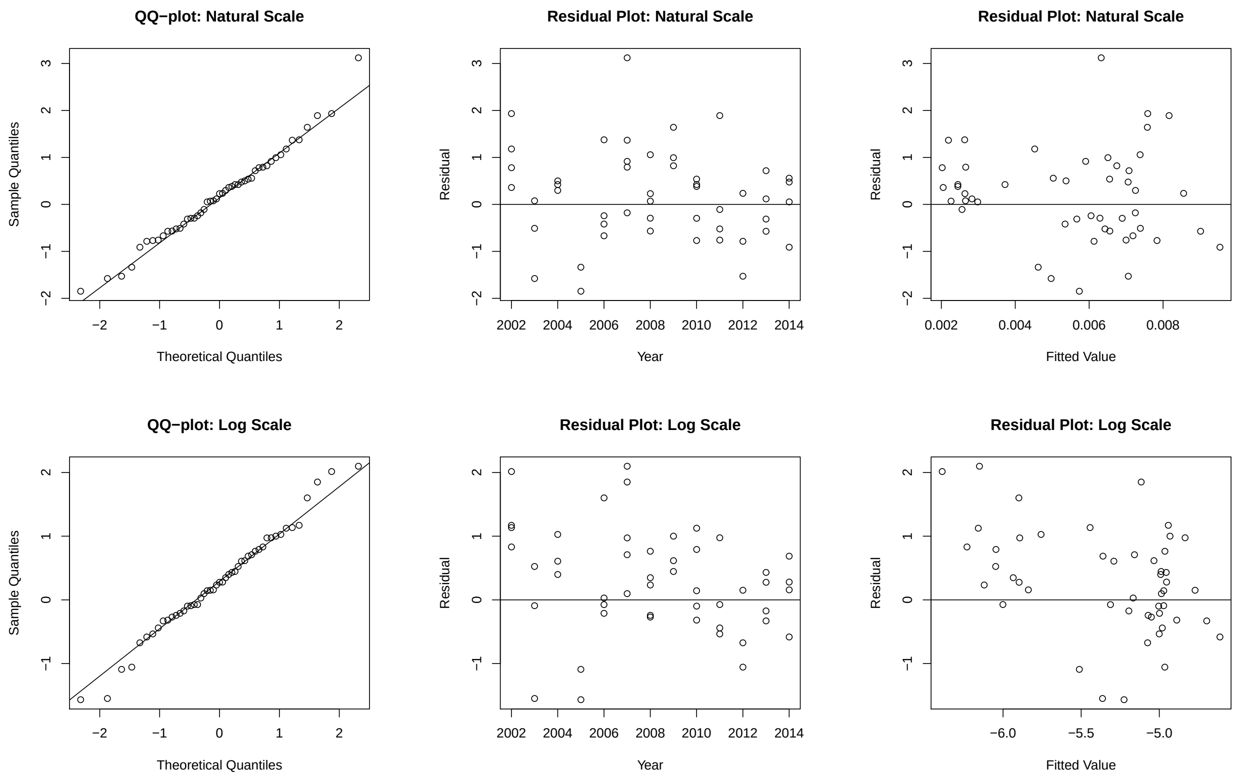






Comment:
10-60% of data in Nanuq and Vulture lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
77	LdS1	2007	0.01	0.01	3.12

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.59E-108	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
54.55	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
12.71	4.00	0.01

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	4.4728	2	0.1068
LdS1	5.7620	2	0.0561

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

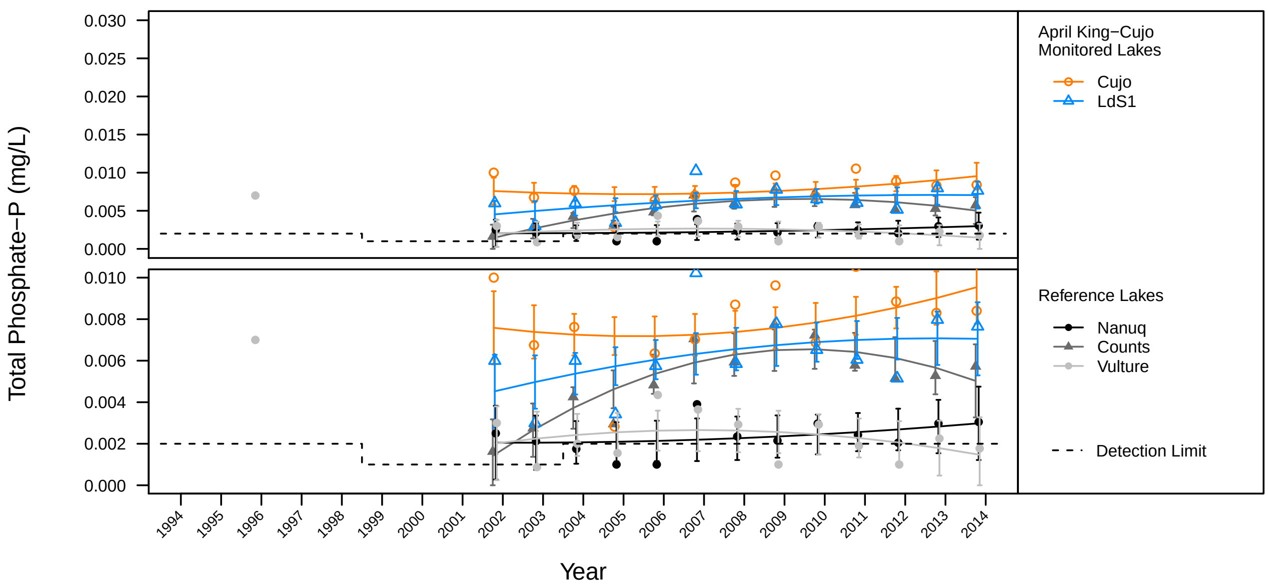
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.7780
Reference Lake	Nanuq	0.1580
Reference Lake	Vulture	0.1180
Monitored Lake	Cujo	0.1470
Monitored Lake	LdS1	0.2070

- Conclusions:
  Model fit for LdS1 is weak. Model fit for Nanuq, Vulture, and Cujo lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total phosphate-P for each monitored lake in 2014 Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	8.40e-03	9.54e-03	8.98e-04	7.78e-03	1.13e-02	2.63e-03
LdS1	7.65e-03	7.05e-03	8.98e-04	5.30e-03	8.81e-03	2.63e-03
Nanuq	3.05e-03	2.98e-03	9.01e-04	1.22e-03	4.75e-03	NA
Counts	5.72e-03	5.03e-03	8.98e-04	3.27e-03	6.79e-03	NA
Vulture	1.78e-03	1.47e-03	9.21e-04	0.00e+00	3.28e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Phosphorus	April	King-Cujo	Lake	Water	none	none	Tobit regression	#1b separate intercepts & slopes	lake-specific	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

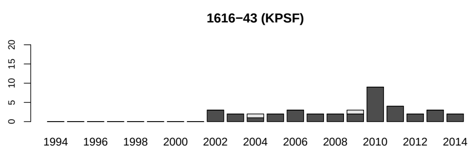
Analysis of August Total Phosphate-P in Lakes of the King-Cujo Watershed and Lac du Sauvage

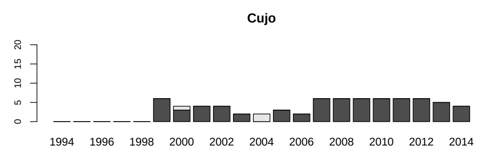
November 18, 2014

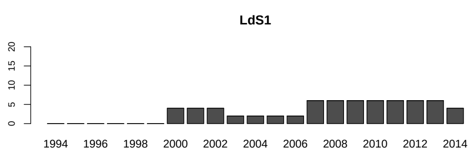
1 Censored Values:

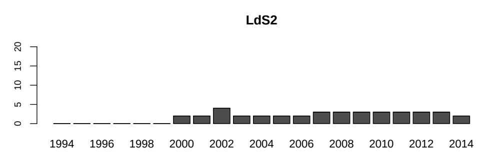
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

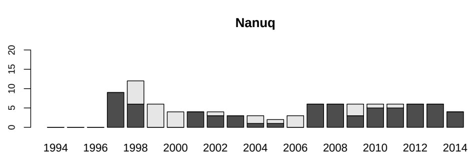


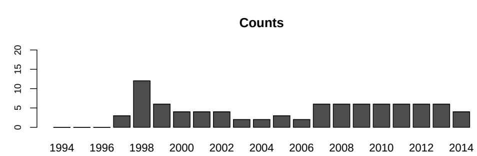






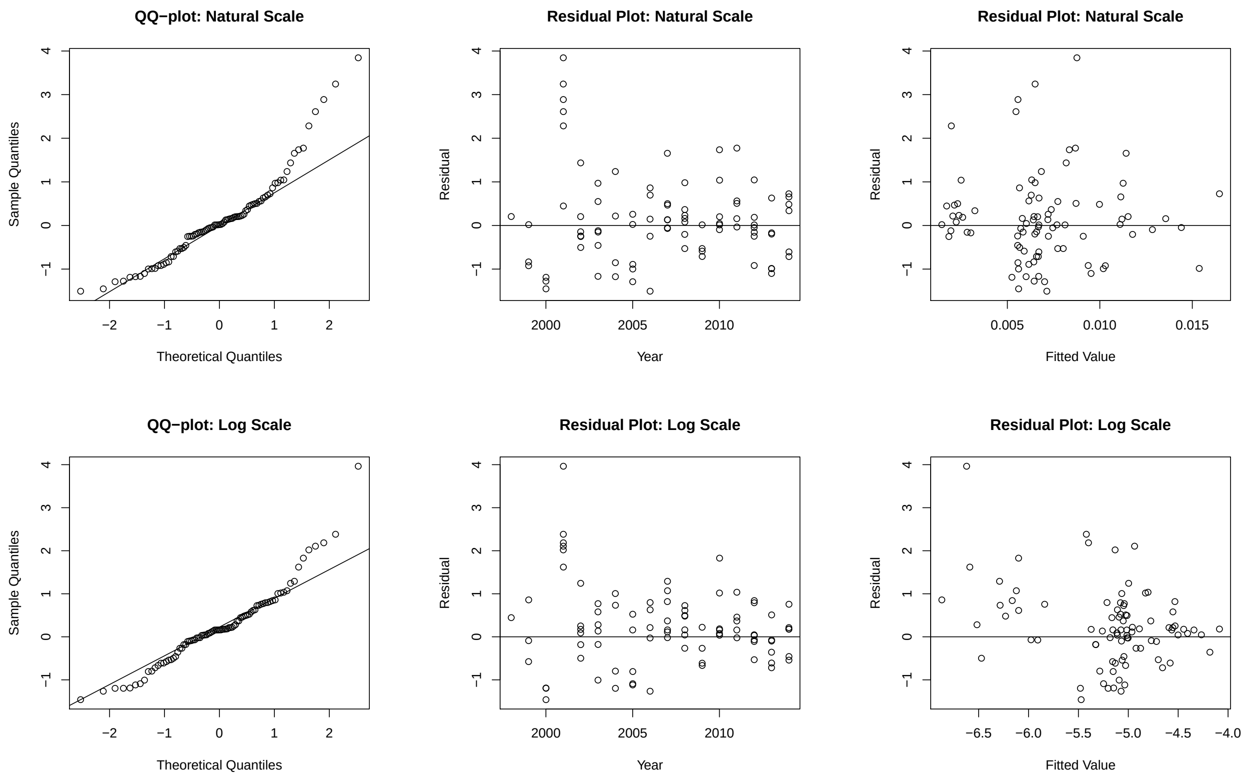
1.2 Reference





Comment:
10-60% of data in Nanuq and Vulture lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
29	Counts	2001	0.01	0.01	3.24
50	Cujo	2001	0.02	0.01	3.84

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
113	Nanuq	2001	0.01	-6.62	3.96

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
62.48	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
1.38	4.00	0.85

- Conclusions:
  The slopes do not differ significantly among reference lakes.

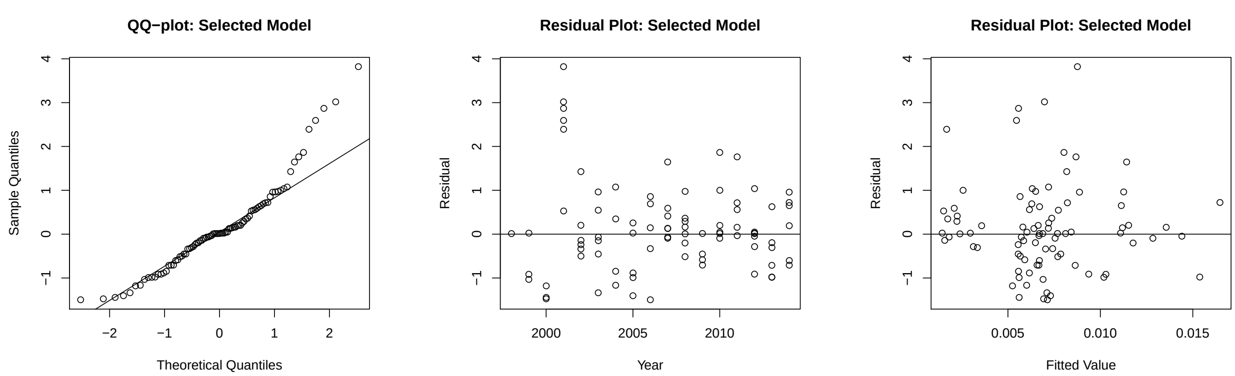
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.035	0.965	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
29	Counts	2001	0.01	0.01	3.02
50	Cujo	2001	0.02	0.01	3.82

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	2.5518	2	0.2792
Cujo	3.0450	2	0.2182
LdS1	0.1618	2	0.9223
LdS2	0.2003	2	0.9047

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

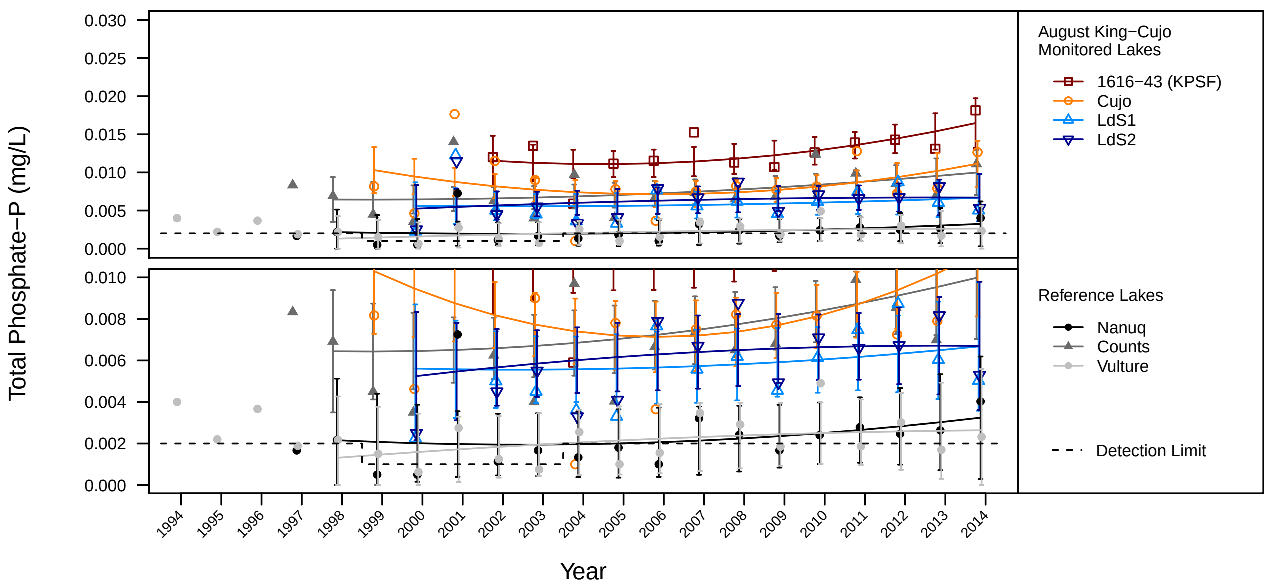
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.6550
Monitored Lake	1616-43 (KPSF)	0.3990
Monitored Lake	Cujo	0.1060
Monitored Lake	LdS1	0.0230
Monitored Lake	LdS2	0.0440

- Conclusions:
  Model fit for 1616-43 (KPSF) is weak. Model fit for Cujo, LdS1, and LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total phosphate-P for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.81e-02	1.65e-02	1.66e-03	1.32e-02	1.97e-02	4.87e-03
Cujo	1.26e-02	1.11e-02	1.54e-03	8.12e-03	1.41e-02	4.50e-03
LdS2	5.30e-03	6.70e-03	1.58e-03	3.61e-03	9.79e-03	4.61e-03
LdS1	5.02e-03	6.67e-03	1.58e-03	3.58e-03	9.76e-03	4.61e-03
Nanuq	4.02e-03	3.24e-03	1.50e-03	2.96e-04	6.19e-03	NA
Counts	1.11e-02	9.98e-03	1.50e-03	7.04e-03	1.29e-02	NA
Vulture	2.32e-03	2.64e-03	1.51e-03	0.00e+00	5.59e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Phosphorus	August	King-Cujo	Lake	Water	none	none	Tobit regression	#2 shared slopes	lake-specific	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

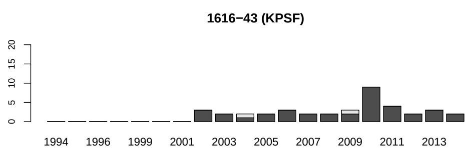
Analysis of August Total Phosphate-P in King-Cujo Watershed Streams

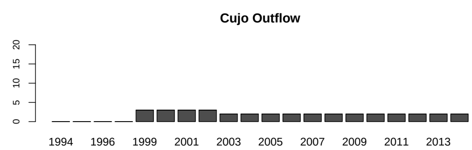
November 19, 2014

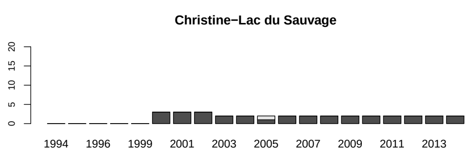
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

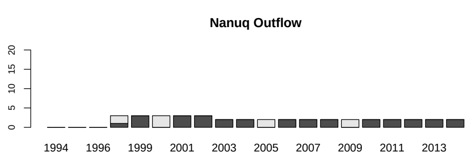
1.1 Monitored

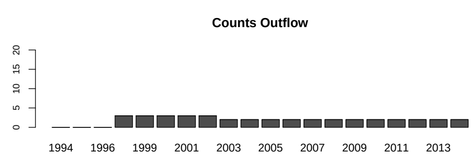


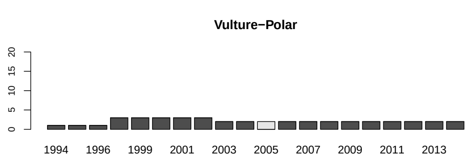




1.2 Reference

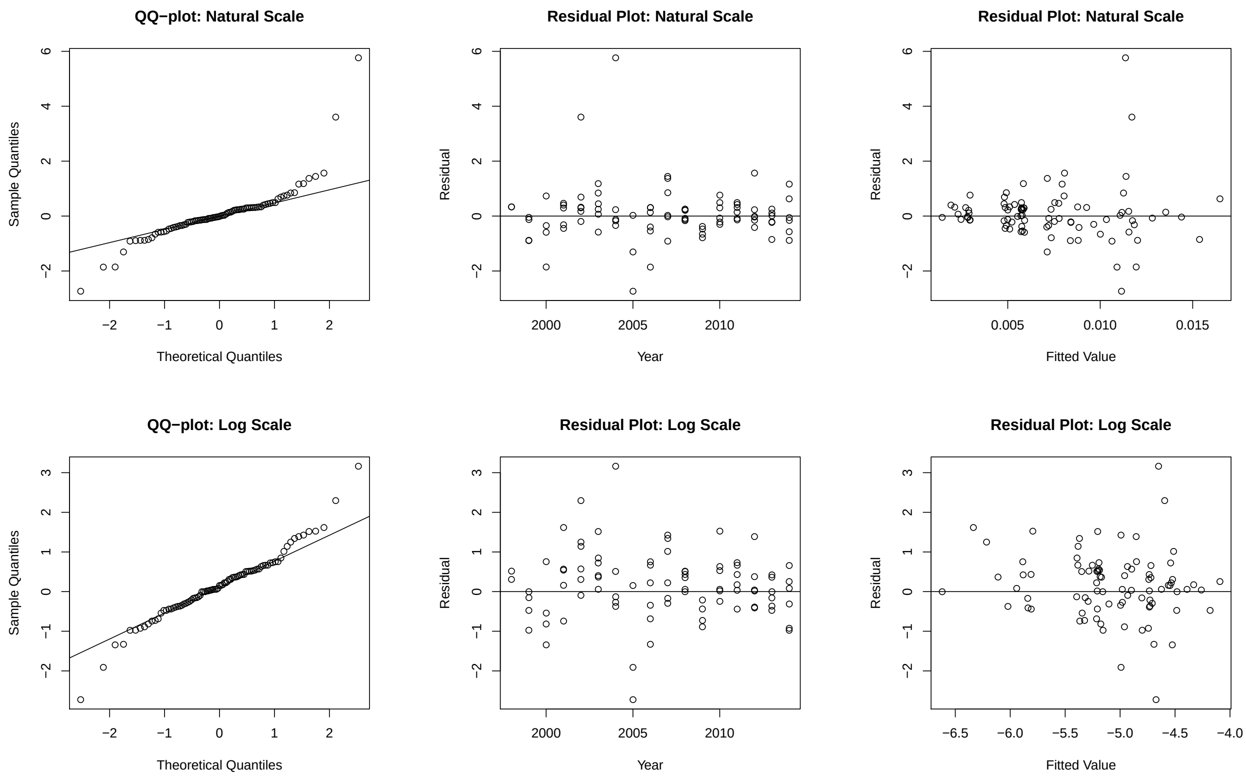






Comment:
10-60% of data in Nanuq Outflow was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
72	Cujo Outflow	2002	0.02	0.01	3.61
74	Cujo Outflow	2004	0.03	0.01	5.76

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
74	Cujo Outflow	2004	0.03	-4.65	3.16

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
108.78	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
8.81	4.00	0.07

- Conclusions:
  The slopes do not differ significantly among reference streams.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.633	0.367	0.000	Indistinguishable support for 1 & 2; choose Model 2.

- Conclusions:
  Results of AIC do not agree with reference model testing. AIC suggests that reference streams are best modeled using separate slopes and intercepts. Contrasts suggest that reference streams share a common slope; however, these results are marginally significant, suggesting that there may be important differences in reference stream slopes. Proceeding with monitored contrasts using reference model 1b (fitting separate slopes and intercepts for reference streams).

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	2.6364	2	0.2676
Cujo Outflow	0.9502	2	0.6218
Christine-Lac du Sauvage	0.0433	2	0.9786

- Conclusions:
  No significant deviations were found when comparing monitored streams to a constant slope of zero.

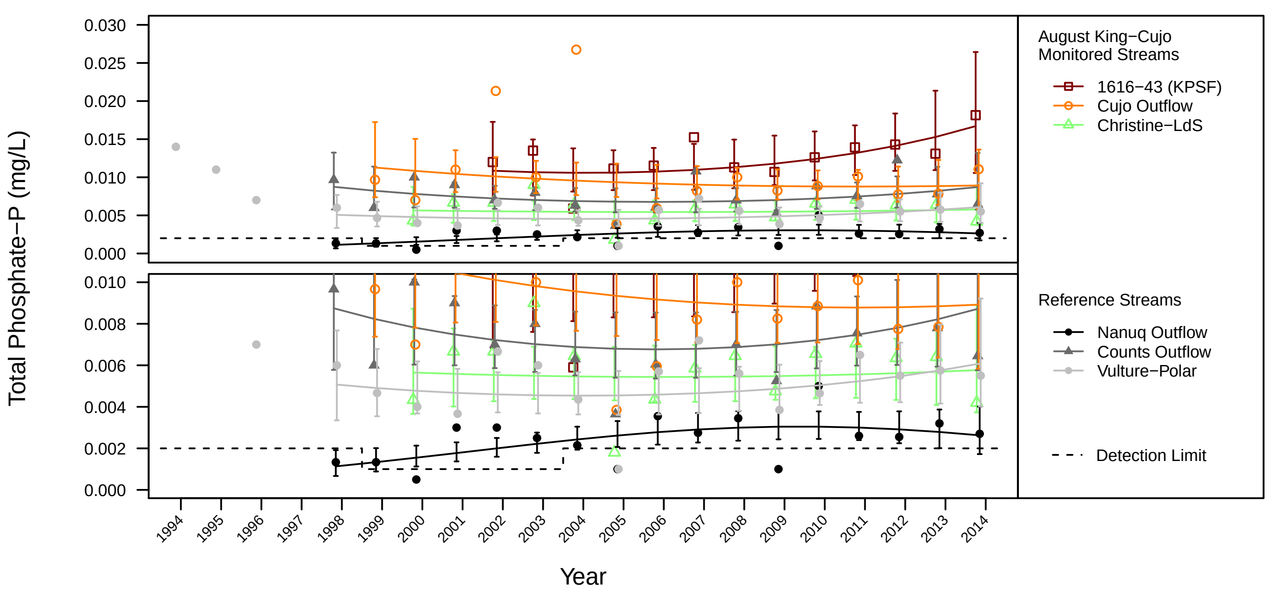
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.0880
Reference Stream	Nanuq Outflow	0.2790
Reference Stream	Vulture-Polar	0.0450
Monitored Stream	1616-43 (KPSF)	0.3330
Monitored Stream	Christine-Lac du Sauvage	0.0030
Monitored Stream	Cujo Outflow	0.0330

- Conclusions:
  Model fit for Nanuq Outflow and 1616-43 (KPSF) is weak. Model fit for Counts Outflow, Vulture-Polar, Cujo Outflow, and Christine-Lac du Sauvage is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total phosphate-P for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.81e-02	1.67e-02	3.91e-03	1.06e-02	2.64e-02	1.14e-02
Cujo Outflow	1.11e-02	8.92e-03	1.93e-03	5.84e-03	1.36e-02	5.65e-03
Christine-Lac du Sauvage	4.20e-03	5.77e-03	1.28e-03	3.73e-03	8.91e-03	3.75e-03
Nanuq Outflow	2.70e-03	2.63e-03	5.67e-04	1.72e-03	4.01e-03	NA
Counts Outflow	6.45e-03	8.72e-03	1.84e-03	5.76e-03	1.32e-02	NA
Vulture-Polar	5.50e-03	6.09e-03	1.29e-03	4.02e-03	9.22e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Phosphorus	August	King-Cujo	Stream	Water	none	log e	Tobit regression	#1b separate intercepts & slopes	site-specific	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

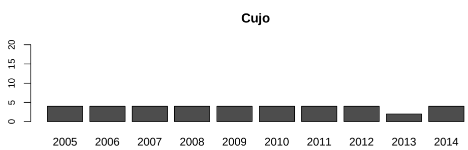
Analysis of April Total Organic Carbon in Lakes of the King-Cujo Watershed and Lac du Sauvage

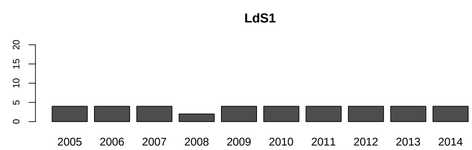
November 20, 2014

1 Censored Values:

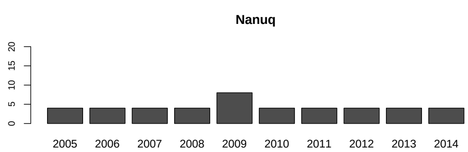
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

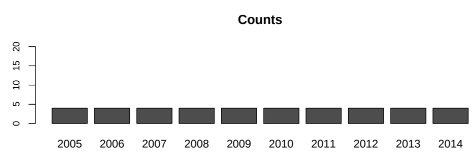
1.1 Monitored

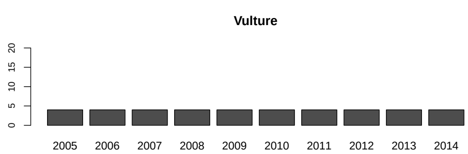




1.2 Reference

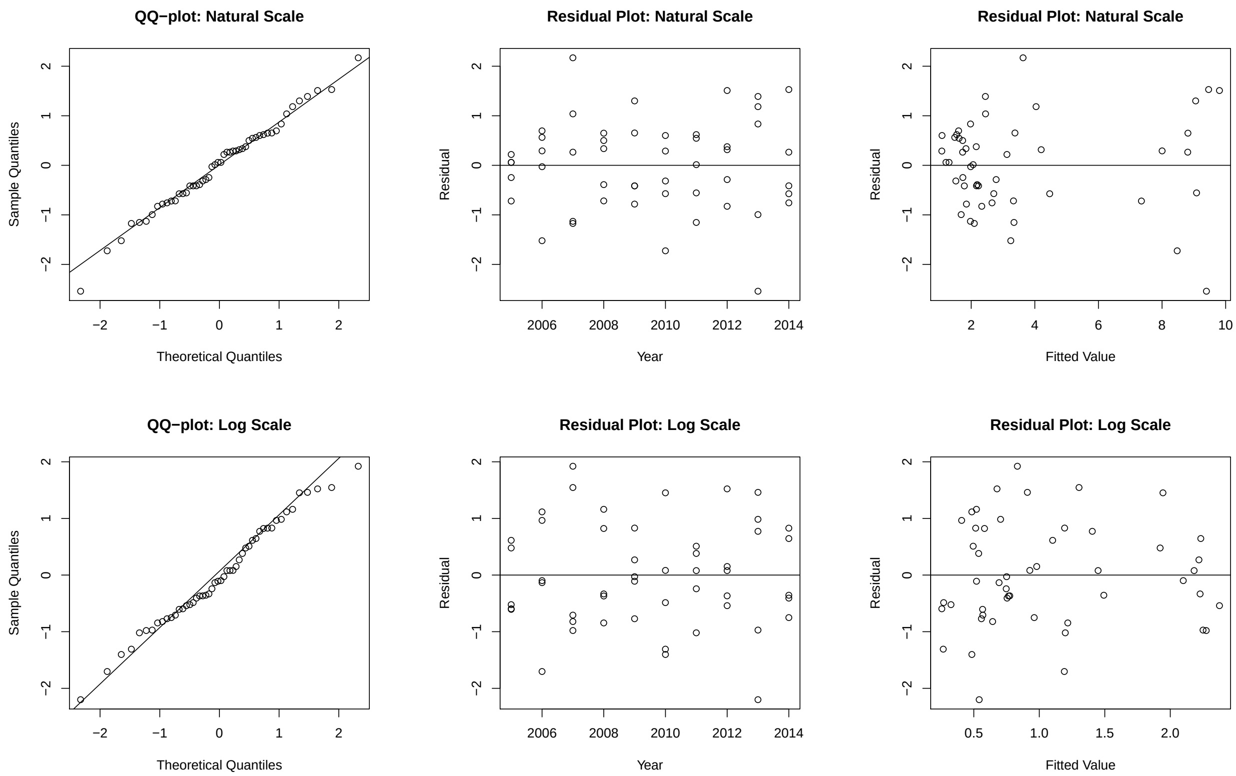






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.32E-24	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
48.68	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
6.85	4.00	0.14

- Conclusions:
  The slopes do not differ significantly among reference lakes.

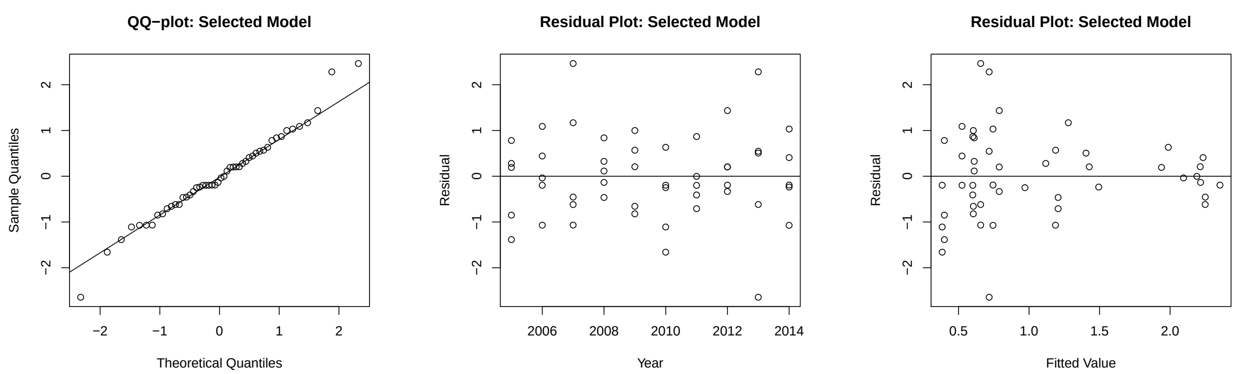
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
The reduced model shows some dependence on fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	0.23	2.00	0.89
LdS1	0.50	2.00	0.78

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

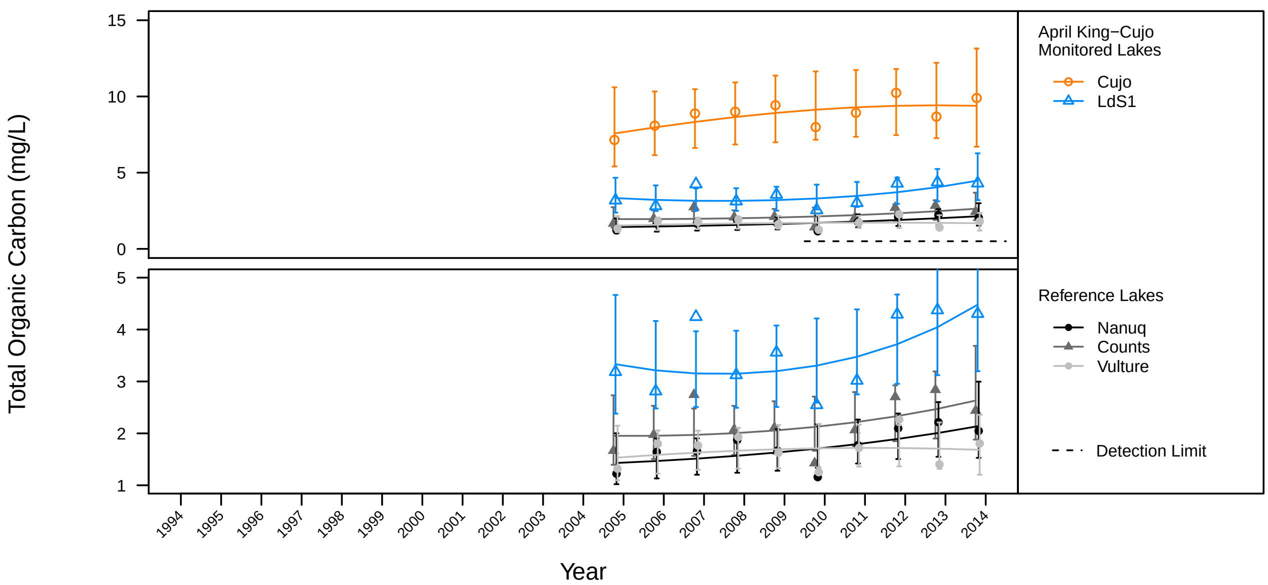
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1370
Monitored Lake	Cujo	0.5210
Monitored Lake	LdS1	0.3520

- Conclusions:
  Model fit for LdS1 Lake is weak. Model fit for pooled reference lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	9.90E+00	9.39E+00	1.61E+00	6.70E+00	1.31E+01	4.72E+00
LdS1	4.30E+00	4.48E+00	7.69E-01	3.20E+00	6.27E+00	2.25E+00
Nanuq	2.05E+00	2.14E+00	3.67E-01	1.53E+00	3.00E+00	
Counts	2.44E+00	2.63E+00	4.52E-01	1.88E+00	3.69E+00	
Vulture	1.81E+00	1.68E+00	2.89E-01	1.20E+00	2.36E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
TOC	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

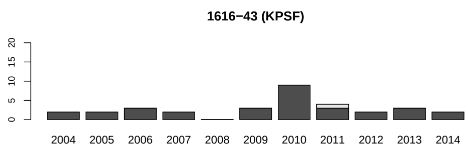
Analysis of August Total Organic Carbon in Lakes of the King-Cujo Watershed and Lac du Sauvage

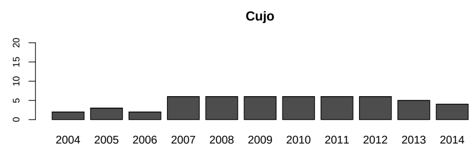
November 18, 2014

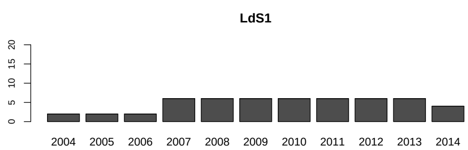
1 Censored Values:

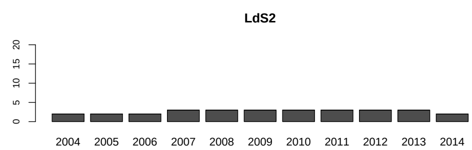
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

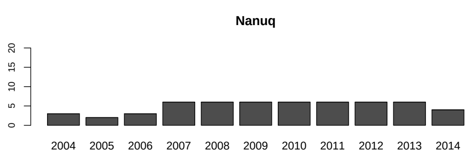


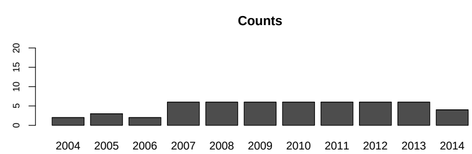


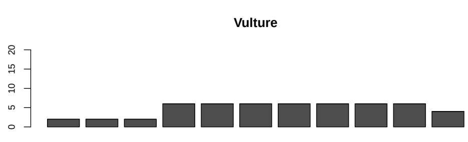




1.2 Reference

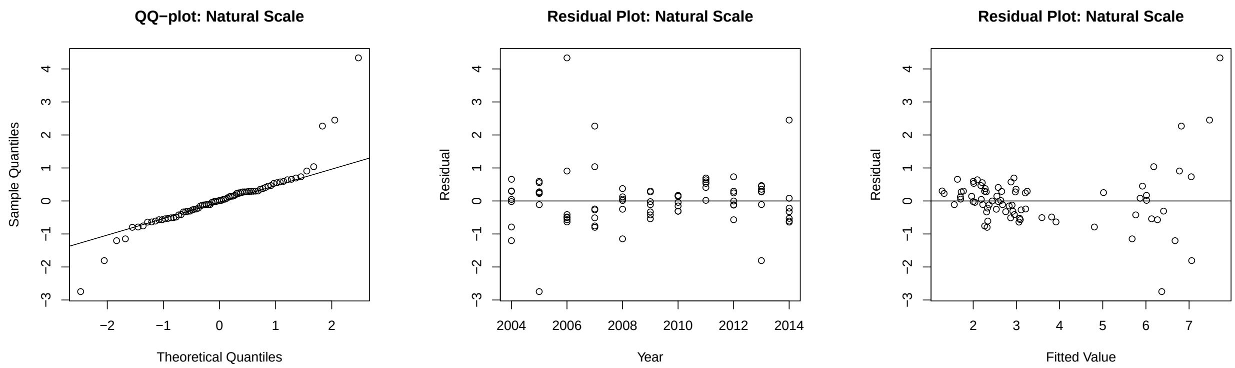


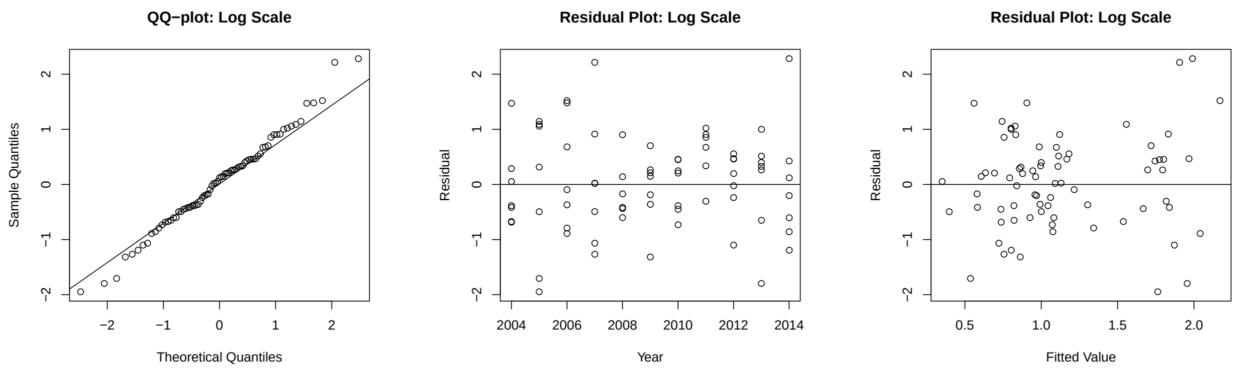




Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit





Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
13	1616-43 (KPSF)	2006	9.79	7.71	4.34

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
84.99	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
8.22	4.00	0.08

- Conclusions:
  The slopes do not differ significantly among reference lakes.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. AIC suggests that reference lakes are best modeled using separate slopes and intercepts. Contrasts suggest that reference lakes share a common slope; however, these results are marginally significant, suggesting that there may be important differences in reference lake slopes. Proceeding with monitored contrasts using reference model 1b (fitting separate slopes and intercepts for reference lakes).

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	1.3444	2	0.5106
Cujo	4.1284	2	0.1269
LdS1	4.7628	2	0.0924
LdS2	3.6644	2	0.1601

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

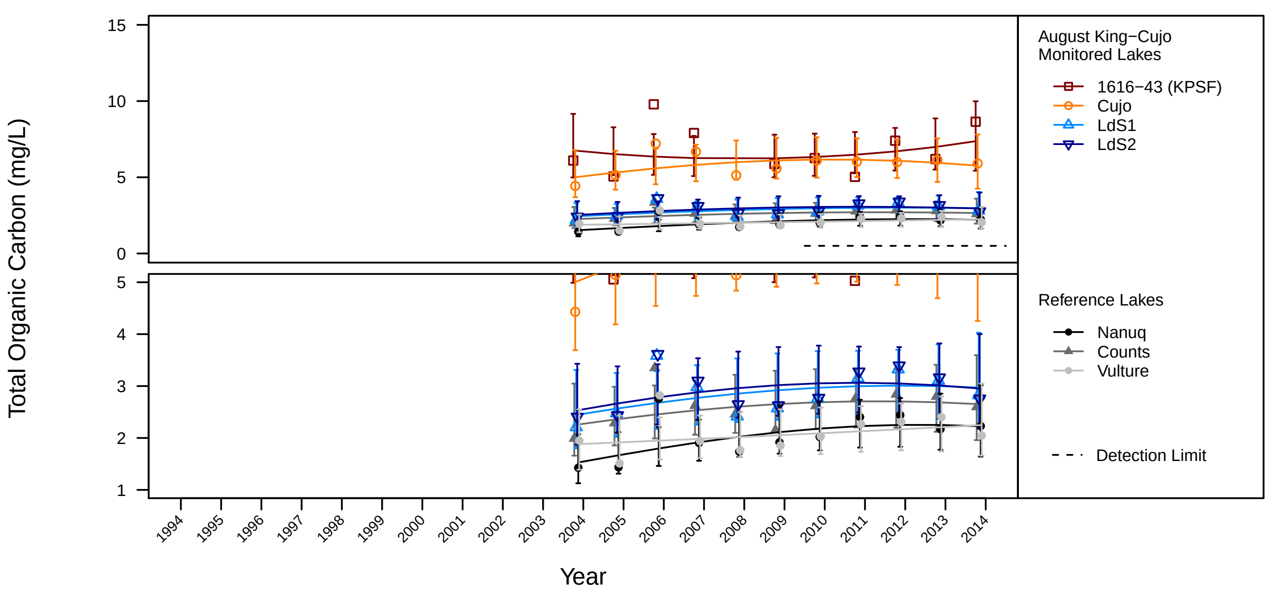
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.1900
Reference Lake	Nanuq	0.4080
Reference Lake	Vulture	0.1230
Monitored Lake	1616-43 (KPSF)	0.0590
Monitored Lake	Cujo	0.2490
Monitored Lake	LdS1	0.2330
Monitored Lake	LdS2	0.2090

- Conclusions:
  Model fit for Nanuq, Cujo, LdS1, and LdS2 is weak. Model fit for Counts, Vulture, and 1616-43 (KPSF) is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	8.64E+00	7.37E+00	1.14E+00	5.43E+00	9.99E+00	3.35E+00
Cujo	5.91E+00	5.76E+00	8.93E-01	4.25E+00	7.81E+00	2.61E+00
LdS2	2.75E+00	2.95E+00	4.57E-01	2.18E+00	4.00E+00	1.34E+00
LdS1	2.83E+00	2.97E+00	4.60E-01	2.19E+00	4.03E+00	1.35E+00
Nanuq	2.23E+00	2.23E+00	3.45E-01	1.64E+00	3.01E+00	
Counts	2.60E+00	2.65E+00	4.11E-01	1.96E+00	3.60E+00	
Vulture	2.05E+00	2.25E+00	3.48E-01	1.66E+00	3.05E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
TOC	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

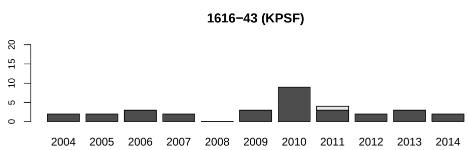
Analysis of August Total Organic Carbon in King-Cujo Watershed Streams

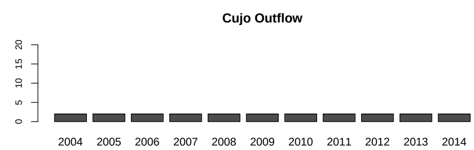
November 20, 2014

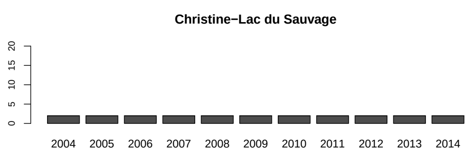
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

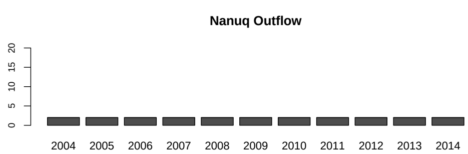
1.1 Monitored

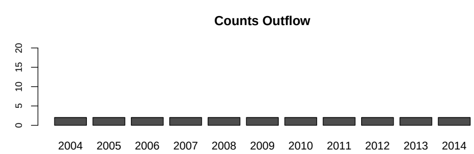


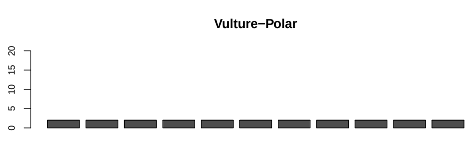




1.2 Reference

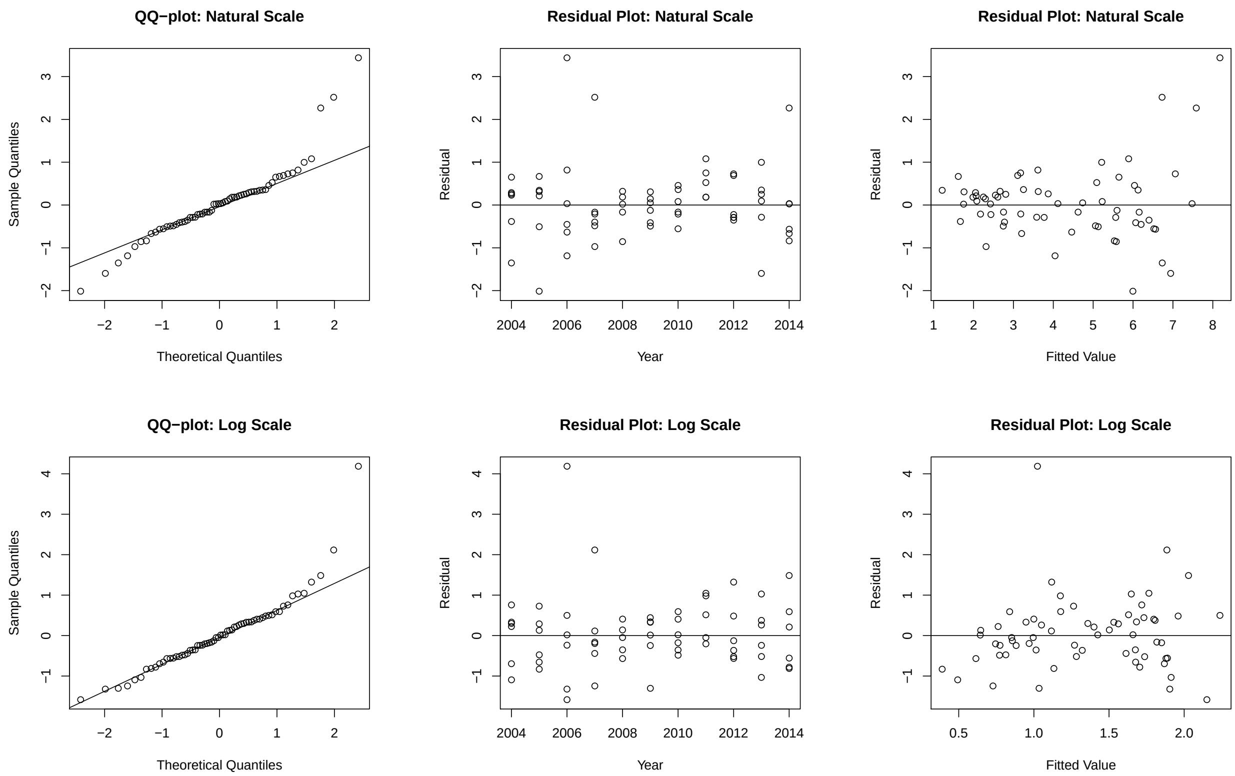






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
13	1616-43 (KPSF)	2006	9.79	8.18	3.44

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
97	Nanuq Outflow	2006	4.00	1.02	4.19

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
13.58	6.00	0.03

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
3.68	4.00	0.45

- Conclusions:
  The slopes do not differ significantly among reference streams.

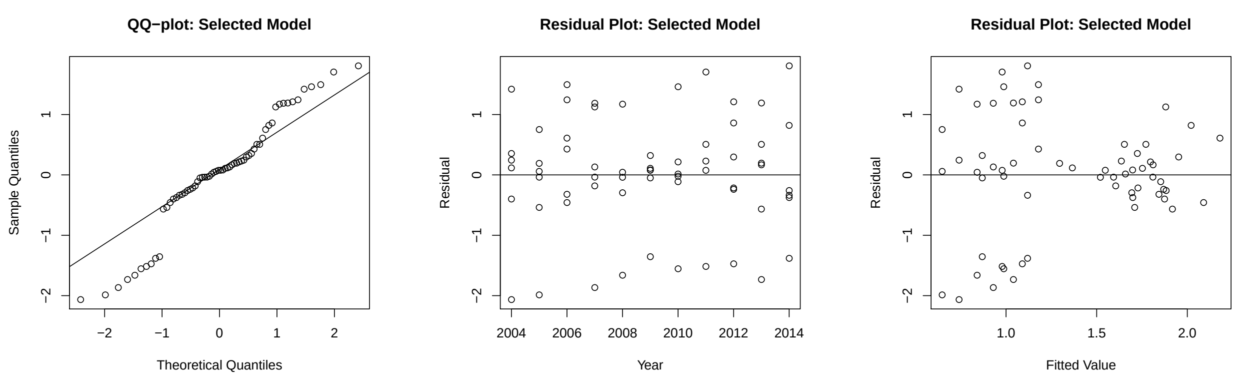
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:

3.4 Assess Fit of Reduced Model



Outliers:

None

The reduced model shows dependence on fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	0.6061	2	0.7386
Cujo Outflow	1.5152	2	0.4688
Christine-Lac du Sauvage	0.2754	2	0.8714

- Conclusions:
  No significant deviations were found when comparing monitored streams to the common slope of reference streams.

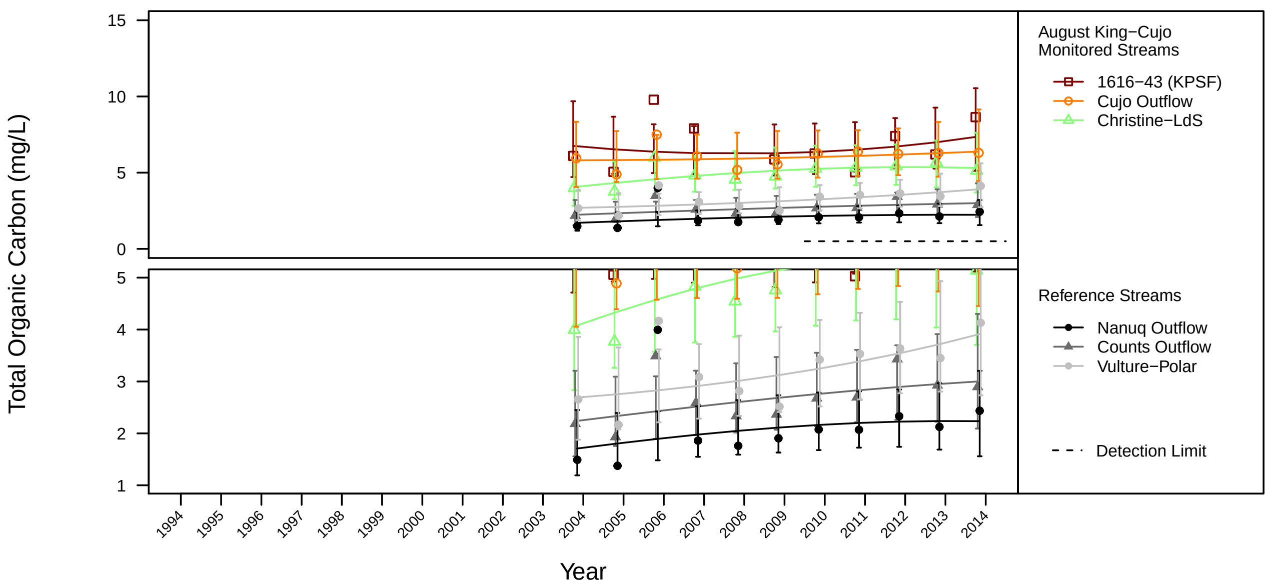
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.1240
Monitored Stream	1616-43 (KPSF)	0.0490
Monitored Stream	Christine-Lac du Sauvage	0.4560
Monitored Stream	Cujo Outflow	0.0780

- Conclusions:
  Model fit for Christine-Lac du Sauvage is weak. Model fit for pooled reference streams, 1616-43 (KPSF), and Cujo Outflow is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	8.64E+00	7.35E+00	1.35E+00	5.12E+00	1.05E+01	3.96E+00
Cujo Outflow	6.30E+00	6.38E+00	1.17E+00	4.45E+00	9.15E+00	3.43E+00
Christine-Lac du Sauvage	5.14E+00	5.31E+00	9.76E-01	3.70E+00	7.61E+00	2.86E+00
Nanuq Outflow	2.44E+00	2.24E+00	4.11E-01	1.56E+00	3.20E+00	
Counts Outflow	2.90E+00	3.00E+00	5.51E-01	2.09E+00	4.30E+00	
Vulture-Polar	4.13E+00	3.92E+00	7.20E-01	2.73E+00	5.62E+00	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
TOC	August	King-Cujo	Stream	Water	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

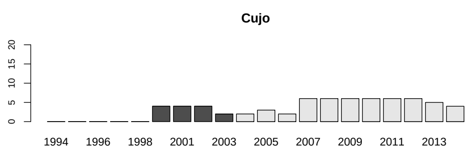
Analysis of April Total Antimony in Lakes of the King-Cujo Watershed and Lac du Sauvage

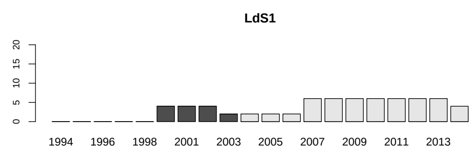
November 20, 2014

1 Censored Values:

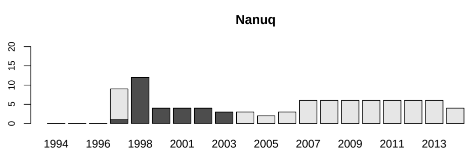
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

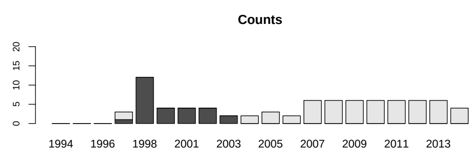
1.1 Monitored

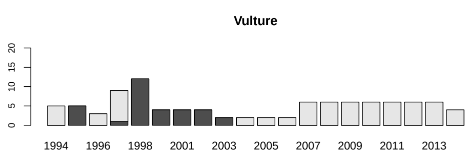




1.2 Reference

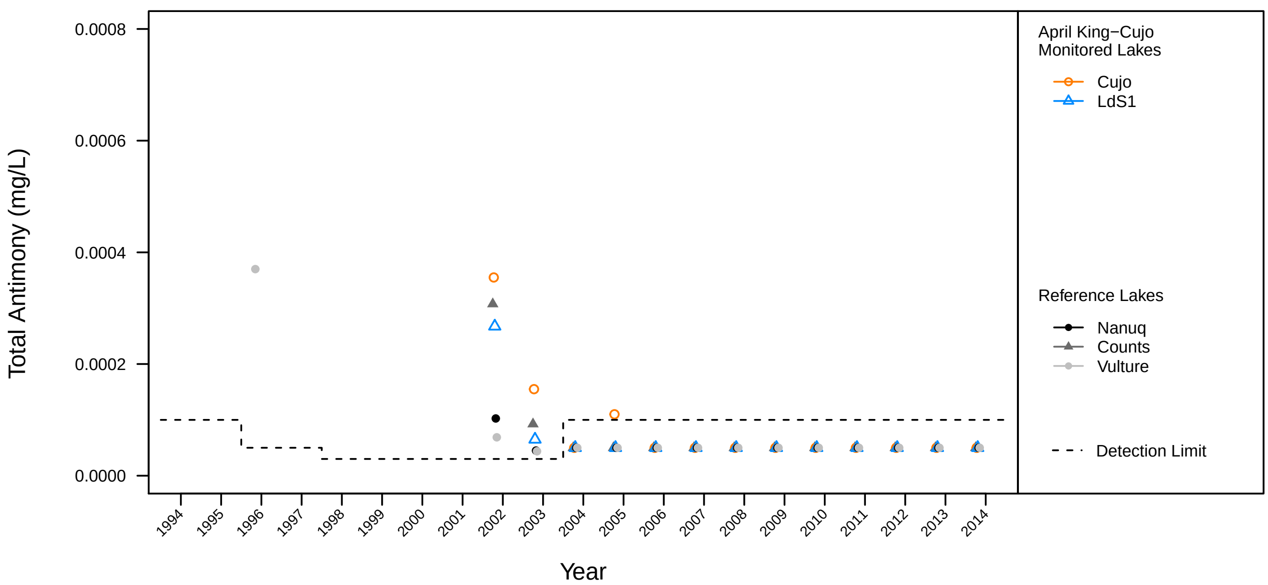






Comment:
Greater than 60% of data in all reference and monitores lakes was less than the detection limit. All lakes were excluded from further analyses. No statistical tests were performed. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Antimony	April	King-Cujo	Lake	Water	ALL	NA	NA	NA	0.02	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

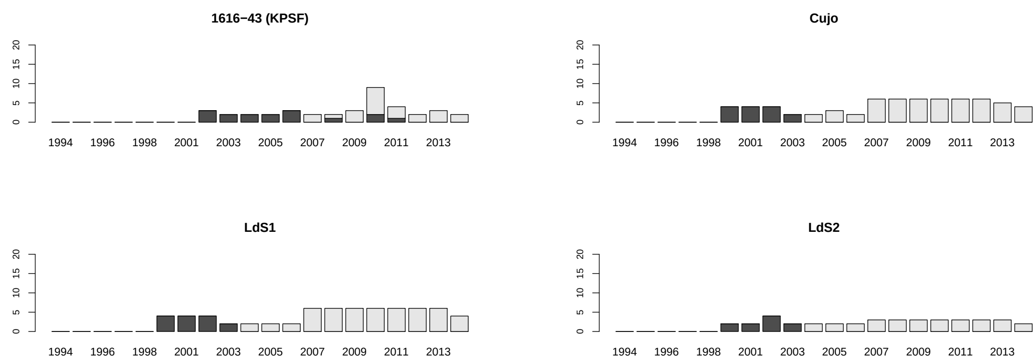
Analysis of August Total Antimony in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 18, 2014

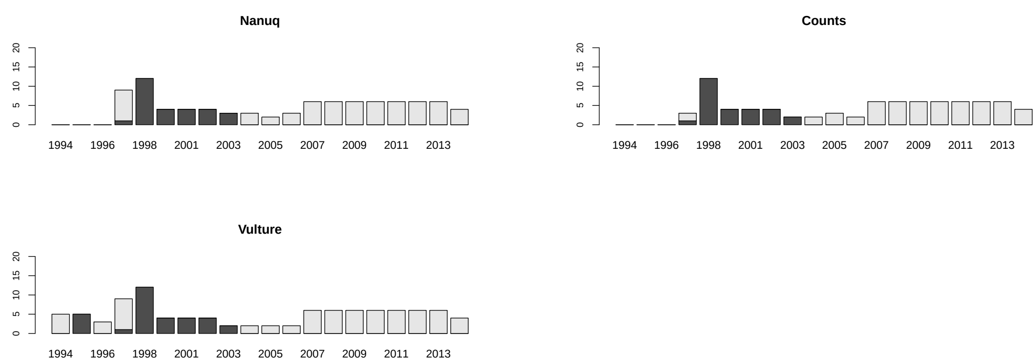
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

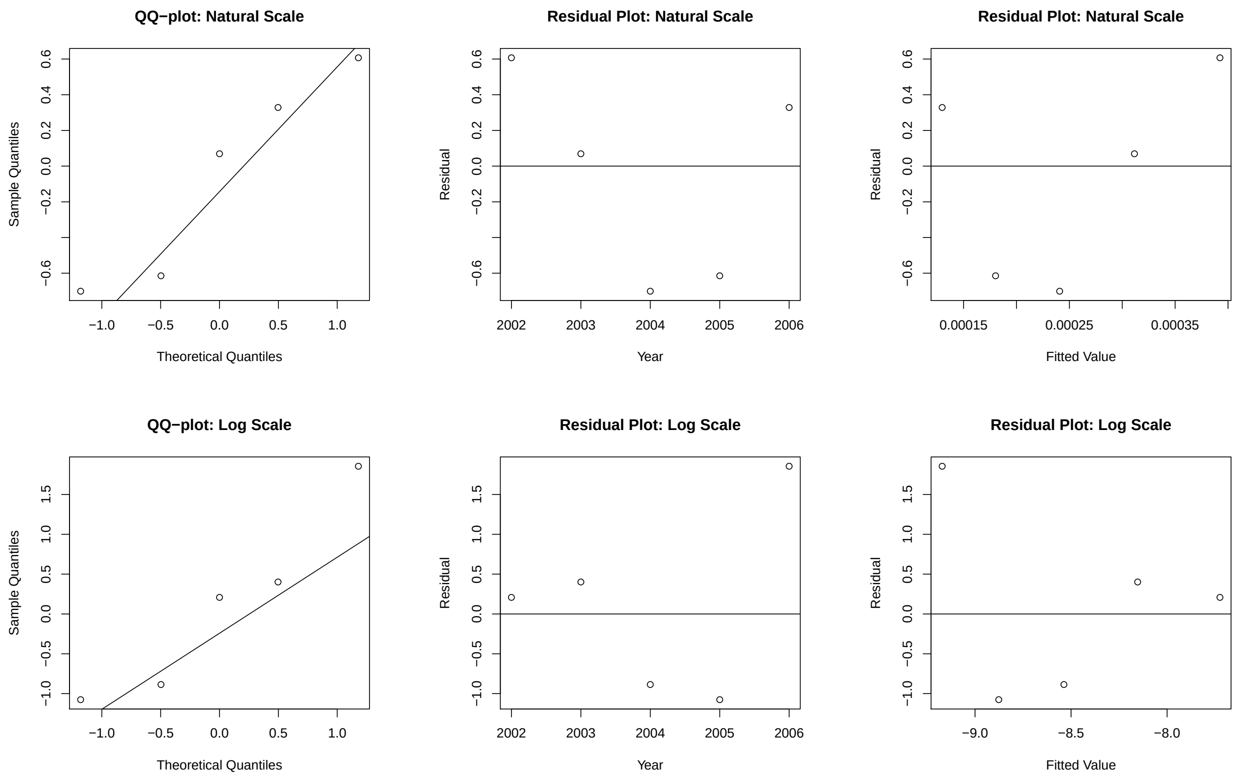


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Cujo, LdS1, and LdS2 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in 1616-43 (KPSF) was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	10.9633	2	0.0042

- Conclusions:
  1616-43 (KPSF) shows significant deviation from a slope of zero.

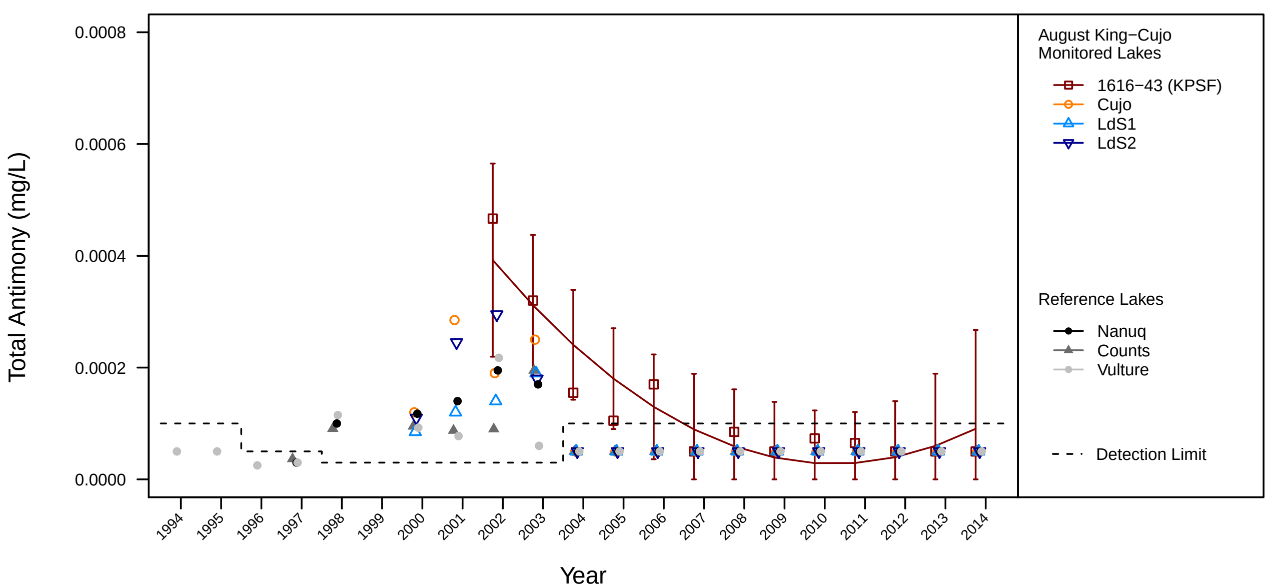
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-43 (KPSF)	0.8580

- Conclusions:
  Model provides a good fit for 1616-43 (KPSF).

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total antimony for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5e-05	9.04e-05	9.03e-05	0e+00	2.67e-04	2.64e-04
Cujo	5e-05	NA	NA	NA	NA	NA
LdS2	5e-05	NA	NA	NA	NA	NA
LdS1	5e-05	NA	NA	NA	NA	NA
Nanuq	5e-05	NA	NA	NA	NA	NA
Counts	5e-05	NA	NA	NA	NA	NA
Vulture	5e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Antimony	August	King-Cujo	Lake	Water	Counts Nanuq Vulture Cujo LdS1 LdS2	none	Tobit regression	#1a slope of zero	0.02	1616-43 (KPSF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

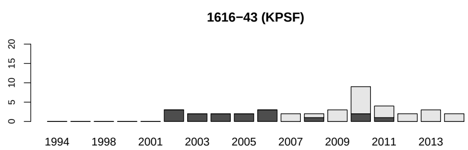
Analysis of August Antimony in King-Cujo Watershed Streams

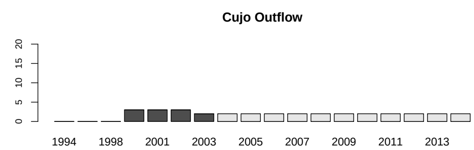
November 18, 2014

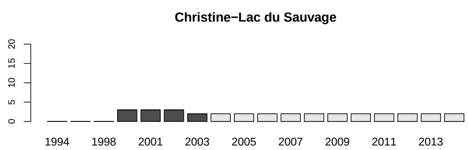
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

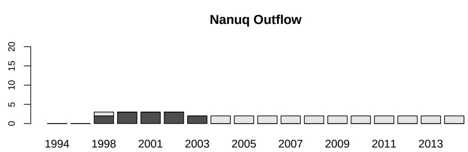
1.1 Monitored

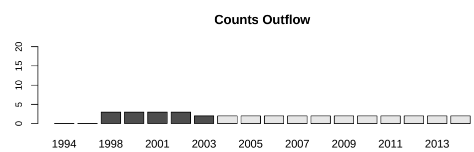


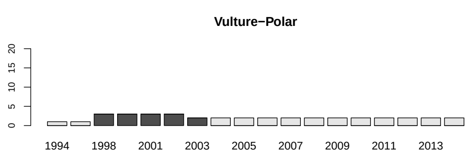




1.2 Reference

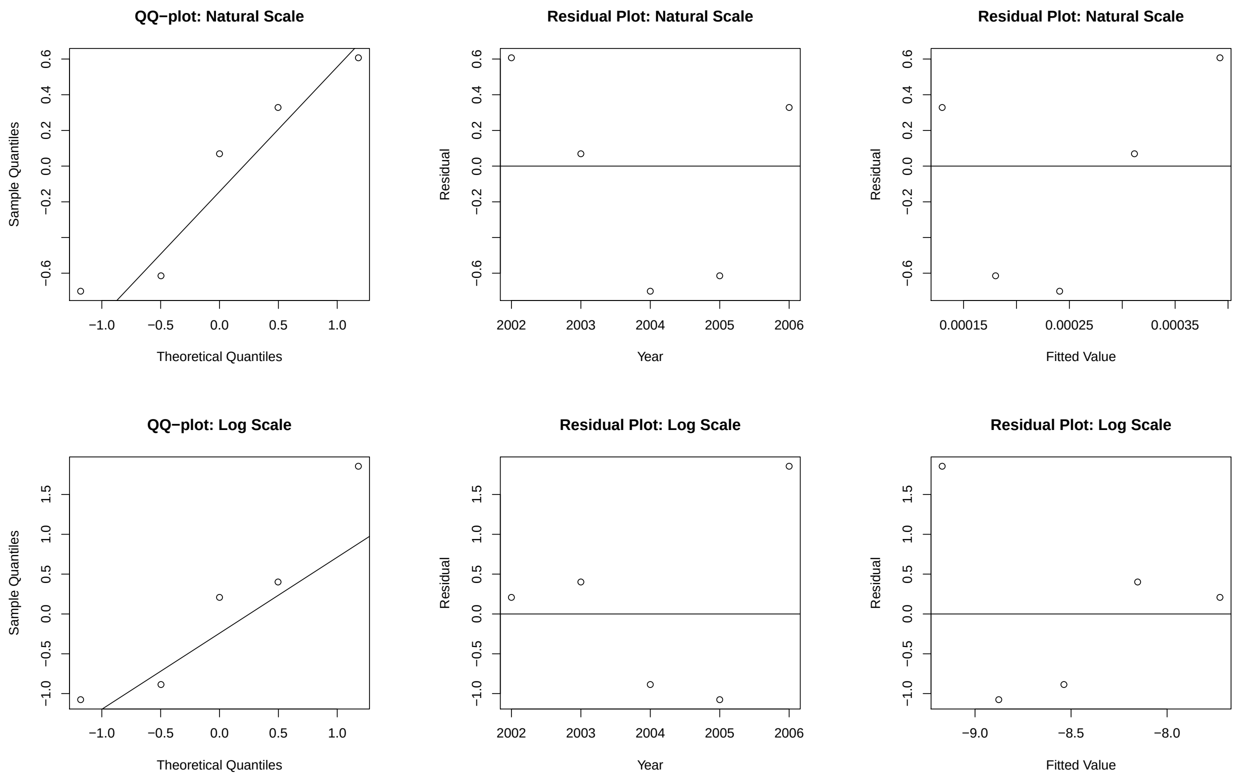






Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar, Cujo Outflow, and Christine-Lac du Sauvage was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in 1616-43 (KPSF) was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	10.9633	2	0.0042

- Conclusions:
  1616-43 (KPSF) shows significant deviation from a slope of zero.

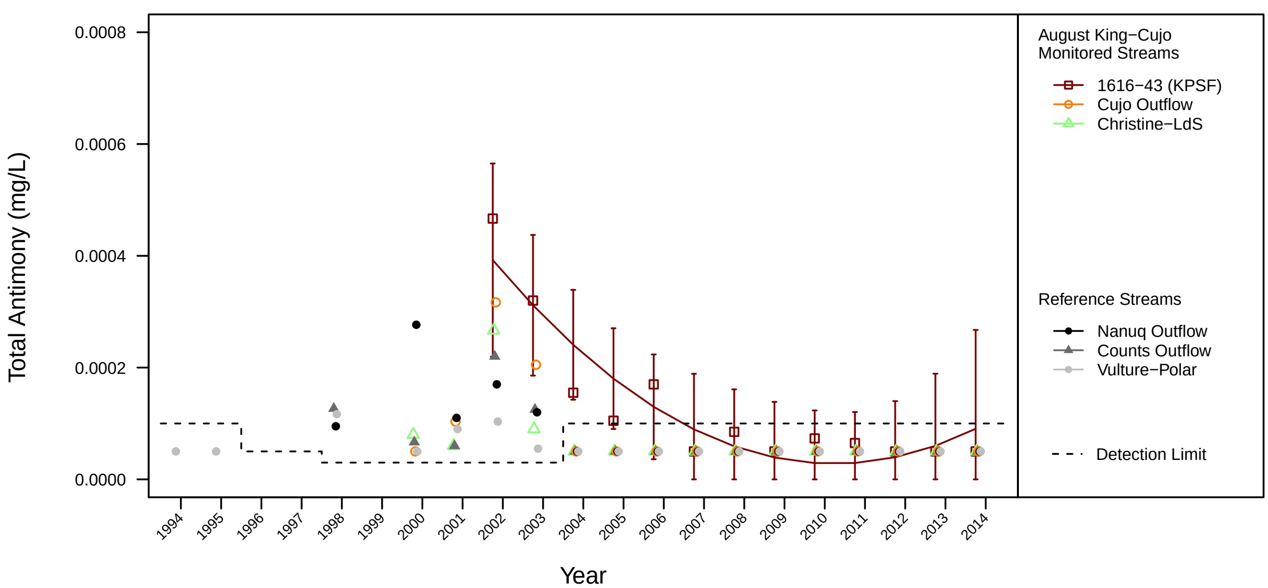
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-43 (KPSF)	0.8580

- Conclusions:
  Model provides a good fit for 1616-43 (KPSF).

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total antimony for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5e-05	9.04e-05	9.03e-05	0e+00	2.67e-04	2.64e-04
Cujo Outflow	5e-05	NA	NA	NA	NA	NA
Christine-Lac du Sauvage	5e-05	NA	NA	NA	NA	NA
Nanuq Outflow	5e-05	NA	NA	NA	NA	NA
Counts Outflow	5e-05	NA	NA	NA	NA	NA
Vulture-Polar	5e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Antimony	August	King-Cujo	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar Cujo Outflow Christine-Lac du Sauvage	none	Tobit regression	#1a slope of zero	0.02	1616-43 (KPSF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

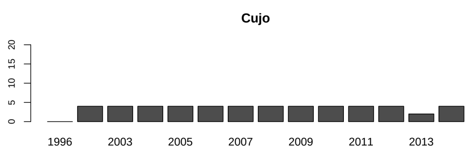
Analysis of April Total Arsenic in Lakes of the King-Cujo Watershed and Lac du Sauvage

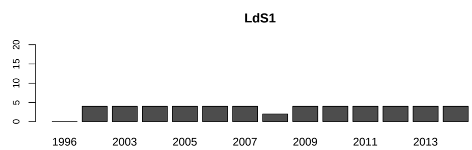
November 20, 2014

1 Censored Values:

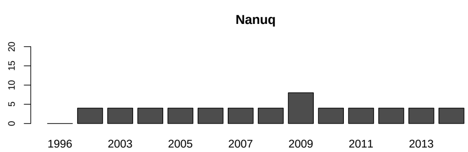
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

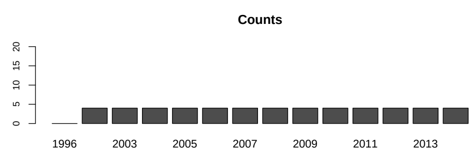
1.1 Monitored

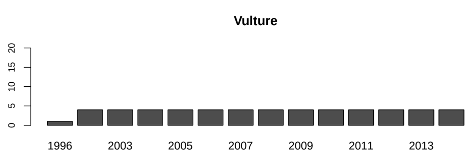




1.2 Reference

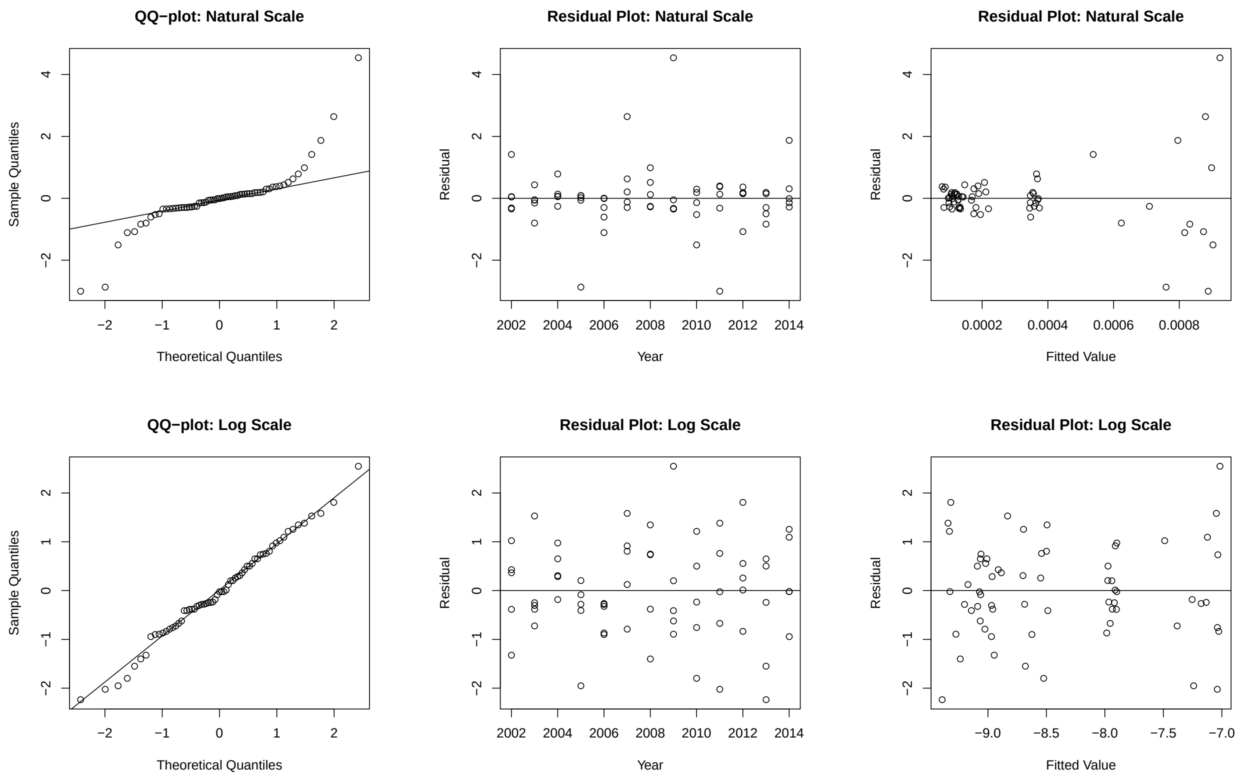






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
58	Cujo	2009	0.00	0.00	4.54
60	Cujo	2011	0.00	0.00	-3.00

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	3.69E-213	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
18413.86	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
13.94	4.00	0.01

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	12.48	2.00	0.00
LdS1	0.09	2.00	0.96

- Conclusions:
  Cujo Lake shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Cujo-vs-Nanuq	2.8958	3	0.4080
Cujo-vs-Counts	5326.1878	3	0.0000
Cujo-vs-Vulture	1410.3024	3	0.0000

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

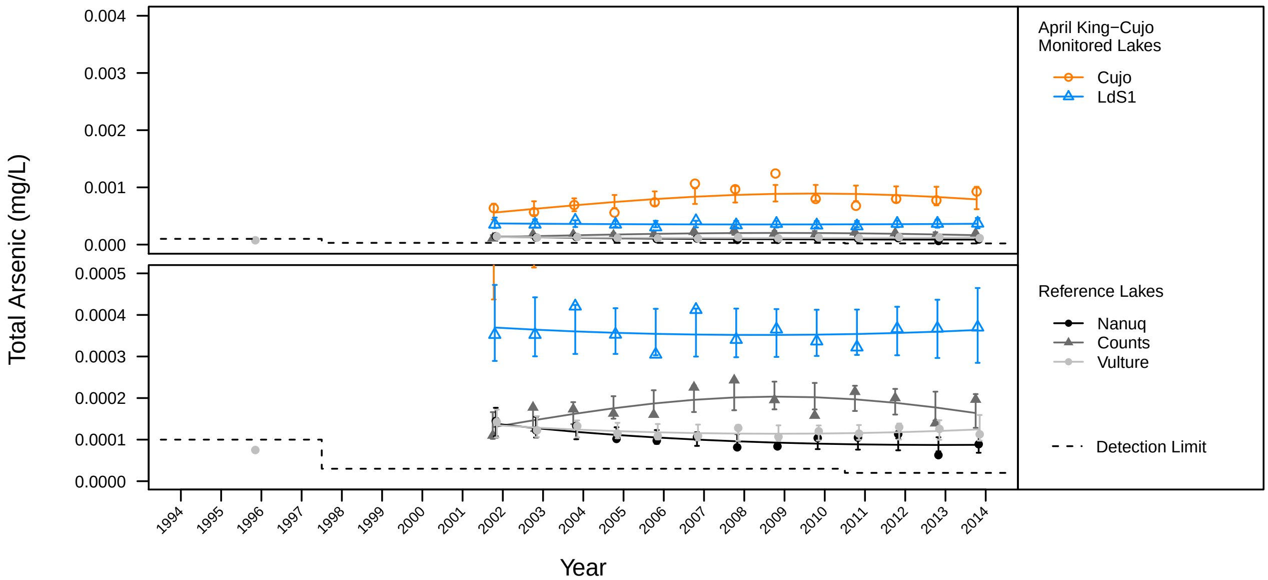
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4160
Reference Lake	Nanuq	0.5000
Reference Lake	Vulture	0.3290
Monitored Lake	Cujo	0.3840
Monitored Lake	LdS1	0.0320

- Conclusions:
  Model fit for Counts, Vulture, and Cujo lakes is weak. Model fit for LdS1 Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total arsenic for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	9.27e-04	7.90e-04	9.87e-05	6.18e-04	1.01e-03	2.89e-04
LdS1	3.70e-04	3.64e-04	4.55e-05	2.85e-04	4.65e-04	1.33e-04
Nanuq	8.90e-05	8.74e-05	1.09e-05	6.84e-05	1.12e-04	NA
Counts	1.97e-04	1.64e-04	2.05e-05	1.28e-04	2.10e-04	NA
Vulture	1.13e-04	1.25e-04	1.56e-05	9.75e-05	1.59e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Arsenic	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	0.005	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

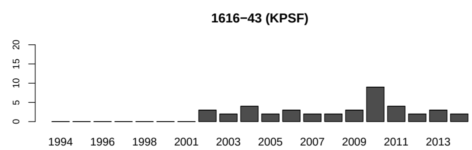
Analysis of August Total Arsenic in Lakes of the King-Cujo Watershed and Lac du Sauvage

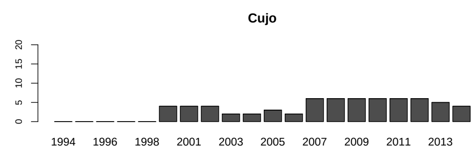
November 18, 2014

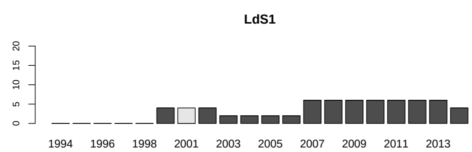
1 Censored Values:

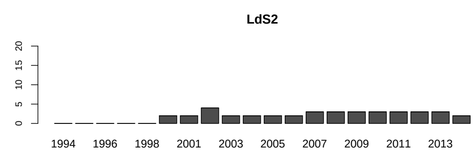
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

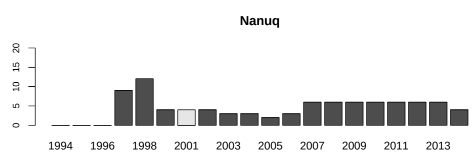


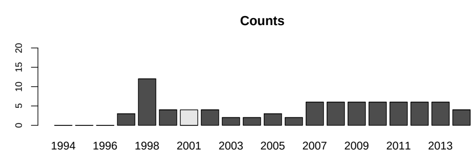


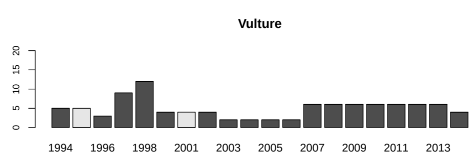




1.2 Reference

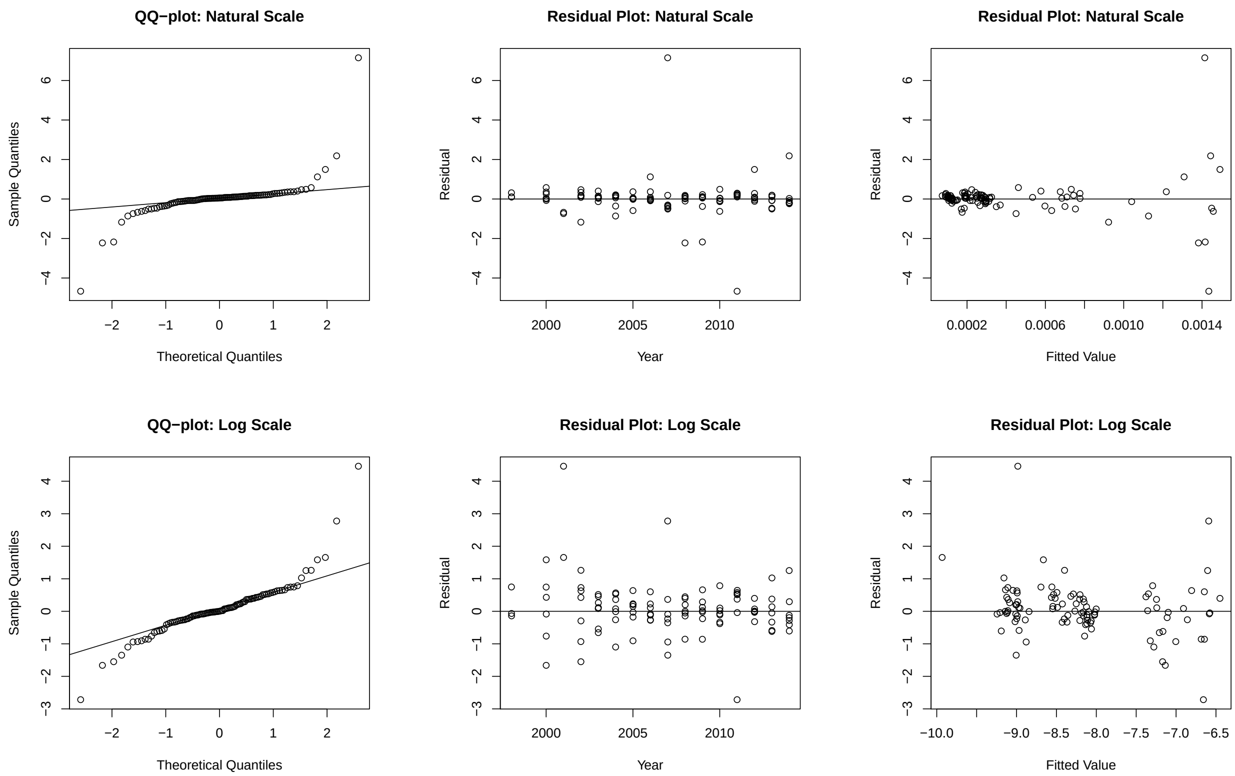






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
14	1616-43 (KPSF)	2007	0.00	0.00	7.15
18	1616-43 (KPSF)	2011	0.00	0.00	-4.67

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
50	Cujo	2001	0.00	-8.98	4.46

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
74.35	6.00	0.00

- Conclusions:
The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
1.46	4.00	0.83

- Conclusions:
The slopes do not differ significantly among reference lakes.

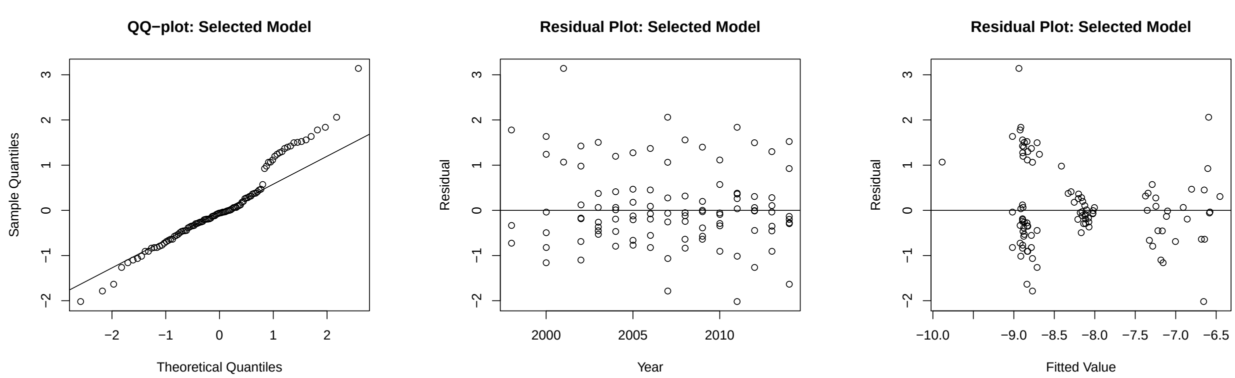
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
50	Cujo	2001	0.00	-8.94	3.14

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	0.3794	2	0.8272
Cujo	1.3035	2	0.5211
LdS1	1.7550	2	0.4158
LdS2	0.2822	2	0.8684

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

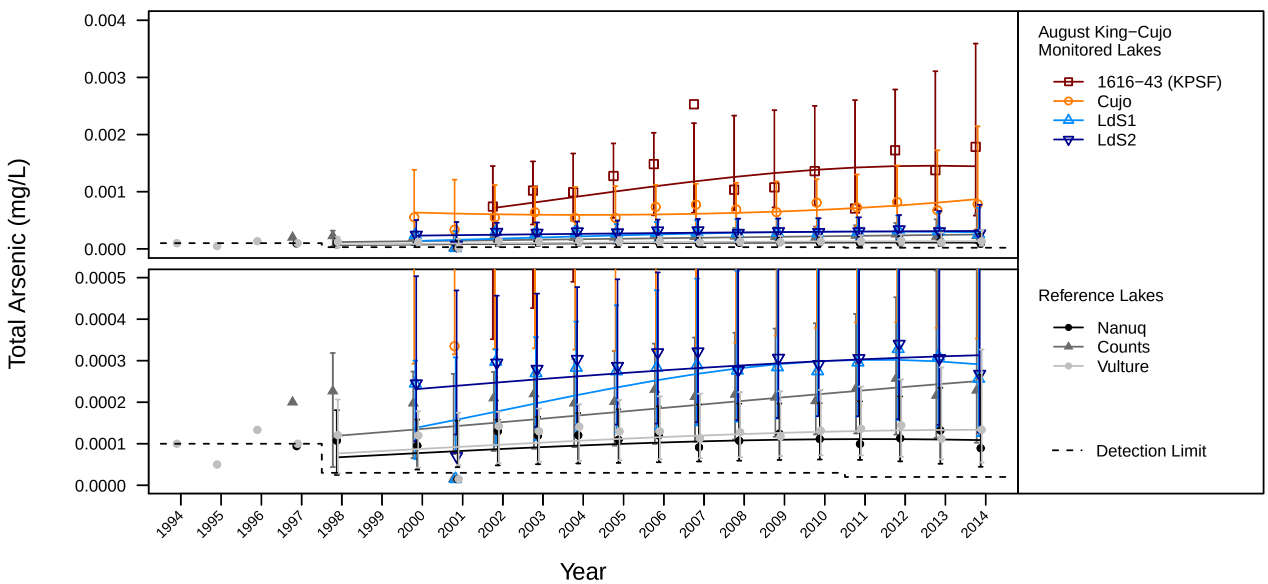
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0800
Monitored Lake	1616-43 (KPSF)	0.3400
Monitored Lake	Cujo	0.2750
Monitored Lake	LdS1	0.1380
Monitored Lake	LdS2	0.0930

- Conclusions:
  Model fit for 1616-43 (KPSF) and Cujo is weak. Model fit for pooled reference lakes, LdS1, and LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total arsenic for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.79e-03	1.45e-03	6.71e-04	5.82e-04	3.59e-03	1.96e-03
Cujo	7.81e-04	8.71e-04	4.00e-04	3.53e-04	2.14e-03	1.17e-03
LdS2	2.68e-04	3.13e-04	1.44e-04	1.27e-04	7.71e-04	4.21e-04
LdS1	2.56e-04	2.91e-04	1.34e-04	1.18e-04	7.18e-04	3.92e-04
Nanuq	8.93e-05	1.09e-04	4.96e-05	4.45e-05	2.66e-04	NA
Counts	2.28e-04	2.51e-04	1.14e-04	1.03e-04	6.13e-04	NA
Vulture	1.34e-04	1.34e-04	6.10e-05	5.47e-05	3.27e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Arsenic	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	0.005	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

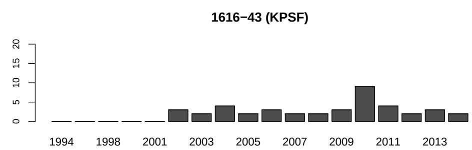
Analysis of August Total Arsenic in King-Cujo Watershed Streams

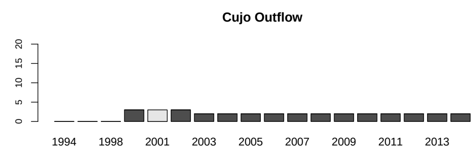
November 18, 2014

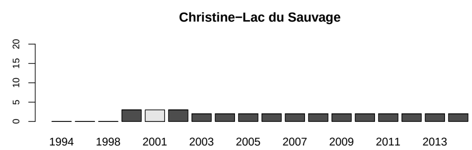
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

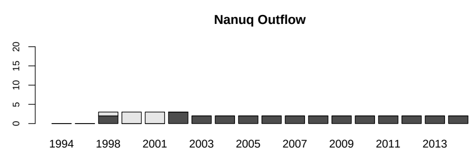
1.1 Monitored

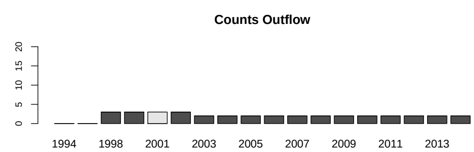


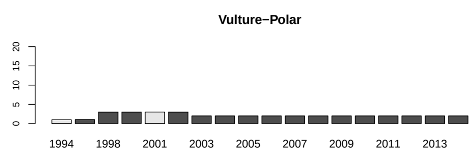




1.2 Reference

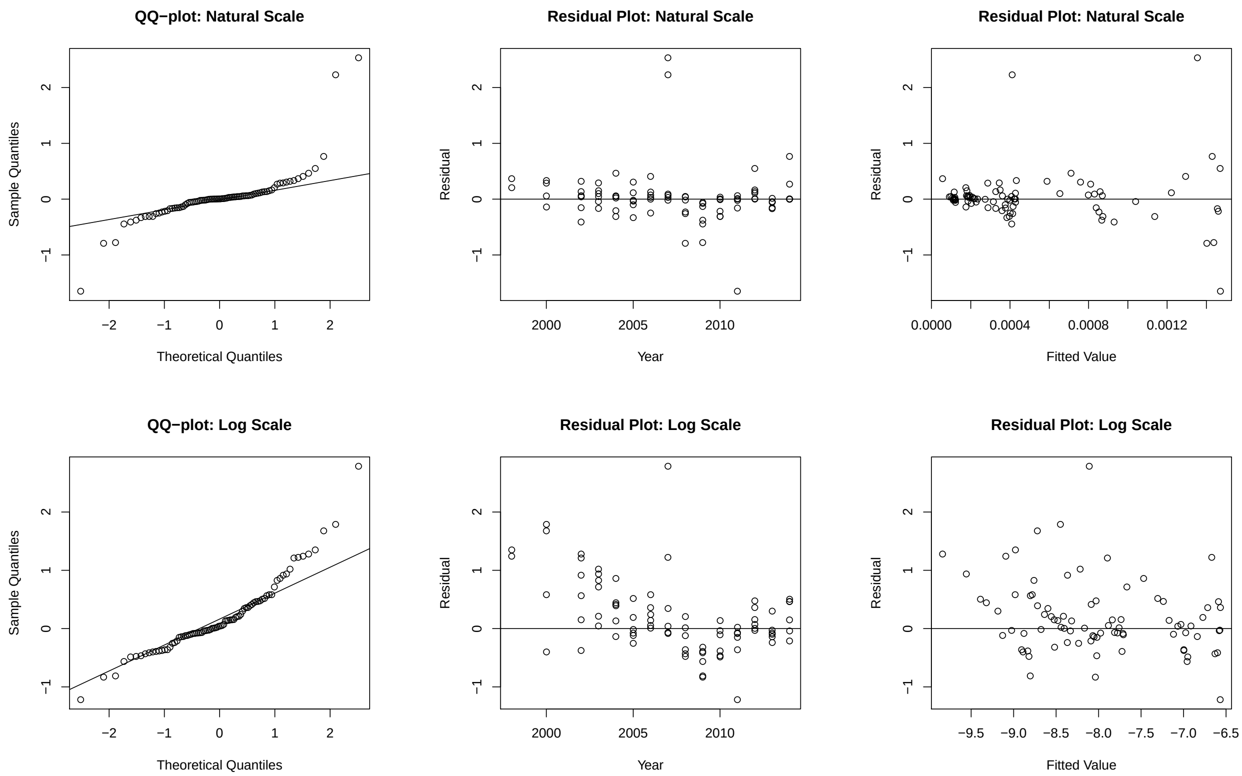






Comment:
10-60% of data in Nanuq Outflow was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
29.73	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
4.42	4.00	0.35

- Conclusions:
  The slopes do not differ significantly among reference streams.

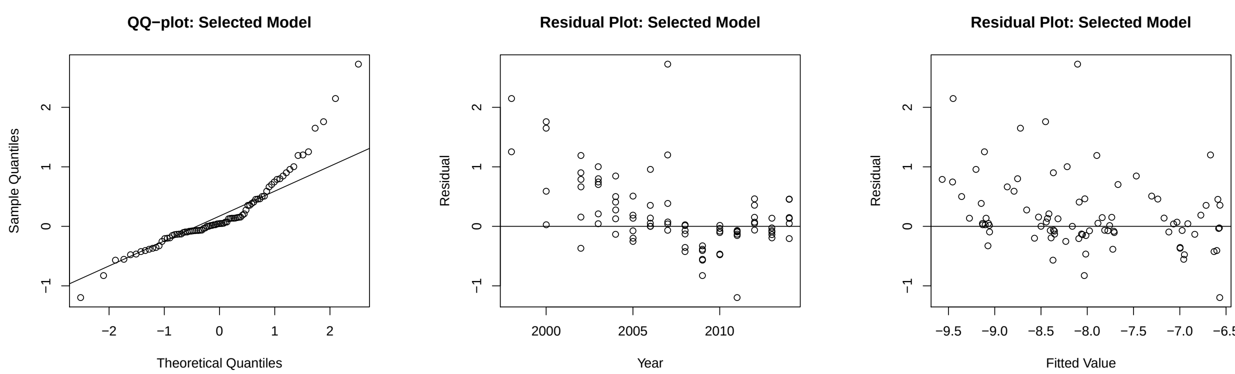
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.156	0.844	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
The reduced model shows dependence on year. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	0.0339	2	0.9832
Cujo Outflow	1.7771	2	0.4112
Christine-Lac du Sauvage	0.1944	2	0.9074

- Conclusions:
  No significant deviations were found when comparing monitored streams to the common slope of reference streams.

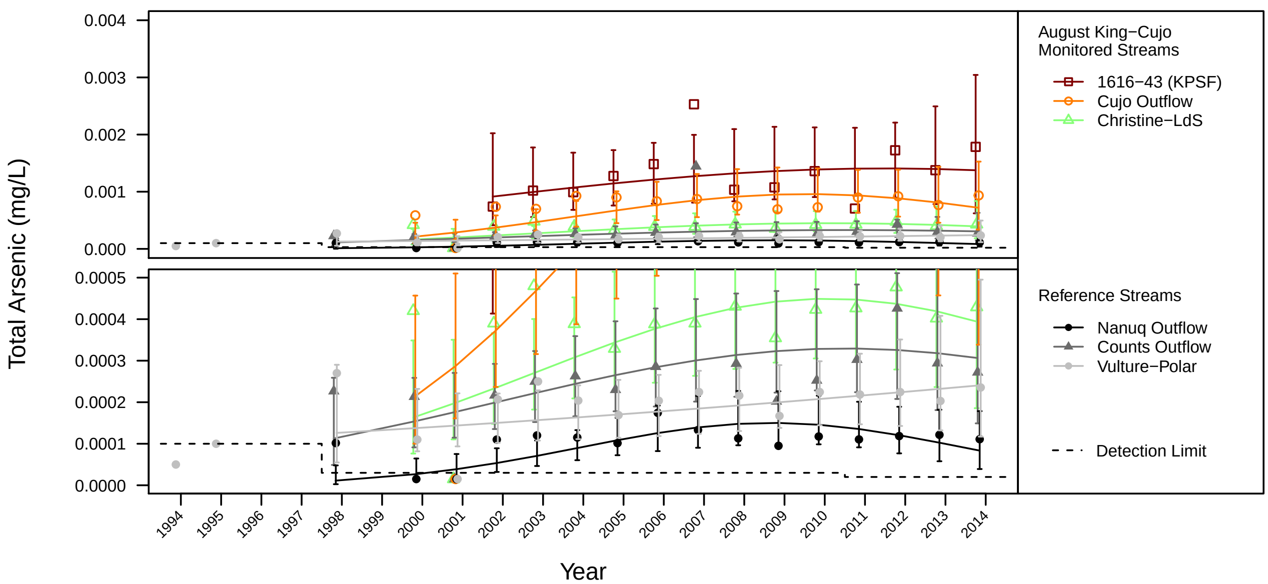
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.3920
Monitored Stream	1616-43 (KPSF)	0.1650
Monitored Stream	Christine-Lac du Sauvage	0.1550
Monitored Stream	Cujo Outflow	0.2240

- Conclusions:
  Model fit for pooled reference streams and Cujo Outflow is weak. Model fit for 1616-43 (KPSF) and Christine-Lac du Sauvage is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total arsenic for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.79e-03	1.38e-03	5.57e-04	6.22e-04	3.04e-03	1.63e-03
Cujo Outflow	9.35e-04	7.19e-04	2.76e-04	3.39e-04	1.53e-03	8.08e-04
Christine-Lac du Sauvage	4.29e-04	3.94e-04	1.52e-04	1.86e-04	8.37e-04	4.43e-04
Nanuq Outflow	1.11e-04	8.35e-05	3.24e-05	3.91e-05	1.79e-04	NA
Counts Outflow	2.72e-04	3.07e-04	1.13e-04	1.49e-04	6.30e-04	NA
Vulture-Polar	2.36e-04	2.41e-04	8.86e-05	1.17e-04	4.95e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Arsenic	August	King-Cujo	Stream	Water	none	log e	Tobit regression	#2 shared slopes	0.005	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

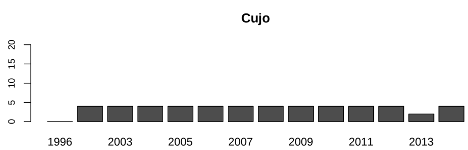
Analysis of April Total Barium in Lakes of the King-Cujo Watershed and Lac du Sauvage

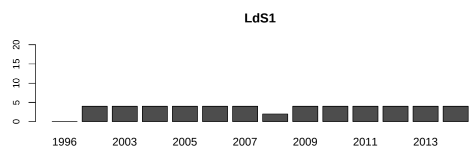
November 18, 2014

1 Censored Values:

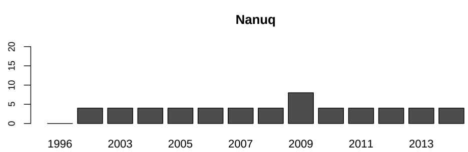
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

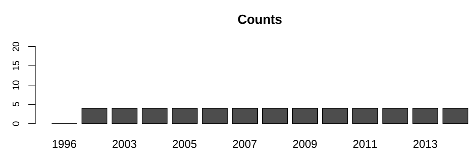
1.1 Monitored

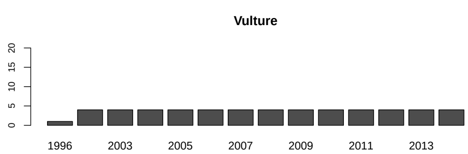




1.2 Reference

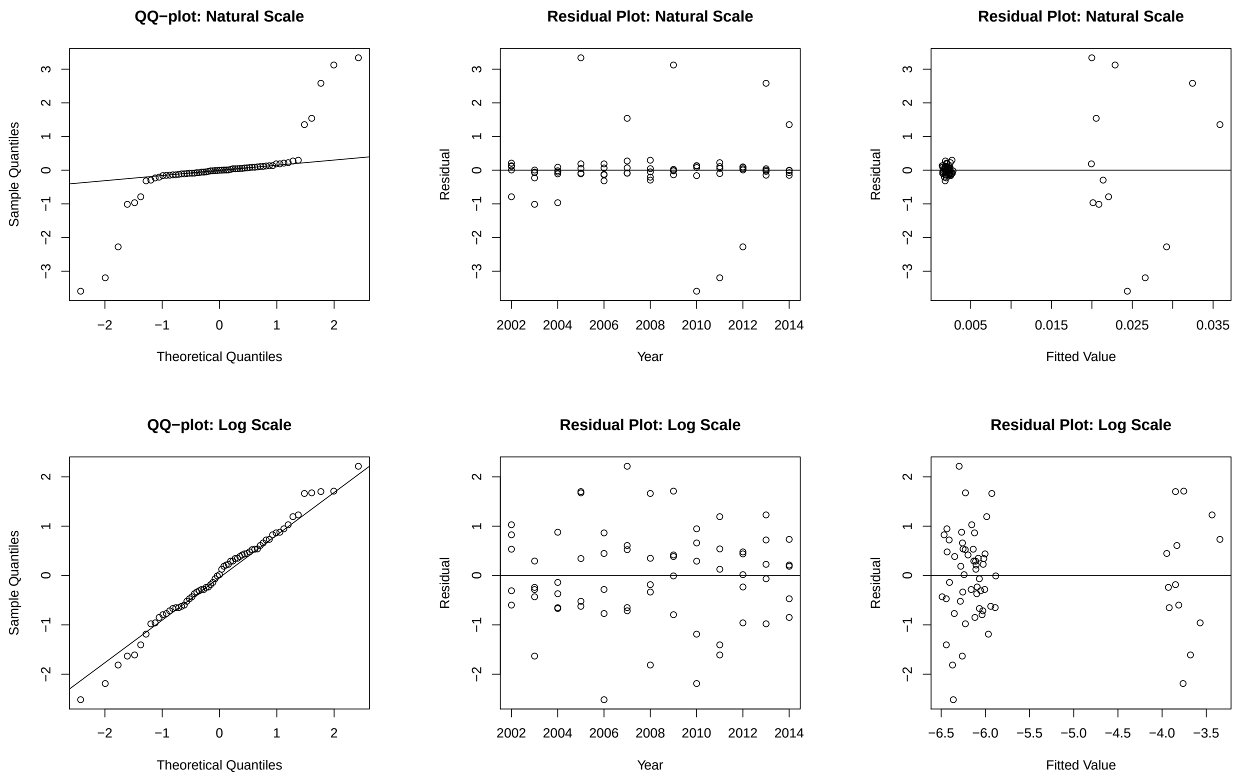






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	0.03	0.02	3.34
58	Cujo	2009	0.03	0.02	3.12
59	Cujo	2010	0.02	0.02	-3.59
60	Cujo	2011	0.02	0.03	-3.20

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	9.32E-120	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
12909.10	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
4.88	4.00	0.30

- Conclusions:
  The slopes do not differ significantly among reference lakes.

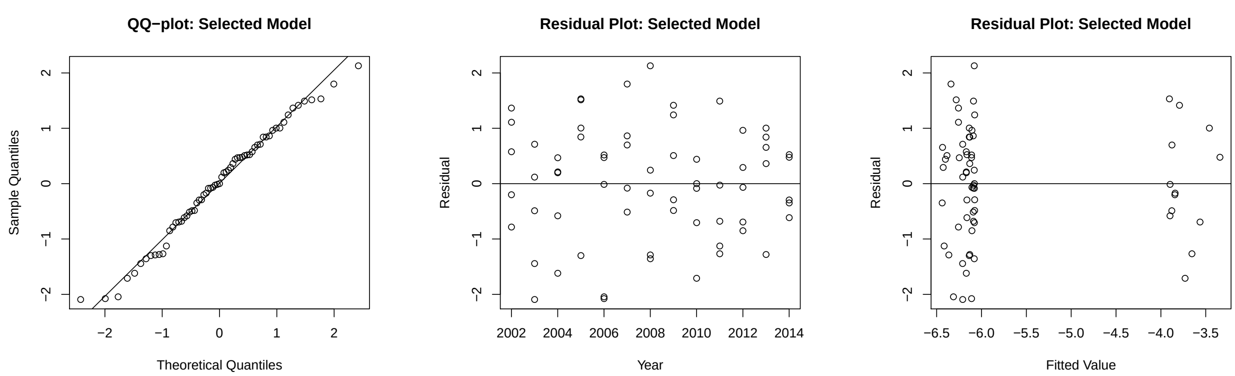
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	7.67	2.00	0.02
LdS1	3.94	2.00	0.14

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

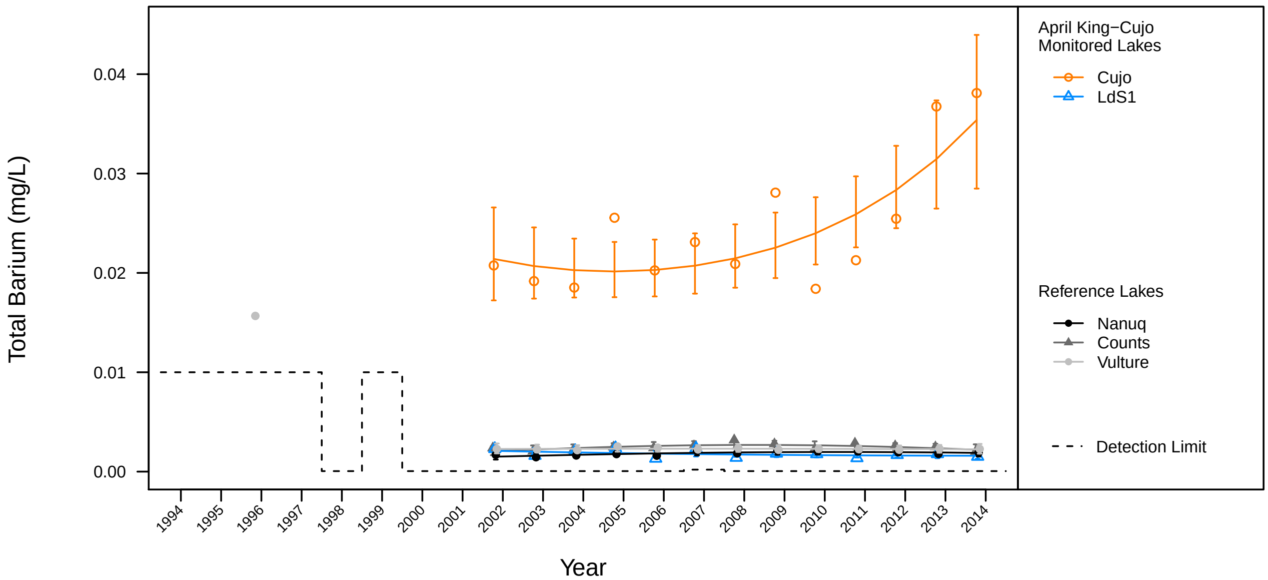
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1110
Monitored Lake	Cujo	0.5950
Monitored Lake	LdS1	0.1970

- Conclusions:
  Model fit for pooled reference lakes and LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total barium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	3.81e-02	3.54e-02	3.91e-03	2.85e-02	4.40e-02	1.15e-02
LdS1	1.52e-03	1.60e-03	1.77e-04	1.29e-03	1.99e-03	5.18e-04
Nanuq	1.92e-03	1.88e-03	2.08e-04	1.52e-03	2.34e-03	NA
Counts	2.01e-03	2.21e-03	2.45e-04	1.78e-03	2.75e-03	NA
Vulture	2.29e-03	2.24e-03	2.48e-04	1.81e-03	2.79e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Barium	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	1	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

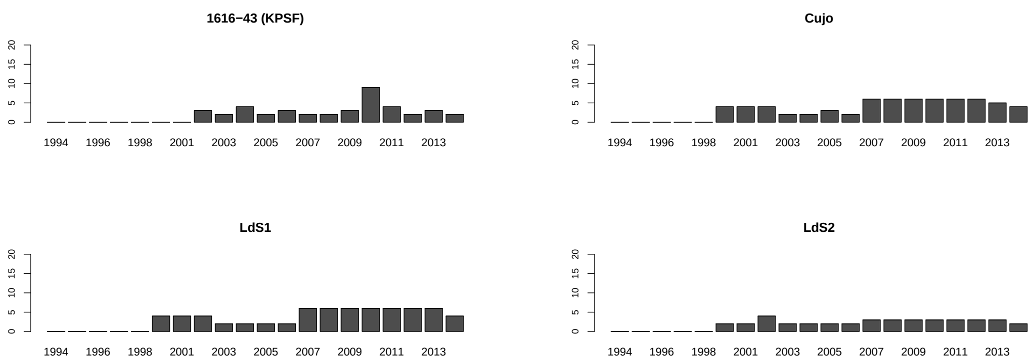
Analysis of August Total Barium in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 20, 2014

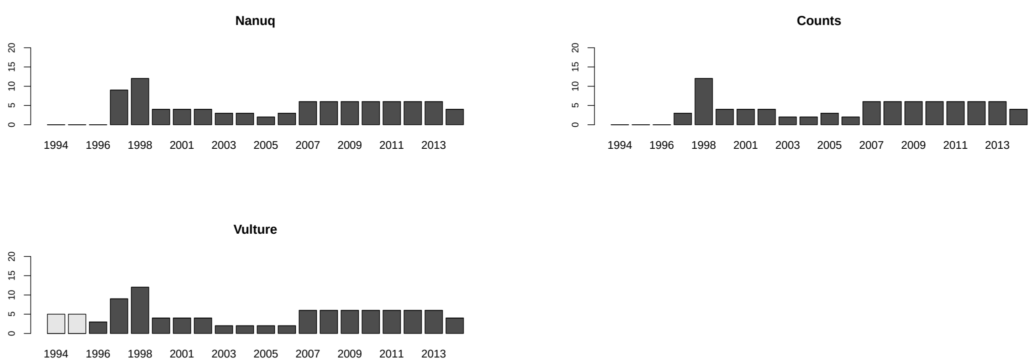
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

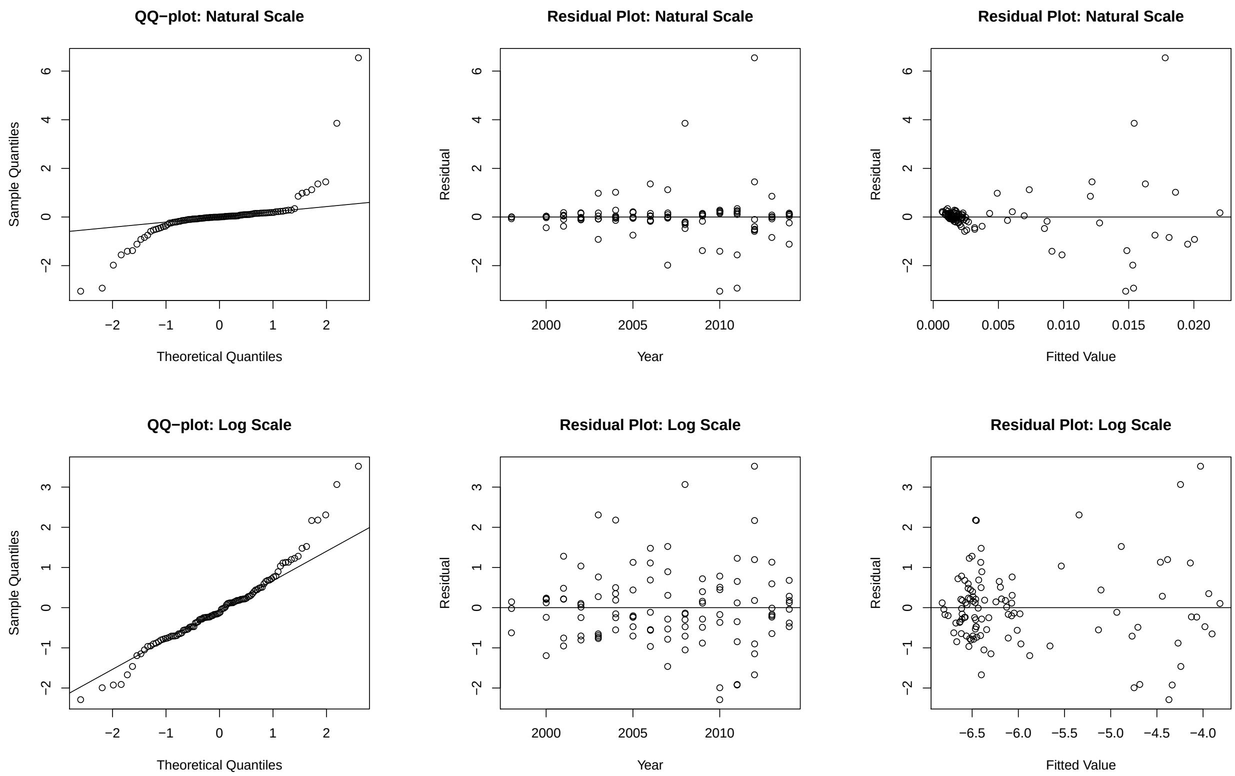


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
15	1616-43 (KPSF)	2008	0.02	0.02	3.85
17	1616-43 (KPSF)	2010	0.01	0.01	-3.05
19	1616-43 (KPSF)	2012	0.03	0.02	6.55

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
15	1616-43 (KPSF)	2008	0.02	-4.24	3.07
19	1616-43 (KPSF)	2012	0.03	-4.03	3.52

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
71.72	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
0.09	4.00	1.00

- Conclusions:
  The slopes do not differ significantly among reference lakes.

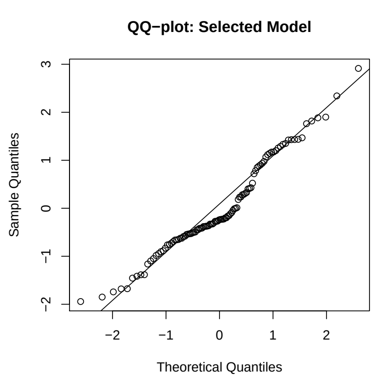
3.3 Compare Reference Models using AIC Weights

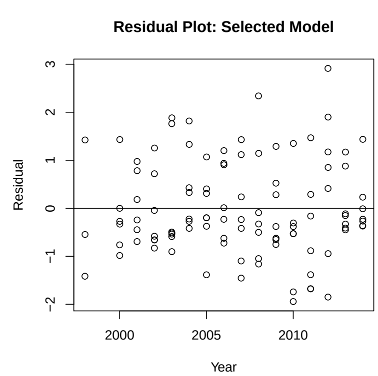
- Results:

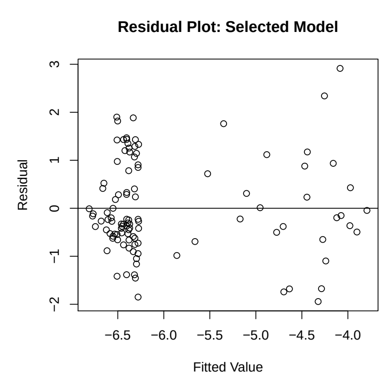
	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model







Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	2.0992	2	0.3501
Cujo	53.1622	2	0.0000
LdS1	2.4158	2	0.2988
LdS2	0.6787	2	0.7122

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

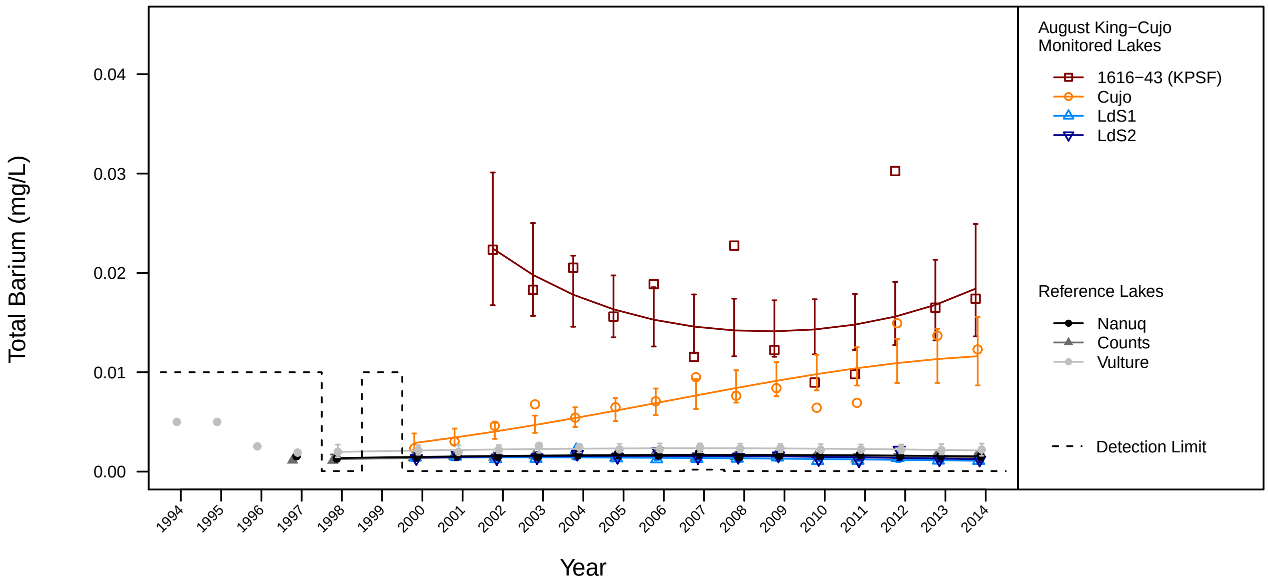
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0650
Monitored Lake	1616-43 (KPSF)	0.1870
Monitored Lake	Cujo	0.7920
Monitored Lake	LdS1	0.3020
Monitored Lake	LdS2	0.1300

- Conclusions:
  Model fit for LdS1 is weak. Model fit for pooled reference lakes, 1616-43 (KPSF), and LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total barium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.74e-02	1.84e-02	2.84e-03	1.36e-02	2.49e-02	8.32e-03
Cujo	1.23e-02	1.16e-02	1.73e-03	8.68e-03	1.55e-02	5.06e-03
LdS2	1.19e-03	1.24e-03	1.85e-04	9.28e-04	1.66e-03	5.41e-04
LdS1	1.10e-03	1.09e-03	1.62e-04	8.15e-04	1.46e-03	4.75e-04
Nanuq	1.58e-03	1.53e-03	2.21e-04	1.15e-03	2.03e-03	NA
Counts	1.54e-03	1.37e-03	1.97e-04	1.03e-03	1.82e-03	NA
Vulture	2.21e-03	2.12e-03	3.06e-04	1.60e-03	2.82e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Barium	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	1	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

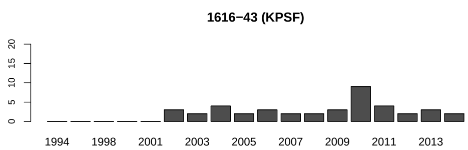
Analysis of August Total Barium in King-Cujo Watershed Streams

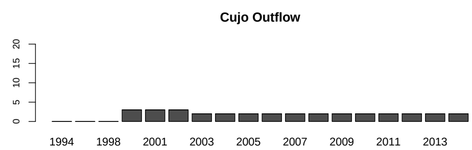
November 18, 2014

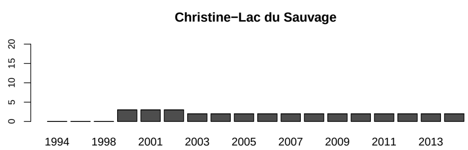
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

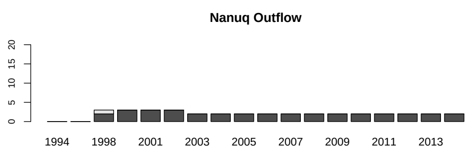
1.1 Monitored

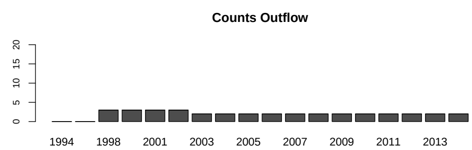


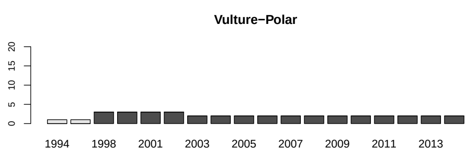




1.2 Reference

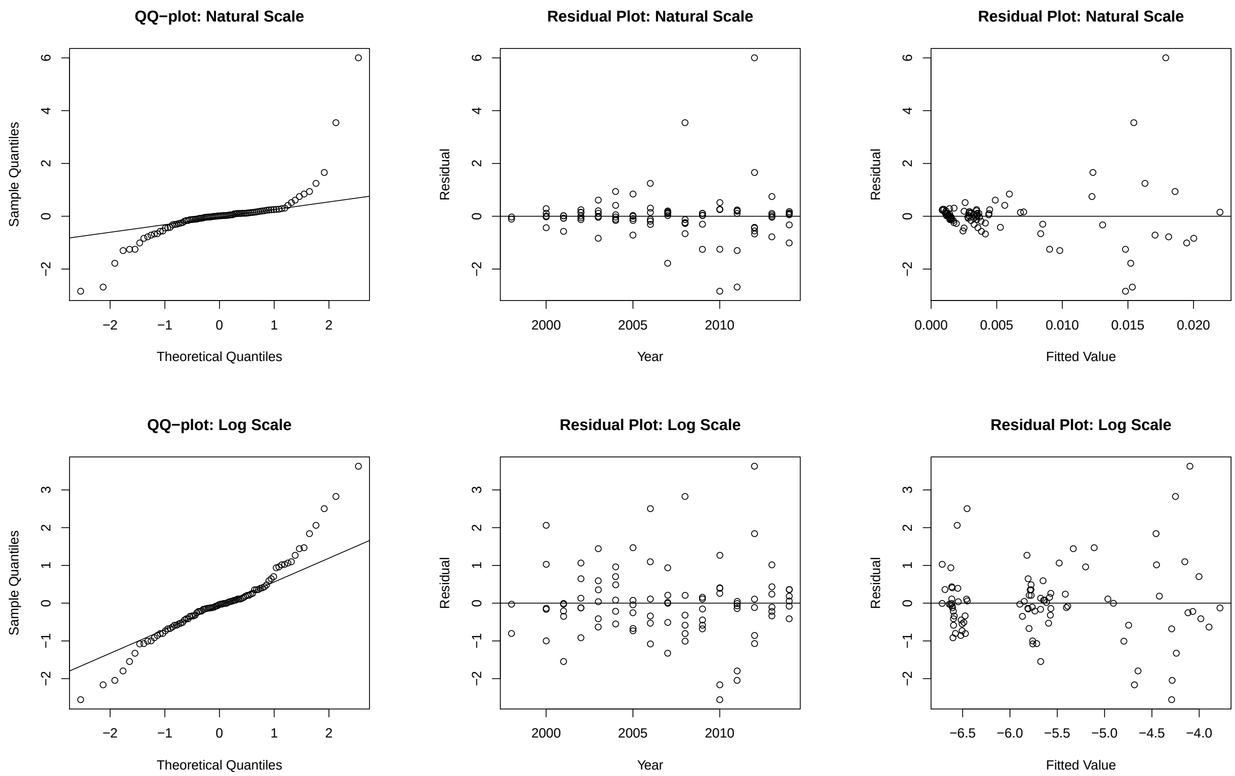






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
15	1616-43 (KPSF)	2008	0.02	0.02	3.54
19	1616-43 (KPSF)	2012	0.03	0.02	6.00

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.03	-4.10	3.63

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Proceeding with anlaysis using log transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
188.75	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
5.92	4.00	0.21

- Conclusions:
  The slopes do not differ significantly among reference streams.

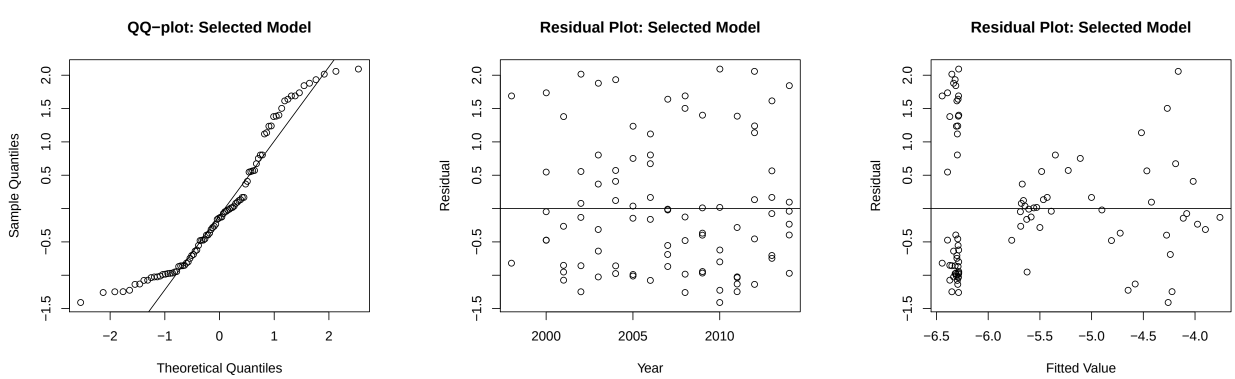
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference streams are best modeled using separate slopes and intercepts, contrasts suggest that reference streams share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference streams) to avoid defaulting to comparing trends in monitored streams against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference stream slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	0.9237	2	0.6301
Cujo Outflow	17.7454	2	0.0001
Christine-Lac du Sauvage	0.7039	2	0.7033

- Conclusions:
  Cujo Outflow shows significant deviation from the common slope of reference streams.

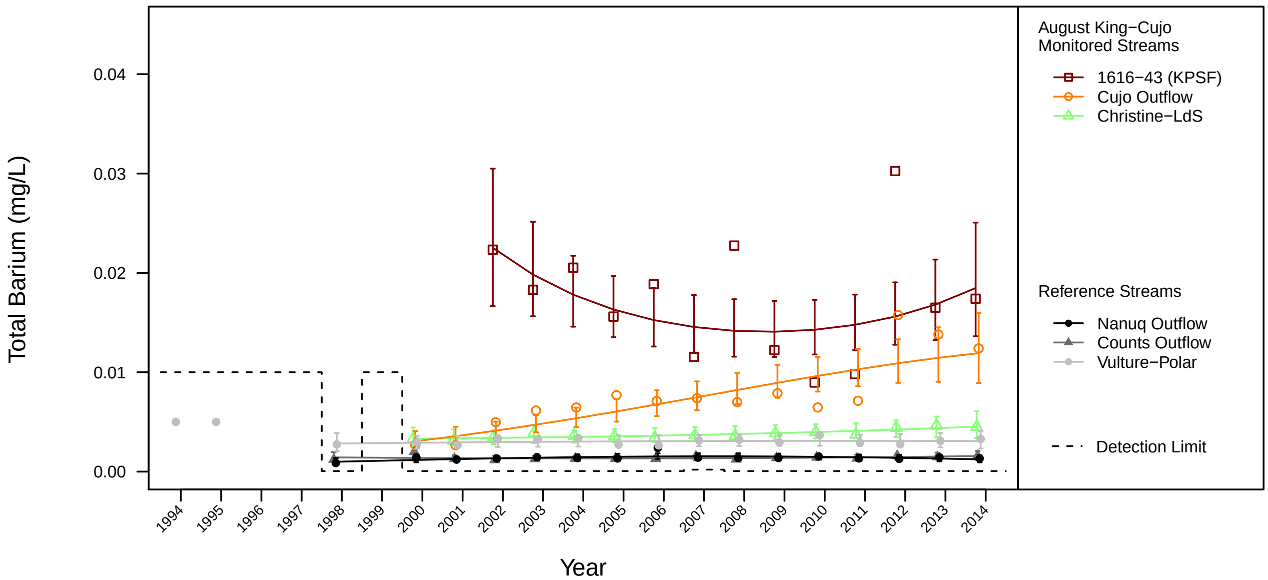
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.0130
Monitored Stream	1616-43 (KPSF)	0.2050
Monitored Stream	Christine-Lac du Sauvage	0.7650
Monitored Stream	Cujo Outflow	0.7680

- Conclusions:
  Model fit for 1616-43 (KPSF) is weak. Model fit for pooled reference streams is poor.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total barium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.74e-02	1.85e-02	2.88e-03	1.36e-02	2.51e-02	8.41e-03
Cujo Outflow	1.24e-02	1.19e-02	1.78e-03	8.90e-03	1.60e-02	5.21e-03
Christine-Lac du Sauvage	4.51e-03	4.53e-03	6.76e-04	3.38e-03	6.07e-03	1.98e-03
Nanuq Outflow	1.32e-03	1.24e-03	1.79e-04	9.33e-04	1.64e-03	NA
Counts Outflow	1.60e-03	1.57e-03	2.26e-04	1.18e-03	2.08e-03	NA
Vulture-Polar	3.28e-03	3.07e-03	4.43e-04	2.31e-03	4.08e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Barium	August	King-Cujo	Stream	Water	none	log e	linear mixed effects regression	#2 shared slopes	1	Cujo Outflow

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

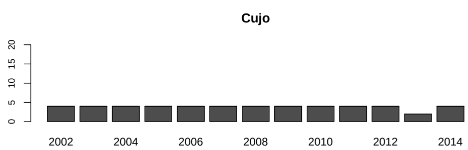
Analysis of April Total Boron in Lakes of the King-Cujo Watershed and Lac du Sauvage

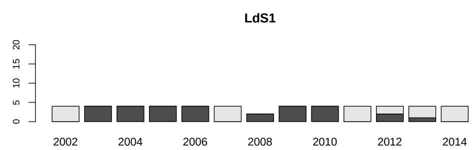
November 20, 2014

1 Censored Values:

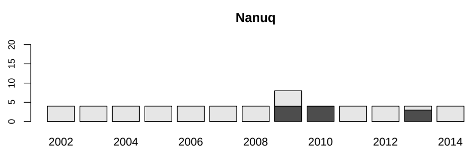
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

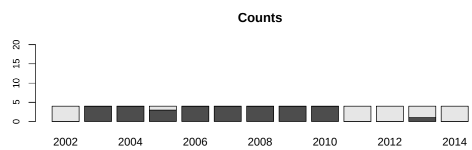
1.1 Monitored

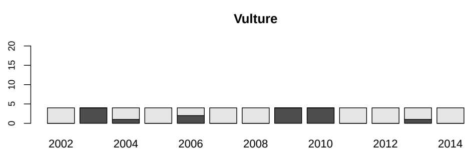




1.2 Reference

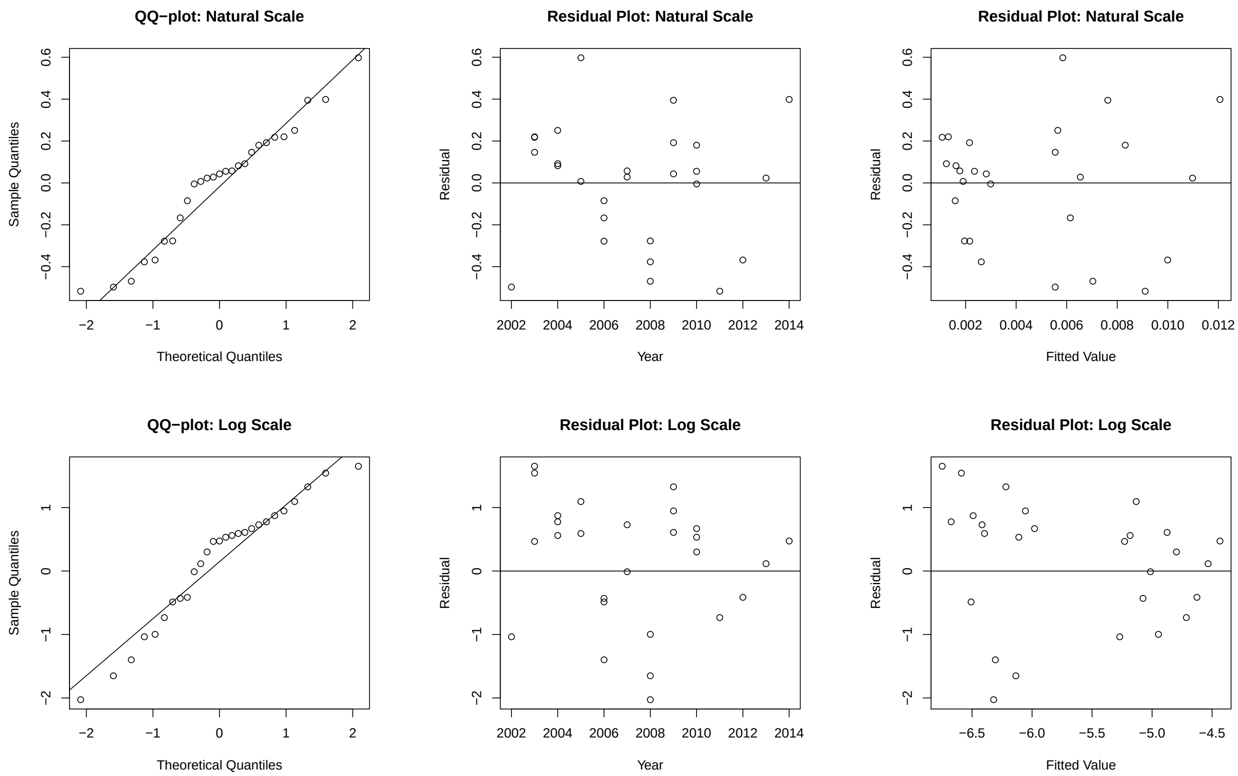






Comment:
Greater than 60% of data in Nanuq, and Vulture lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Counts Lake and LdS1 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	8.32E-53	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

Two of three reference lakes were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	6.0784	2	0.0479
LdS1	0.7850	2	0.6754

- Conclusions:
  Cujo Lake shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of the remaining reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Cujo-vs-Counts	22.3161	3	0.0001

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of the reference lake.

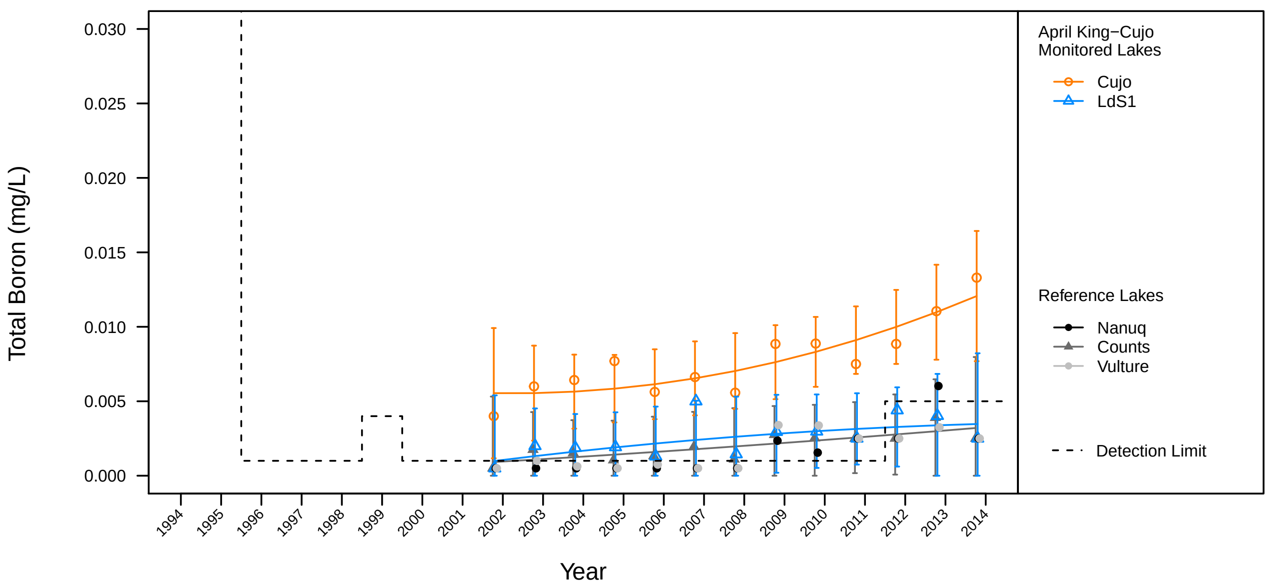
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.6560
Monitored Lake	Cujo	0.7830
Monitored Lake	LdS1	0.3910

- Conclusions:
  Model fit for LdS1 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total boron for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.33e-02	1.21e-02	2.23e-03	7.69e-03	1.64e-02	6.53e-03
LdS1	2.50e-03	3.47e-03	2.42e-03	0.00e+00	8.22e-03	7.09e-03
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	2.50e-03	3.20e-03	2.43e-03	0.00e+00	7.97e-03	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Boron	April	King-Cujo	Lake	Water	Nanuq Vulture	none	Tobit regression	#1b separate intercepts & slopes	1.5	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

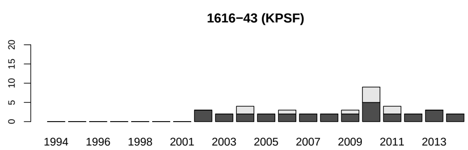
Analysis of August Total Boron in Lakes of the King-Cujo Watershed and Lac du Sauvage

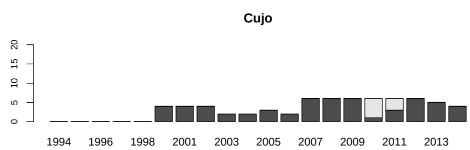
November 18, 2014

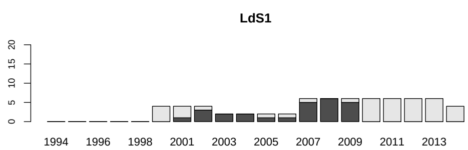
1 Censored Values:

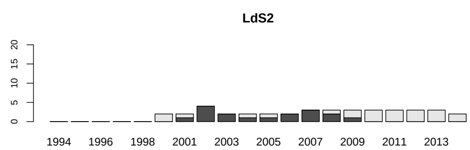
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

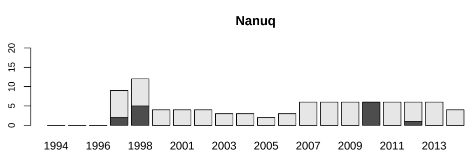


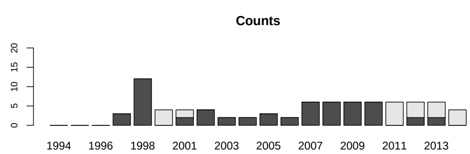






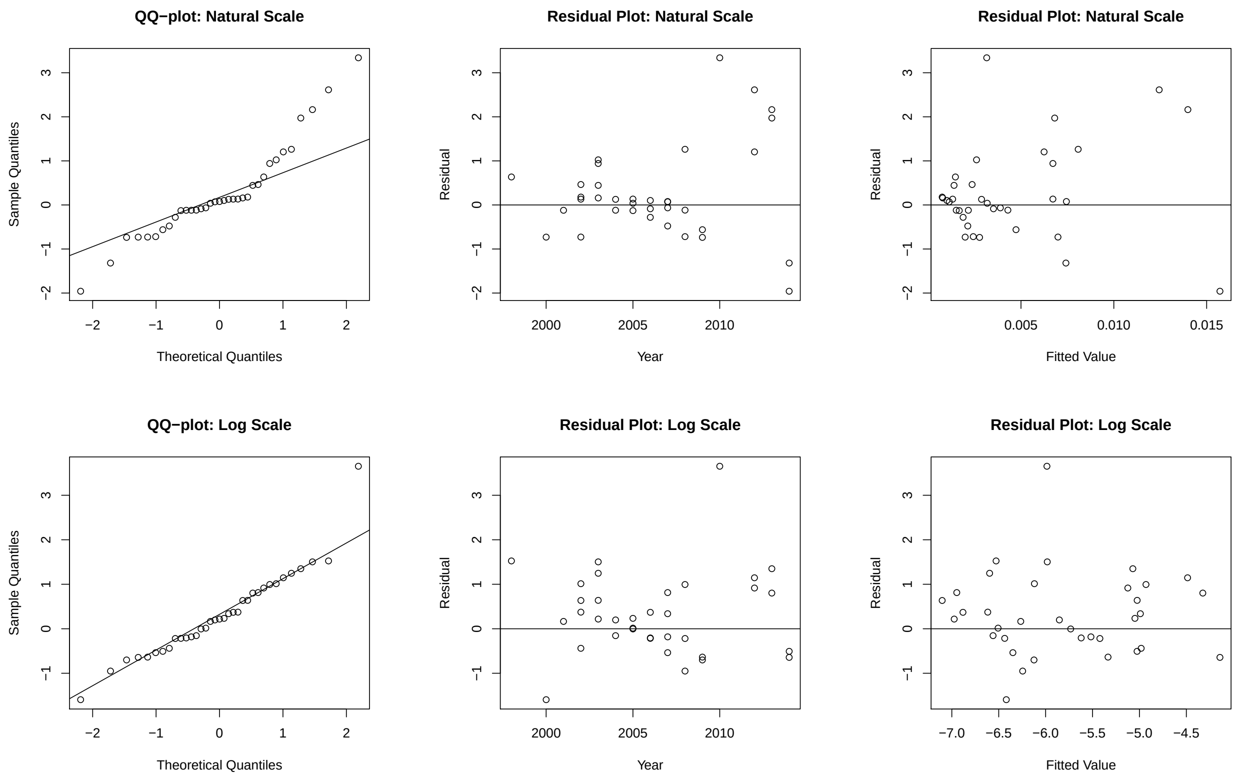
1.2 Reference





Comment:
Greater than 60% of data in Nanuq, Vulture, and LdS1 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Counts, 1616-43 (KPSF), Cujo, and LdS2 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
38	Counts	2010	0.01	0.00	3.34

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
38	Counts	2010	0.01	-5.99	3.65

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

Two of three reference lakes were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	10.7036	2	0.0047
Cujo	29.2218	2	0.0000
LdS2	1.1957	2	0.5500

- Conclusions:
  1616-43 (KPSF) and Cujo Lake show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)-vs-Counts	108.3125	3	0.0000
Cujo-vs-Counts	28.7935	3	0.0000

- Conclusions:
  All remaining monitored lakes show significant deviation from the common slope of the reference lake.

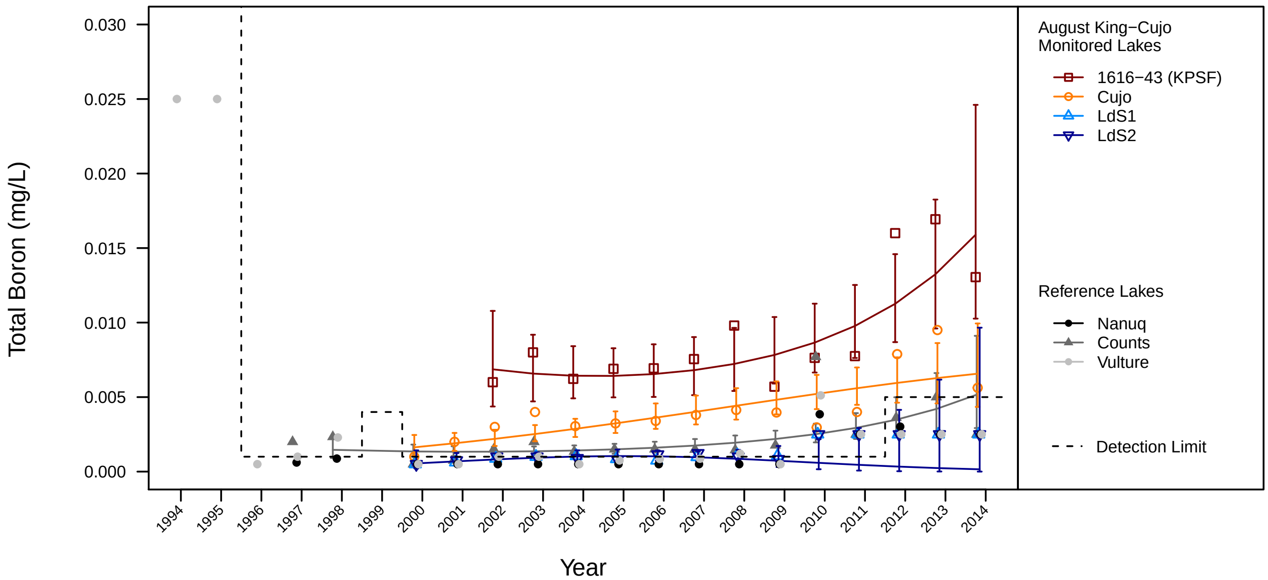
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4490
Monitored Lake	1616-43 (KPSF)	0.6630
Monitored Lake	Cujo	0.6860
Monitored Lake	LdS2	0.3560

- Conclusions:
  Model fit for Counts and LdS2 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total boron for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.30e-02	1.59e-02	3.54e-03	1.03e-02	2.46e-02	1.04e-02
Cujo	5.62e-03	6.57e-03	1.39e-03	4.34e-03	9.94e-03	4.06e-03
LdS2	2.50e-03	1.56e-04	3.28e-04	2.51e-06	9.66e-03	9.60e-04
LdS1	2.50e-03	NA	NA	NA	NA	NA
Nanuq	2.50e-03	NA	NA	NA	NA	NA
Counts	2.50e-03	5.16e-03	1.50e-03	2.92e-03	9.11e-03	NA
Vulture	2.50e-03	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Boron	August	King-Cujo	Lake	Water	Nanuq Vulture LdS1	log e	Tobit regression	#1b separate intercepts & slopes	1.5	1616-43 (KPSF) Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

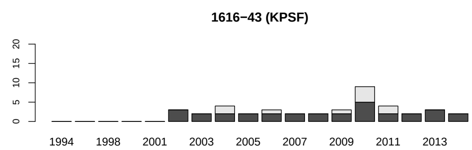
Analysis of August Total Boron in King-Cujo Watershed Streams

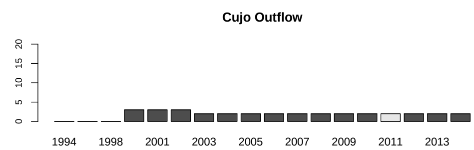
November 20, 2014

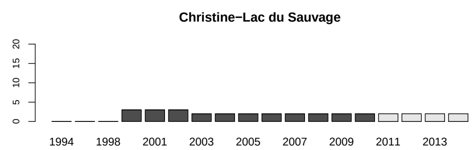
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

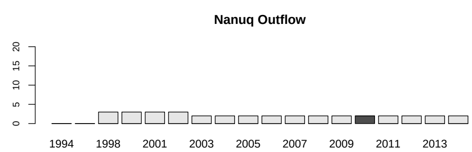
1.1 Monitored

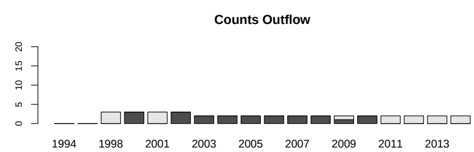


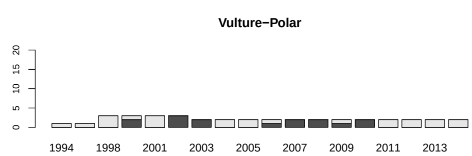




1.2 Reference

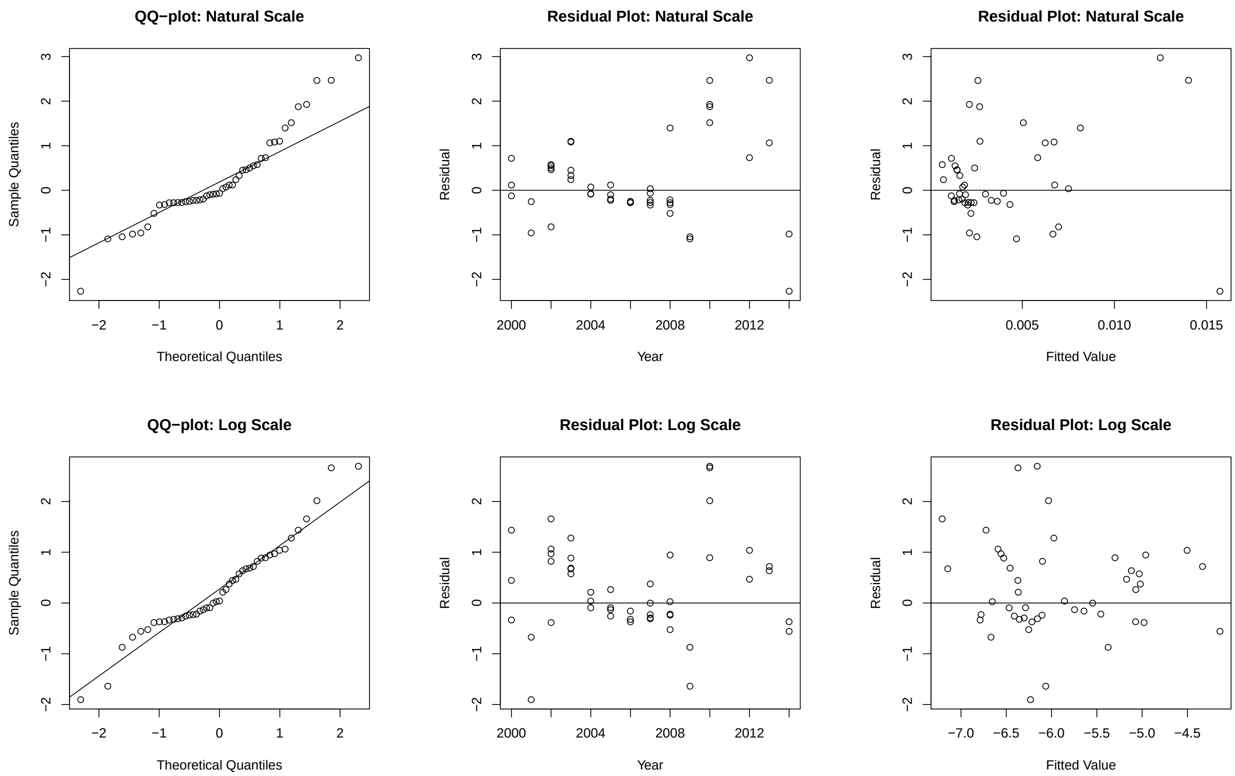






Comment:
Greater than 60% of data in Nanuq Outflow was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Counts Outflow, Vulture-Polar, 1616-43 (KPSF), and Christine-Lac du Sauvage was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
9.91	3.00	0.02

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
1.62	2.00	0.45

- Conclusions:
  The slopes do not differ significantly among reference streams.

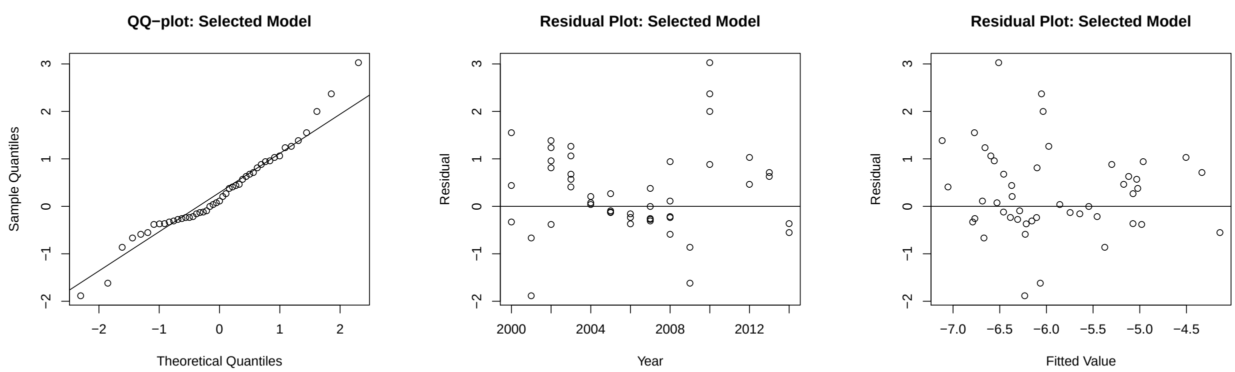
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.431	0.507	0.062	Indistinguishable support for 2 & 1; choose Model 2.

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
122	Vulture-Polar	2010	0.00	-6.51	3.03

Conclusion:
The reduced model shows some dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	1.2644	2	0.5314
Cujo Outflow	0.9755	2	0.6140
Christine-Lac du Sauvage	0.5255	2	0.7689

- Conclusions:
  No significant deviations were found when comparing monitored streams to the common slope of reference streams.

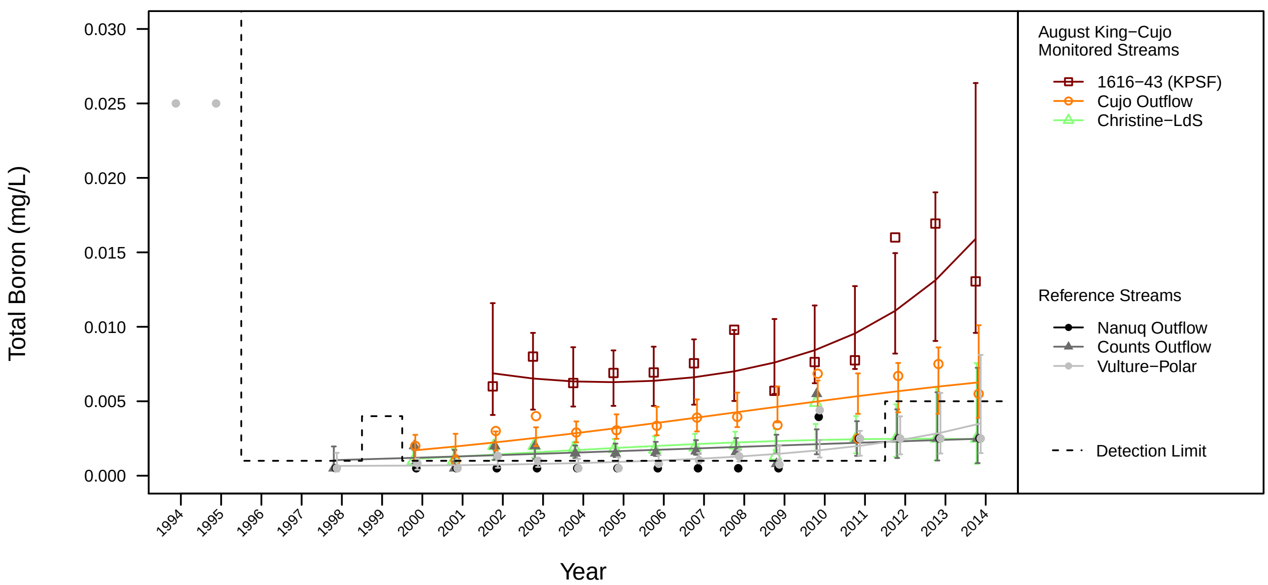
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.4510
Monitored Stream	1616-43 (KPSF)	0.6650
Monitored Stream	Christine-Lac du Sauvage	0.4570
Monitored Stream	Cujo Outflow	0.6000

- Conclusions:
  Model fit for pooled reference streams and Christine-Lac du Sauvage is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total boron for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.3e-02	1.59e-02	4.10e-03	9.59e-03	2.64e-02	1.20e-02
Cujo Outflow	5.5e-03	6.27e-03	1.53e-03	3.89e-03	1.01e-02	4.47e-03
Christine-Lac du Sauvage	2.5e-03	2.46e-03	1.41e-03	8.01e-04	7.55e-03	4.12e-03
Nanuq Outflow	2.5e-03	NA	NA	NA	NA	NA
Counts Outflow	2.5e-03	2.48e-03	1.36e-03	8.49e-04	7.24e-03	NA
Vulture-Polar	2.5e-03	3.51e-03	1.50e-03	1.52e-03	8.11e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Boron	August	King-Cujo	Stream	Water	Nanuq Outflow	log e	Tobit regression	#2 shared slopes	1.5	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

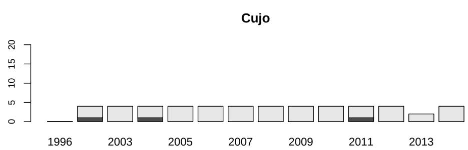
Analysis of April Total Cadmium in Lakes of the King-Cujo Watershed and Lac du Sauvage

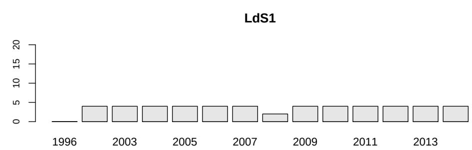
November 18, 2014

1 Censored Values:

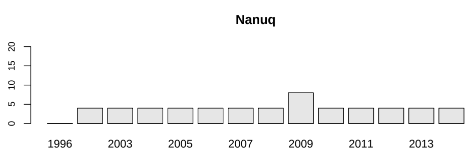
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

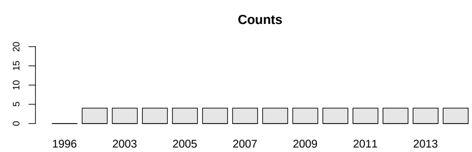
1.1 Monitored

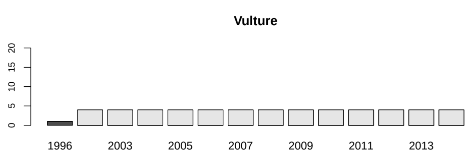




1.2 Reference

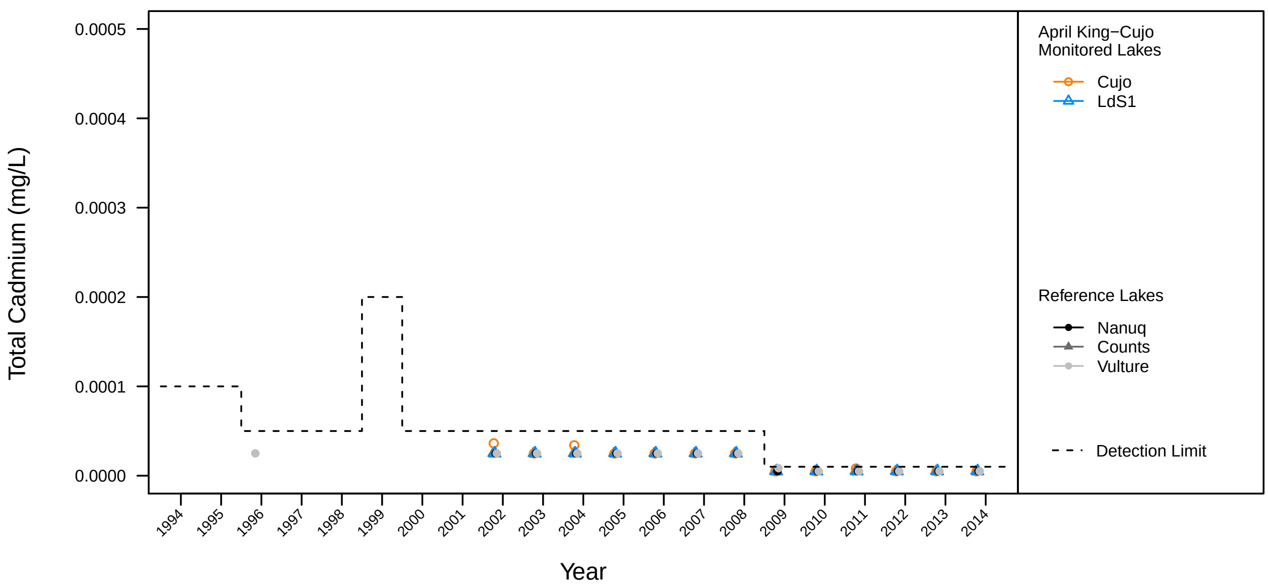






Comment:
Greater than 60% of data in all reference and monitored lakes was less than the detection limit. All lakes were excluded from further analyses. No statistical tests were performed. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Cadmium	April	King-Cujo	Lake	Water	ALL	NA	NA	NA	hardness-dependent	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

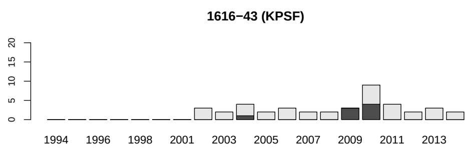
Analysis of August Total Cadmium in Lakes of the King-Cujo Watershed and Lac du Sauvage

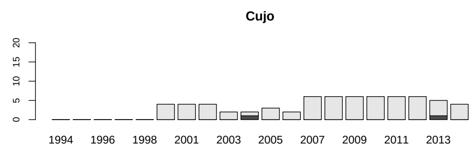
November 18, 2014

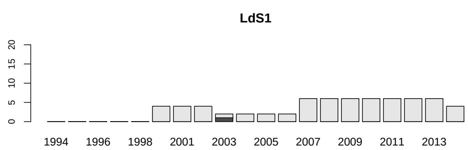
1 Censored Values:

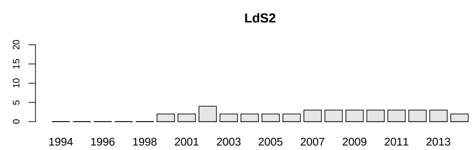
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

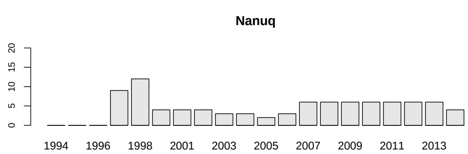


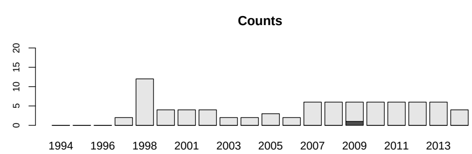


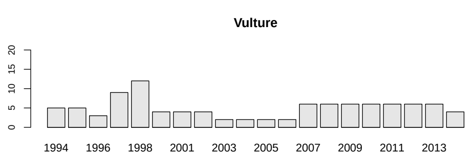




1.2 Reference

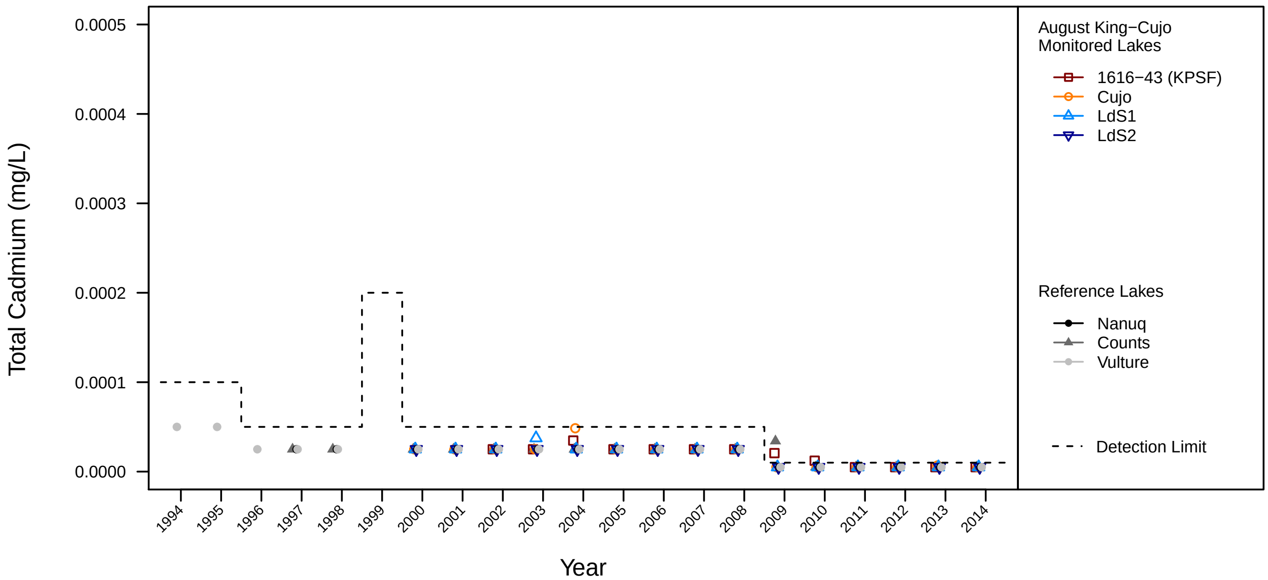






Comment:
Greater than 60% of data in all reference and monitored lakes was less than the detection limit. All lakes were excluded from further analyses. No statistical analyses were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Cadmium	August	King-Cujo	Lake	Water	ALL	NA	NA	NA	hardness-dependent	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

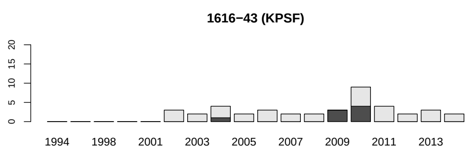
Analysis of August Total Cadmium in King-Cujo Watershed Streams

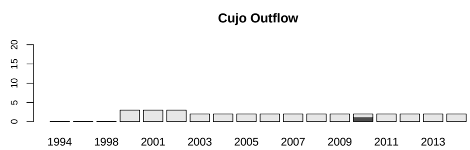
November 18, 2014

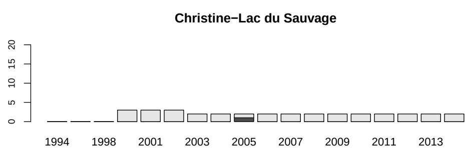
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

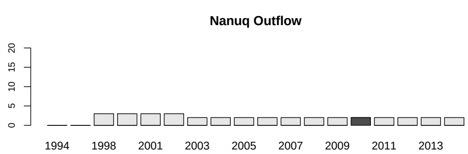
1.1 Monitored

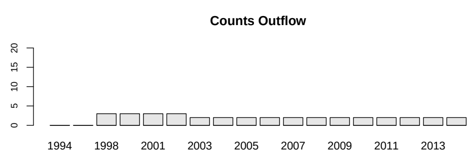


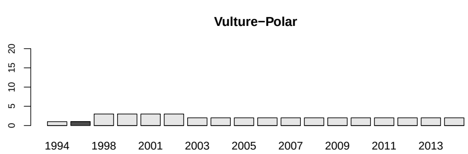




1.2 Reference

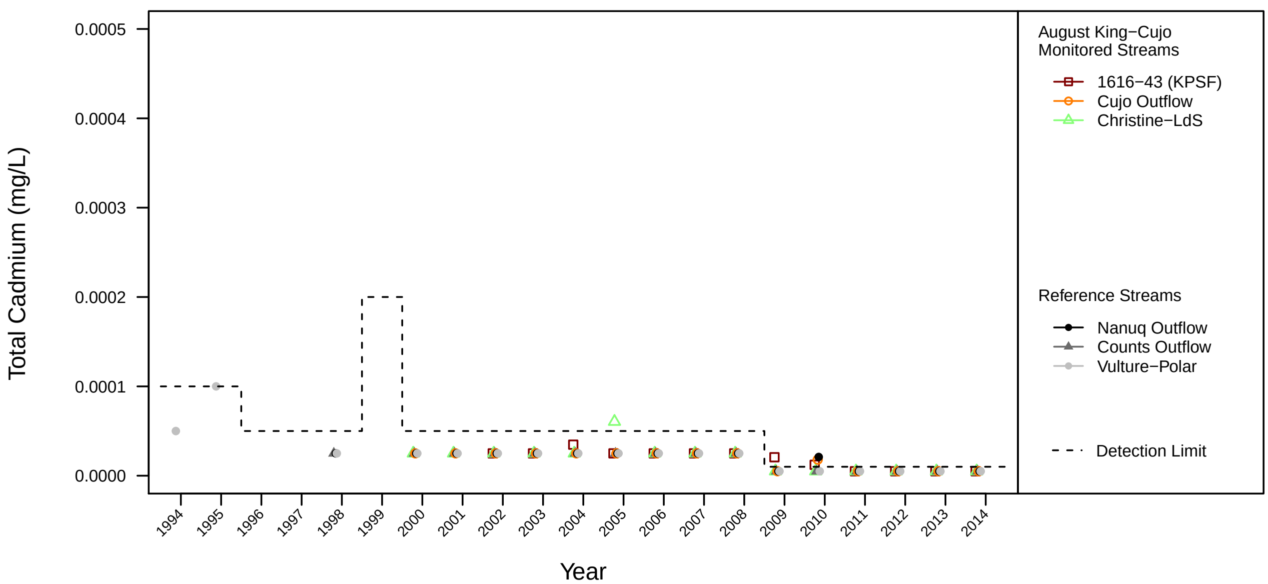






Comment:
Greater than 60% of data in all reference and monitored streams was less than the detection limit. All streams were excluded from further analyses. No statistical analyses were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Cadmium	August	King-Cujo	Stream	Water	ALL	NA	NA	NA	hardness-dependent	NA

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

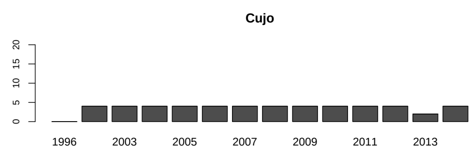
Analysis of April Total Copper in Lakes of the King-Cujo Watershed and Lac du Sauvage

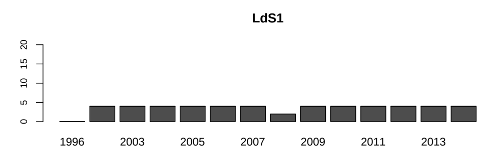
November 20, 2014

1 Censored Values:

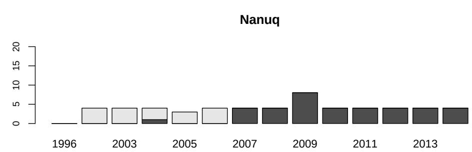
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

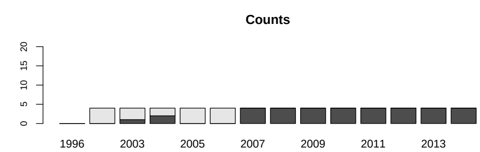
1.1 Monitored

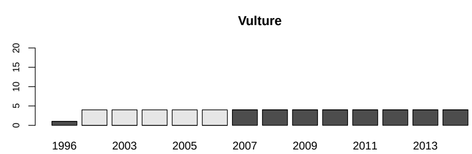




1.2 Reference

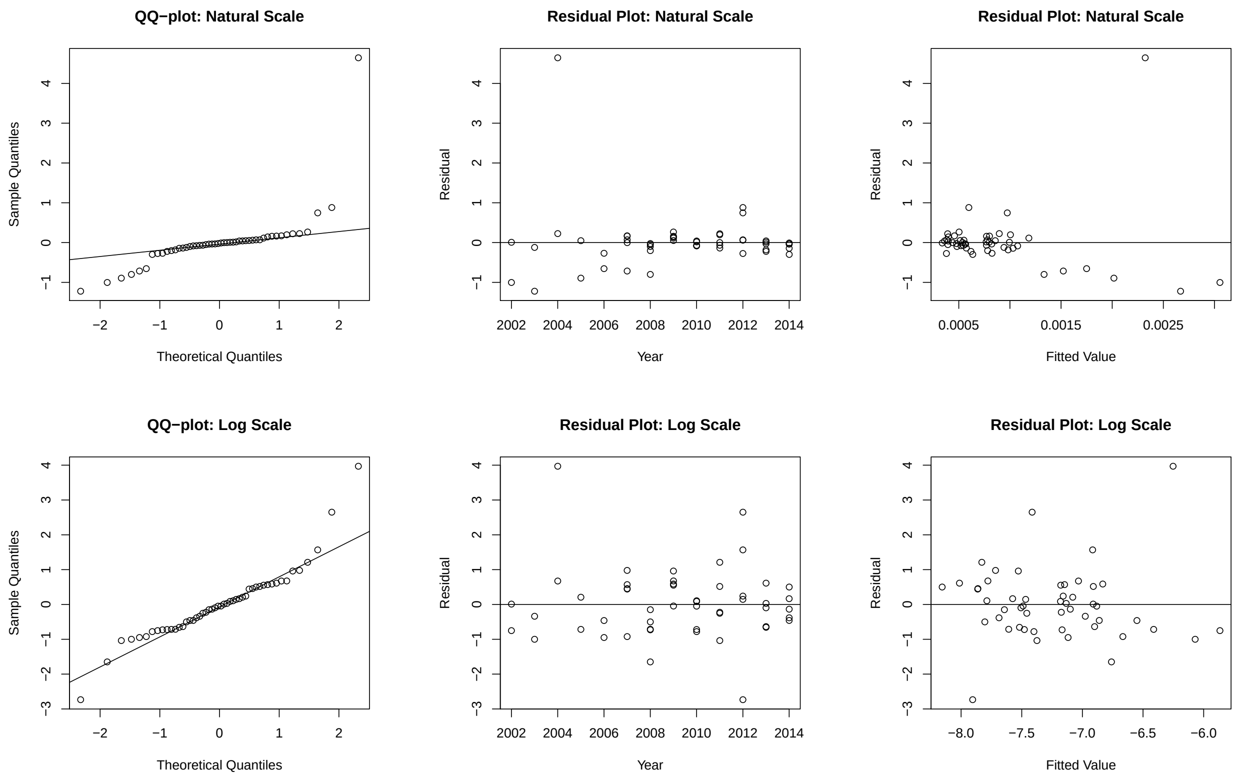






Comment:
10-60% of data in Counts, Nanuq, and Vulture lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
53	Cujo	2004	0.01	0.00	4.64

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
53	Cujo	2004	0.01	-6.25	3.97

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	2.35E-125	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
0.97	6.00	0.99

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
2.54	4.00	0.64

- Conclusions:
  The slopes do not differ significantly among reference lakes.

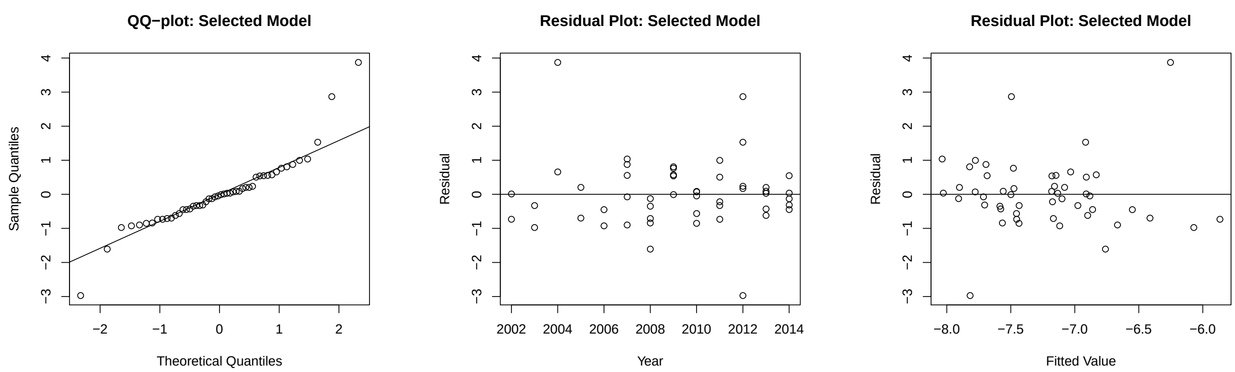
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.050	0.776	0.175	Ref. Model 2

- Conclusions:
  Results of AIC do not agree with reference model testing. Although results of contrasts suggest that reference lakes share a common slope and intercept, AIC reveals that reference lakes are best modeled with separate intercepts. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
53	Cujo	2004	0.01	-6.25	3.87

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	13.5840	2	0.0011
LdS1	6.3305	2	0.0422

- Conclusions:
  All monitored lakes show significant deviation from the common slope of reference lakes.

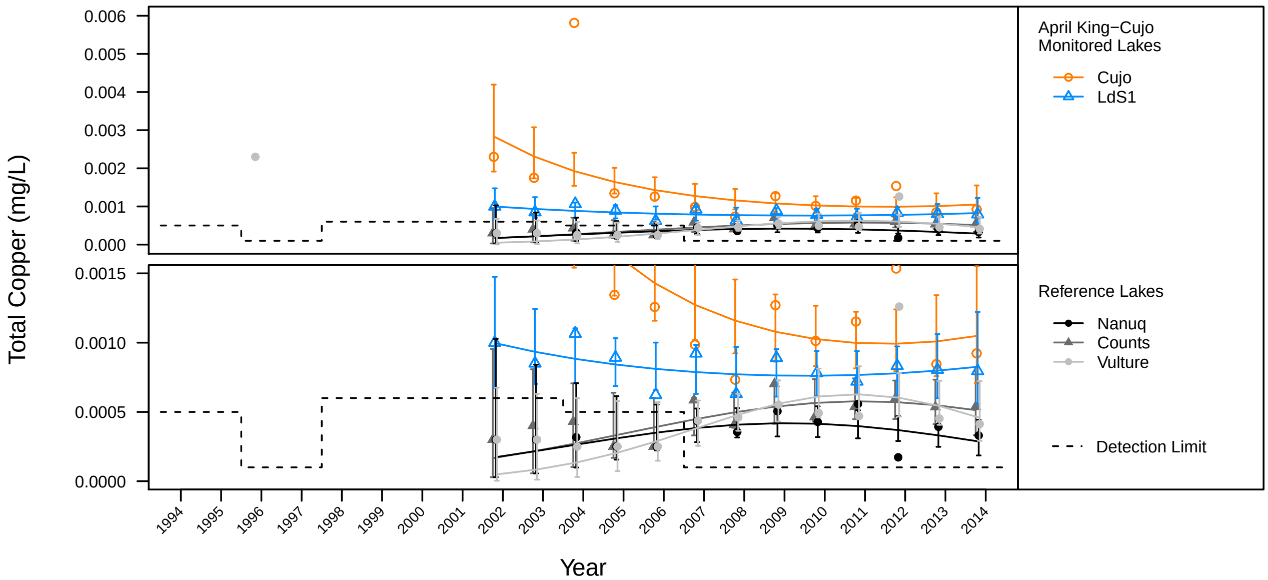
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.5780
Monitored Lake	Cujo	0.4330
Monitored Lake	LdS1	0.2820

- Conclusions:
  Model fit for Cujo Lake and LdS1 is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total copper for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	9.22e-04	1.05e-03	2.10e-04	7.08e-04	1.55e-03	6.13e-04
LdS1	7.95e-04	8.25e-04	1.65e-04	5.58e-04	1.22e-03	4.83e-04
Nanuq	3.30e-04	2.87e-04	6.37e-05	1.86e-04	4.43e-04	NA
Counts	5.38e-04	5.13e-04	1.14e-04	3.32e-04	7.93e-04	NA
Vulture	4.12e-04	4.59e-04	1.06e-04	2.91e-04	7.22e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Copper	April	King-Cujo	Lake	Water	1616-43 (KPSF) LdS2	log e	Tobit regression	#2 shared slopes	hardness-dependent	Cujo LdS1

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

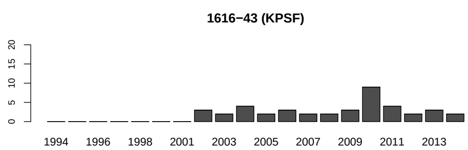
Analysis of August Total Copper in Lakes of the King-Cujo Watershed and Lac du Sauvage

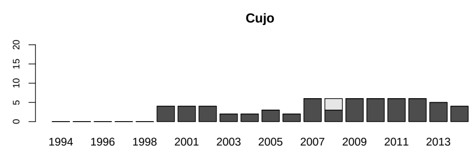
November 20, 2014

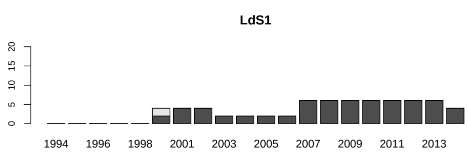
1 Censored Values:

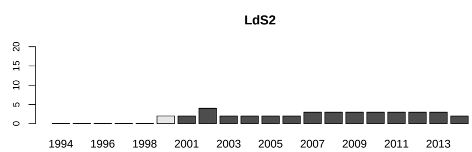
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

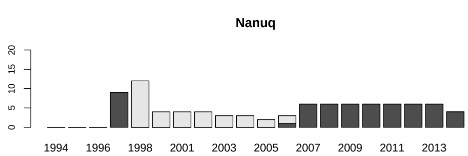


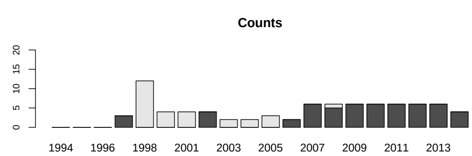


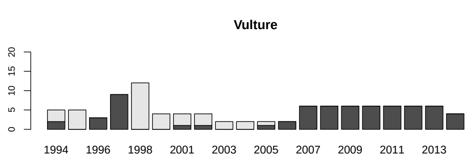




1.2 Reference

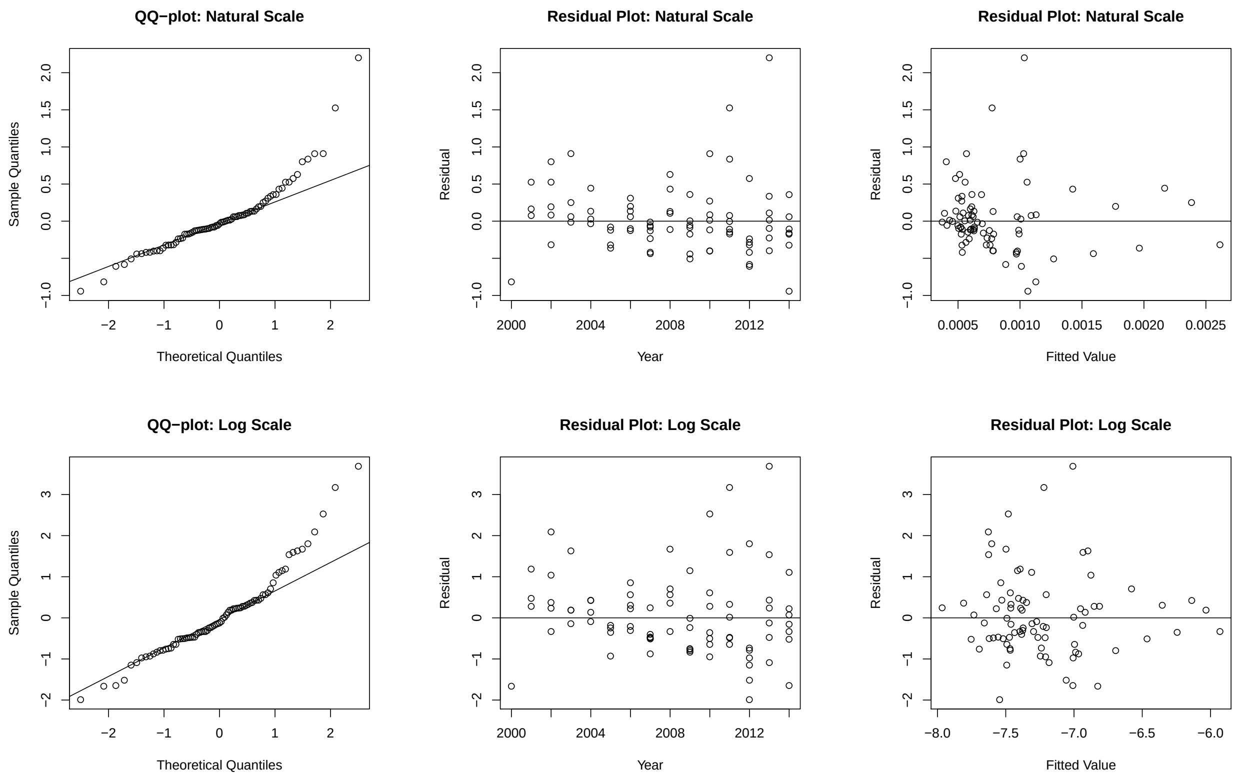






Comment:
10-60% of data in Counts, Nanuq, and Vulture lakes was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
62	Cujo	2013	0.00	-7.01	3.69
102	LdS2	2011	0.00	-7.22	3.17

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
4.91	6.00	0.56

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
3.71	4.00	0.45

- Conclusions:
  The slopes do not differ significantly among reference lakes.

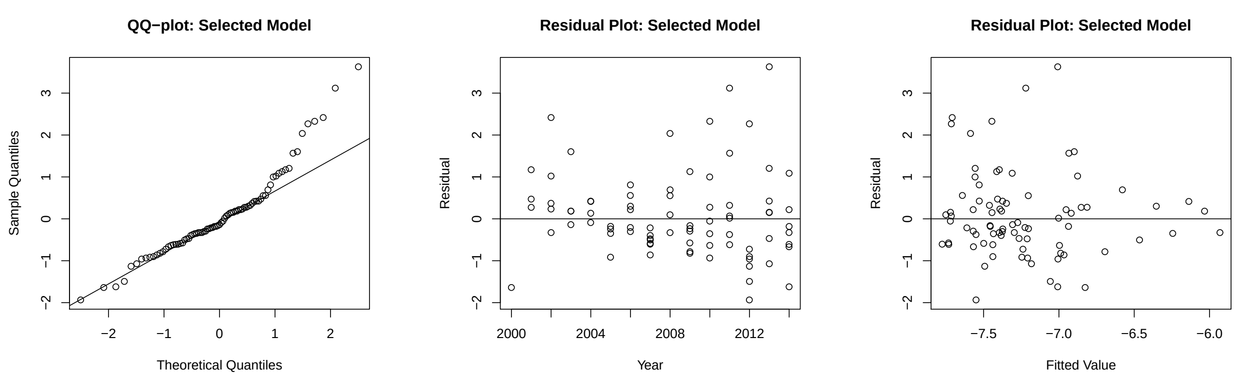
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.147	0.717	0.137	Ref. Model 2

- Conclusions:
  Results of AIC do not agree with reference model testing. Although results of contrasts suggest that reference lakes share a common slope and intercept, AIC reveals that reference lakes are best modeled with separate intercepts. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
62	Cujo	2013	0.00	-7.01	3.63
102	LdS2	2011	0.00	-7.22	3.12

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	43.6573	2	0.0000
Cujo	4.3043	2	0.1162
LdS1	3.6603	2	0.1604
LdS2	0.7512	2	0.6869

- Conclusions:
  1616-43 (KPSF) shows significant deviation from the common slope of reference lakes.

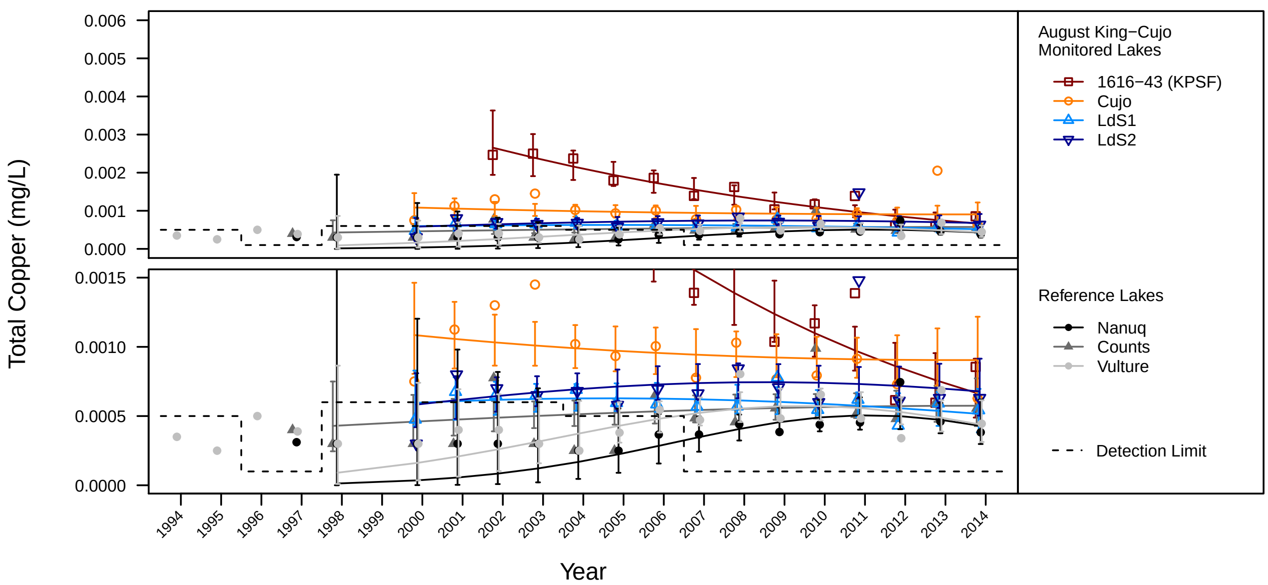
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3520
Monitored Lake	1616-43 (KPSF)	0.8400
Monitored Lake	Cujo	0.0400
Monitored Lake	LdS1	0.1710
Monitored Lake	LdS2	0.0750

- Conclusions:
  Model fit for pooled reference lakes is weak. Model fit for Cujo, LdS1, and LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total copper for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	8.55e-04	6.69e-04	1.07e-04	4.89e-04	9.14e-04	3.12e-04
Cujo	6.28e-04	9.05e-04	1.37e-04	6.72e-04	1.22e-03	4.01e-04
LdS2	6.30e-04	6.78e-04	1.03e-04	5.03e-04	9.15e-04	3.03e-04
LdS1	5.43e-04	5.16e-04	7.87e-05	3.83e-04	6.96e-04	2.30e-04
Nanuq	3.83e-04	4.29e-04	8.01e-05	2.98e-04	6.19e-04	NA
Counts	5.55e-04	5.75e-04	8.68e-05	4.27e-04	7.72e-04	NA
Vulture	4.45e-04	4.38e-04	7.54e-05	3.13e-04	6.14e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Copper	August	King-Cujo	Lake	Water	none	log e	Tobit regression	#2 shared slopes	hardness-dependent	1616-43 (KPSF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

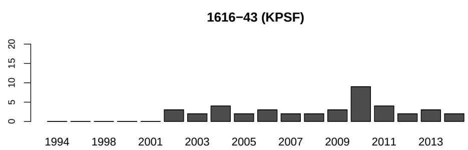
Analysis of August Total Copper in King-Cujo Watershed Streams

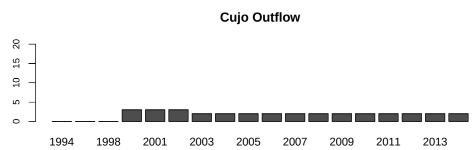
November 20, 2014

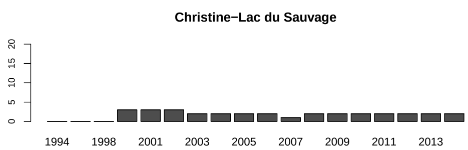
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

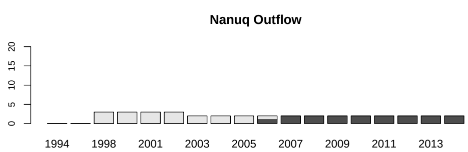
1.1 Monitored

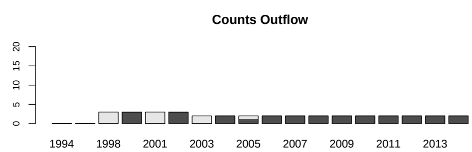


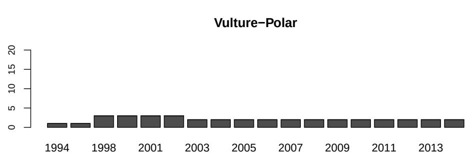




1.2 Reference

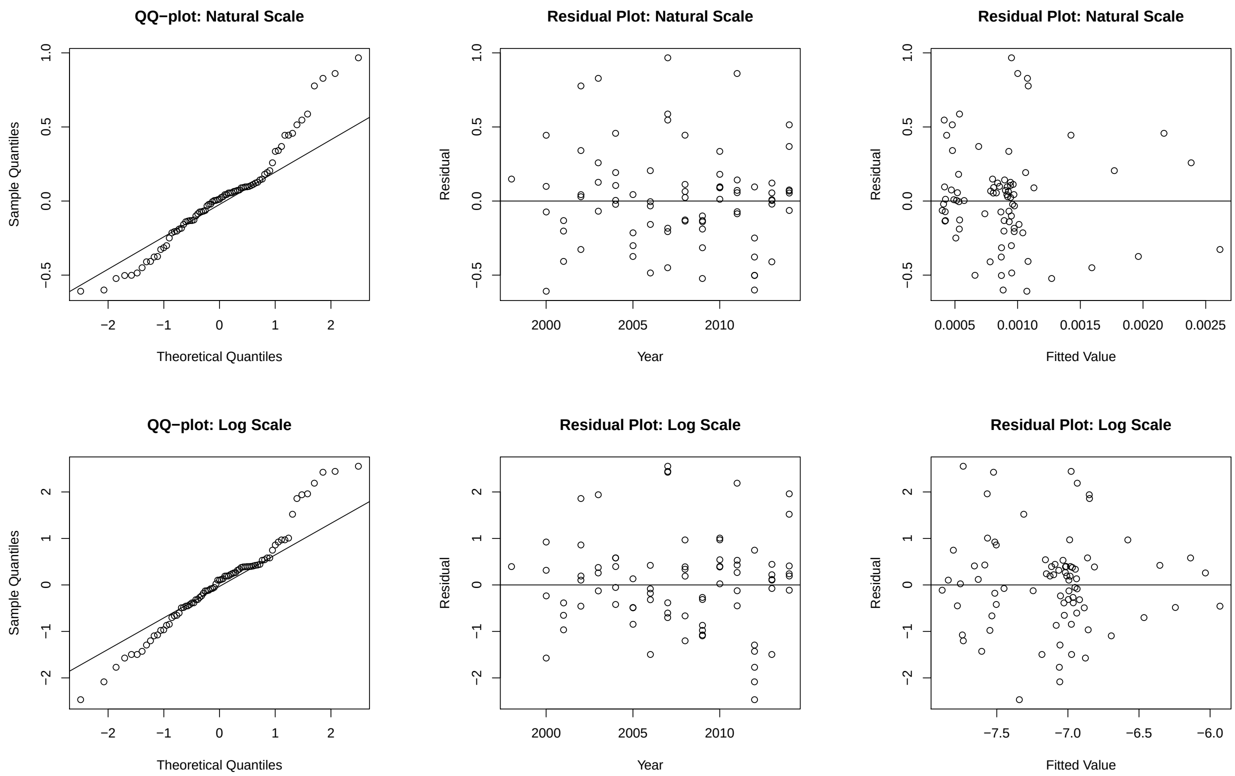






Comment:
10-60% of data in Counts Outflow and Nanuq Outflow was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the un-transformed "natural model".

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
11.72	6.00	0.07

- Conclusions:
  The slopes and intercepts do not differ significantly among reference streams.

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
0.11	4.00	1.00

- Conclusions:
  The slopes do not differ significantly among reference streams.

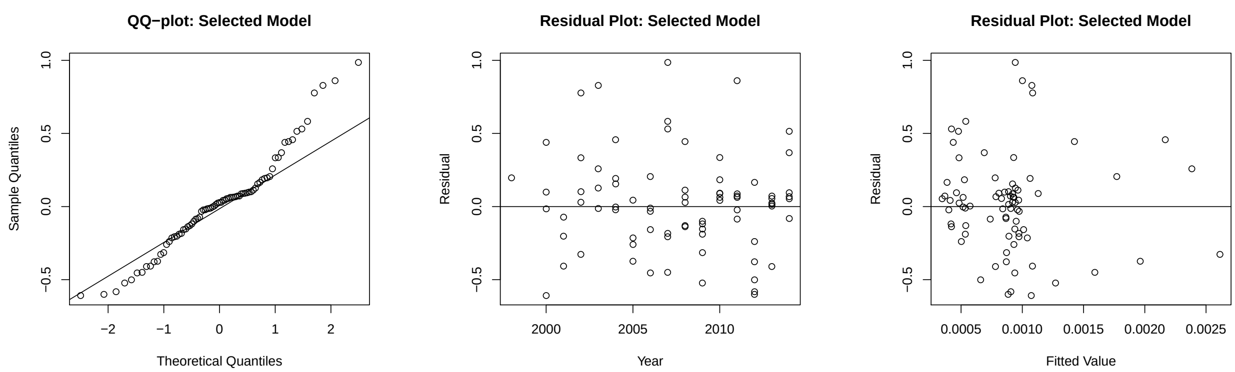
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.019	0.960	0.021	Ref. Model 2

- Conclusions:
  Results of AIC do not agree with reference model testing. Although results of contrasts suggest that reference lakes share a common slope and intercept, AIC reveals that reference lakes are best modeled with separate intercepts. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference stream slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	19.0102	2	0.0001
Cujo Outflow	2.1408	2	0.3429
Christine-Lac du Sauvage	0.0758	2	0.9628

- Conclusions:
  1616-43 (KPSF) shows significant deviation from the common slope of reference streams.

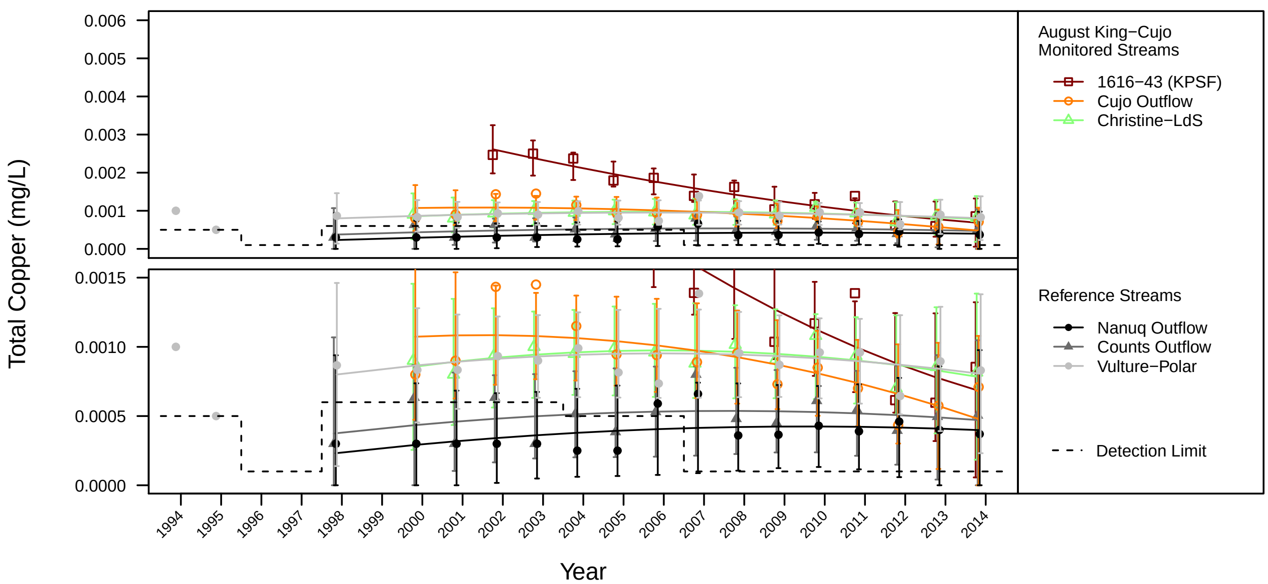
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.7650
Monitored Stream	1616-43 (KPSF)	0.8990
Monitored Stream	Christine-Lac du Sauvage	0.3660
Monitored Stream	Cujo Outflow	0.5210

- Conclusions:
  Model fit for Christine-Lac du Sauvage is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total copper for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	8.55e-04	6.90e-04	3.23e-04	5.70e-05	1.32e-03	9.44e-04
Cujo Outflow	7.10e-04	4.79e-04	3.06e-04	0.00e+00	1.08e-03	8.96e-04
Christine-Lac du Sauvage	8.15e-04	7.85e-04	3.06e-04	1.85e-04	1.38e-03	8.96e-04
Nanuq Outflow	3.70e-04	3.98e-04	2.95e-04	0.00e+00	9.76e-04	NA
Counts Outflow	5.05e-04	4.71e-04	2.94e-04	0.00e+00	1.05e-03	NA
Vulture-Polar	8.30e-04	8.06e-04	2.93e-04	2.31e-04	1.38e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Copper	August	King-Cujo	Stream	Water	none	none	Tobit regression	#2 shared slopes	hardness-dependent	1616-43 (KPSF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

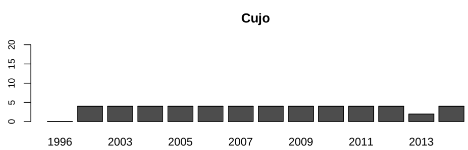
Analysis of April Total Molybdenum in Lakes of the King-Cujo Watershed and Lac du Sauvage

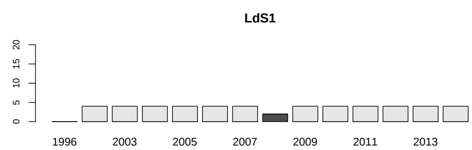
November 19, 2014

1 Censored Values:

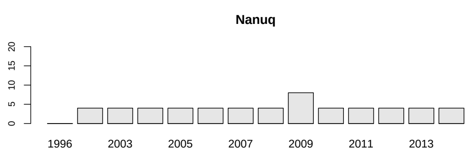
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

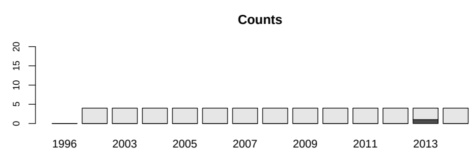
1.1 Monitored

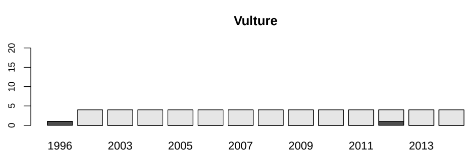




1.2 Reference

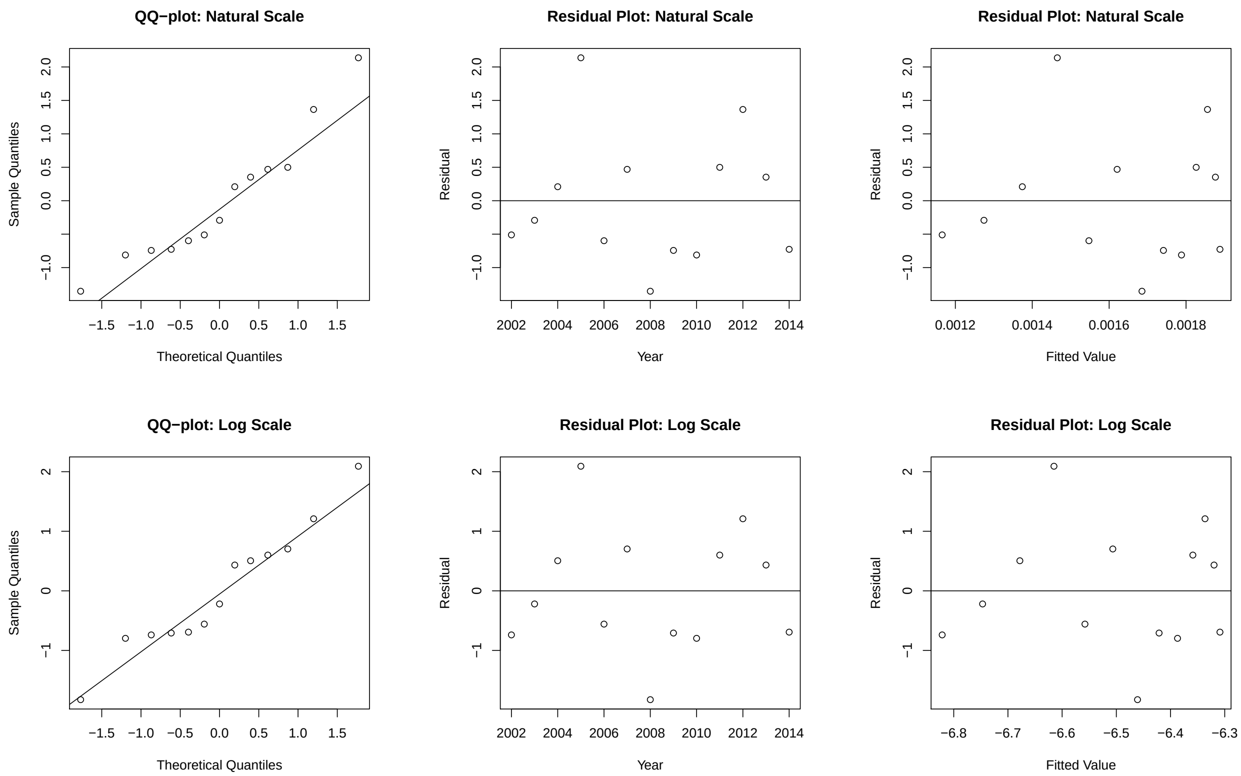






Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and LdS1 was less than the detection limit. These lakes were excluded from further analyses. Cujo Lake is the only lake remaining in the analysis. Linear mixed model regression can not be performed when only one lake remains in the analyis. Proceeding with Tobit regression for the remainder of the analyses. Results for LME and Tobit are comparable when all or most of the data is above detection limit. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	8.82E-37	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the un-transformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	1.6626	2	0.4355

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

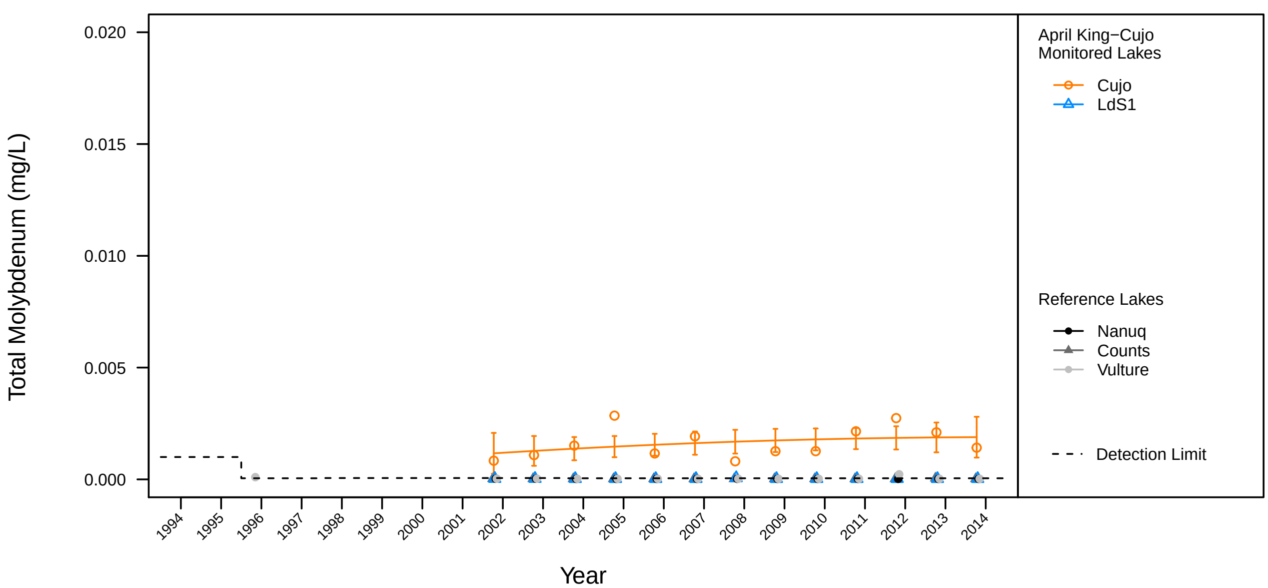
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Cujo	0.1280

- Conclusions:
  Model fit for Cujo Lake Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total molybdenum for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.42e-03	1.89e-03	4.66e-04	9.75e-04	2.8e-03	1.36e-03
LdS1	2.50e-05	NA	NA	NA	NA	NA
Nanuq	2.50e-05	NA	NA	NA	NA	NA
Counts	2.50e-05	NA	NA	NA	NA	NA
Vulture	2.50e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Molybdenum	April	King-Cujo	Lake	Water	Counts Nanuq Vulture LdS1	none	Tobit regression	#1a slope fo zero	19.38	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

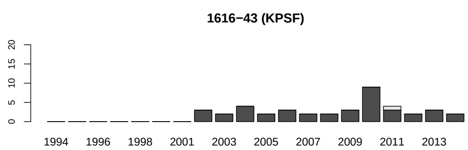
Analysis of August Total Molybdenum in Lakes of the King-Cujo Watershed and Lac du Sauvage

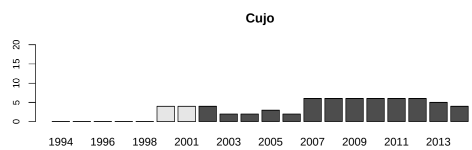
November 19, 2014

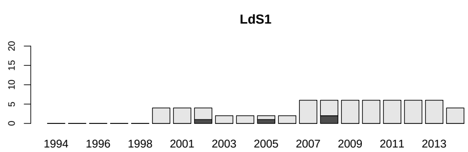
1 Censored Values:

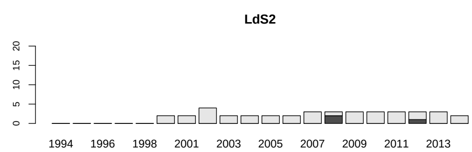
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

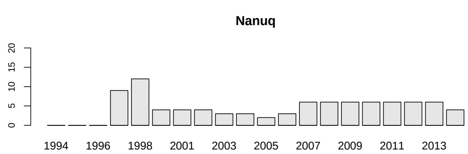


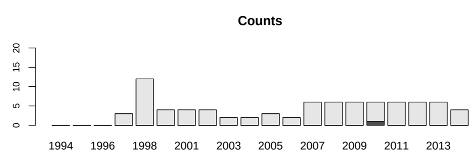


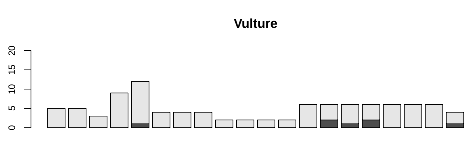




1.2 Reference

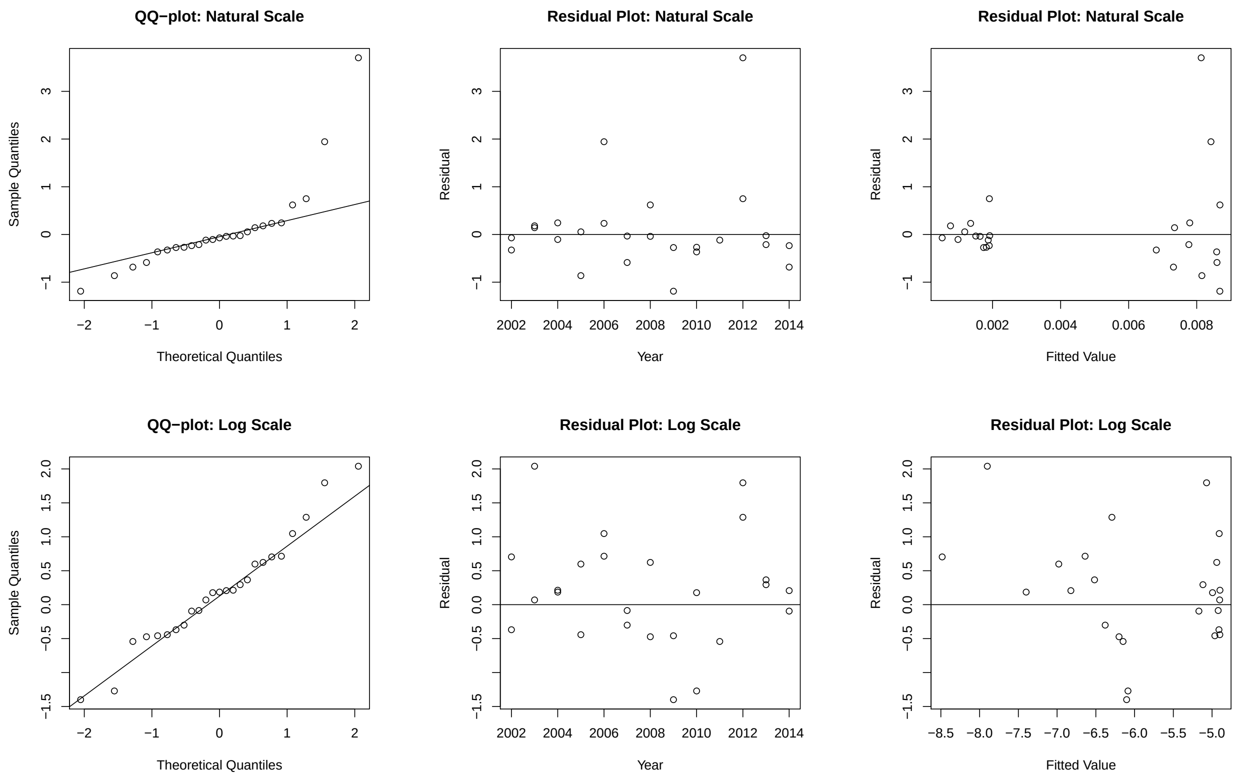






Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, LdS1, and LdS2 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Cujo Lake was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.02	0.01	3.70

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	0.2712	2	0.8732
Cujo	42.1437	2	0.0000

- Conclusions:
  Cujo Lake shows significant deviation from a slope of zero.

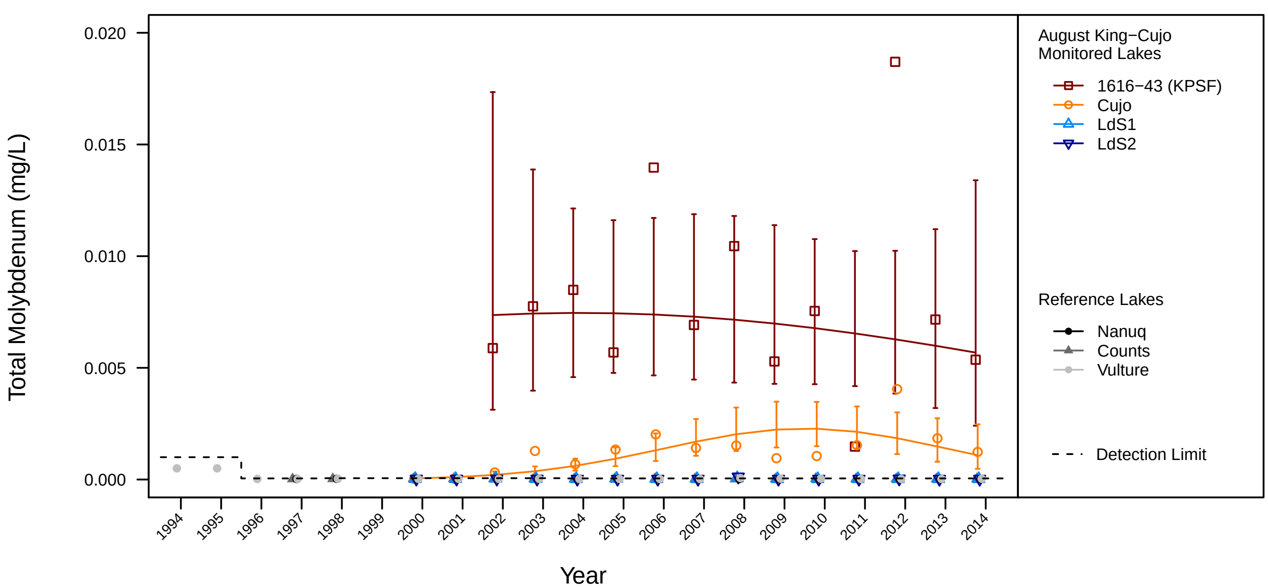
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-43 (KPSF)	0.0240
Monitored Lake	Cujo	0.7660

- Conclusions:
  Model fit for 1616-43 (KPSF) is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total molybdenum for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.36e-03	5.68e-03	2.49e-03	2.41e-03	1.34e-02	7.28e-03
Cujo	1.23e-03	1.09e-03	4.56e-04	4.80e-04	2.47e-03	1.33e-03
LdS2	2.50e-05	NA	NA	NA	NA	NA
LdS1	2.50e-05	NA	NA	NA	NA	NA
Nanuq	2.50e-05	NA	NA	NA	NA	NA
Counts	2.50e-05	NA	NA	NA	NA	NA
Vulture	3.40e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Molybdenum	August	King-Cujo	Lake	Water	Counts Nanuq Vulture LdS1 LdS2	log e	Tobit regression	#1a slope of zero	19.38	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

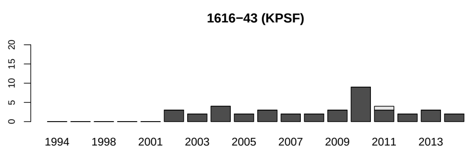
Analysis of August Total Molybdenum in King-Cujo Watershed Streams

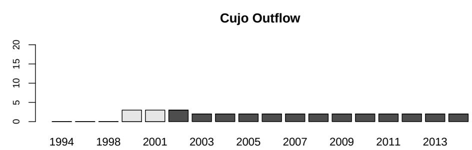
November 20, 2014

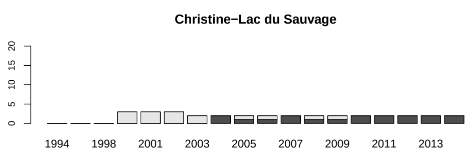
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

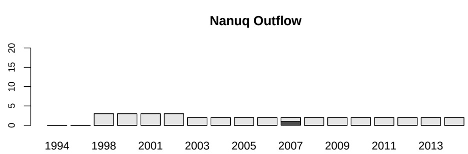
1.1 Monitored

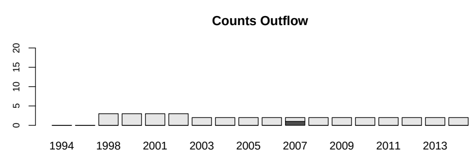


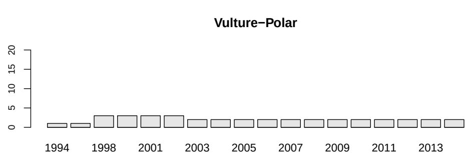




1.2 Reference

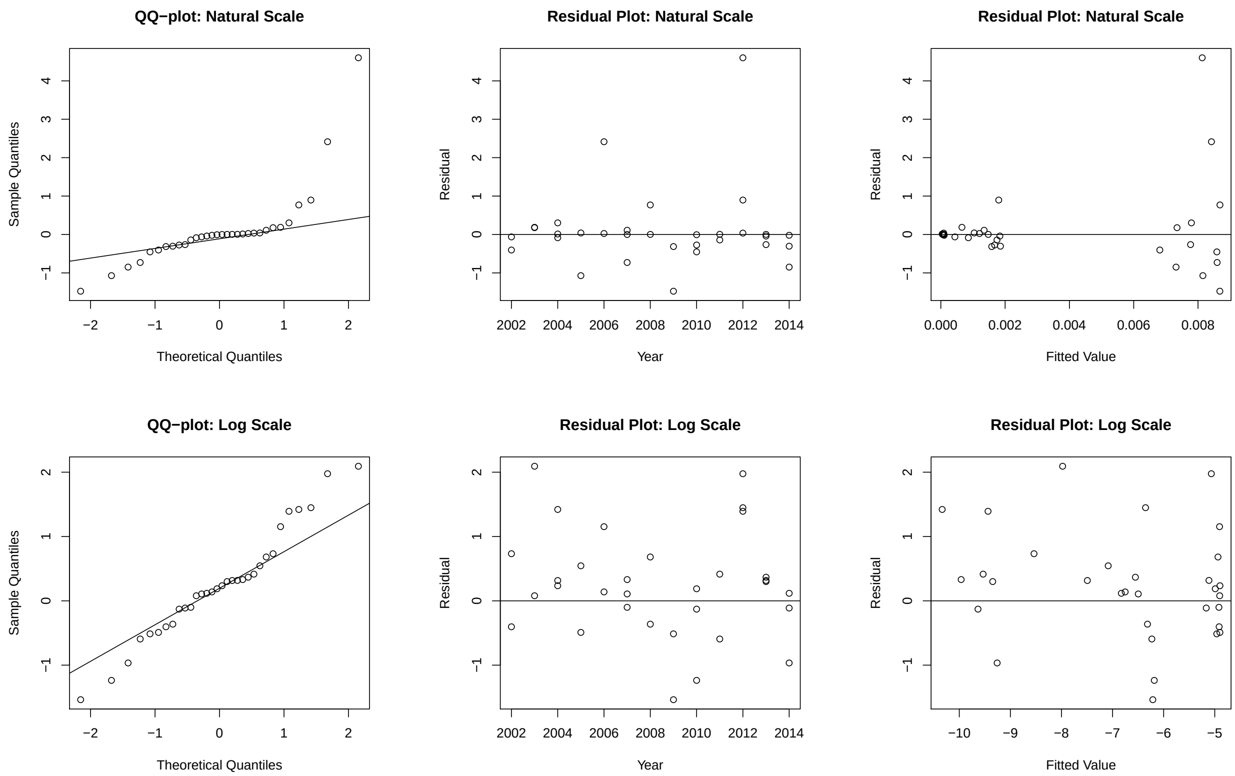






Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, and Vulture-Polar was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Cujo Outflow and Christine-Lac du Savuage was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.02	0.01	4.60

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	0.3210	2	0.8517
Cujo Outflow	49.5985	2	0.0000
Christine-Lac du Sauvage	5.2326	2	0.0731

- Conclusions:
  Cujo Outflow shows significant deviation from a slope of zero.

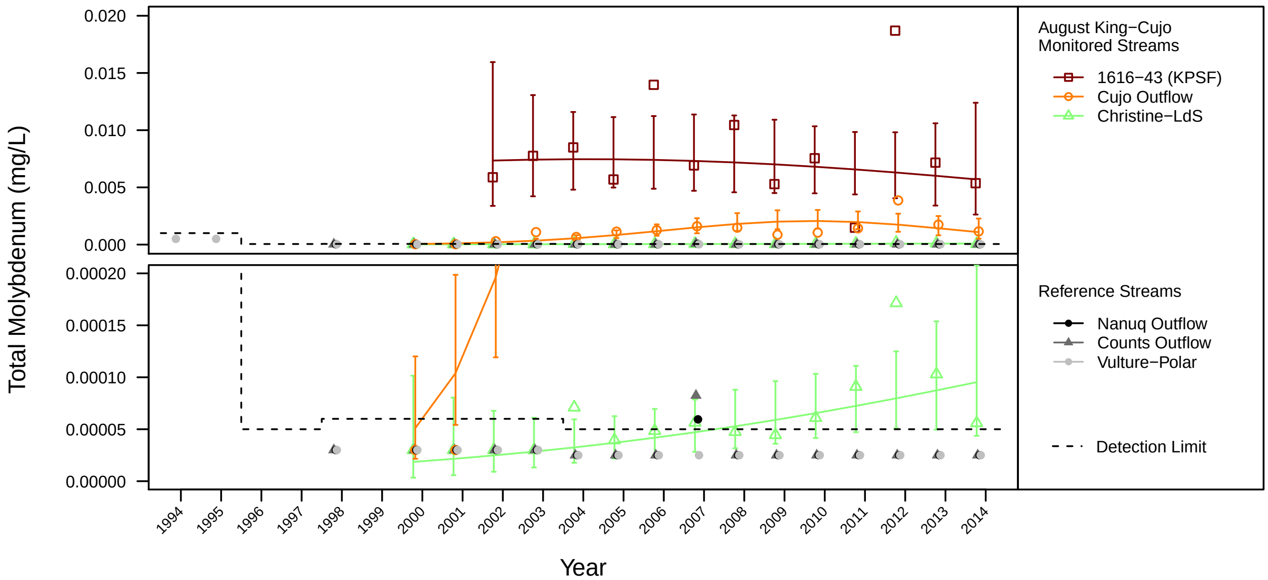
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-43 (KPSF)	0.0230
Monitored Stream	Christine-Lac du Sauvage	0.6690
Monitored Stream	Cujo Outflow	0.7800

- Conclusions:
  Model fit for 1616-43 (KPSF) is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total molybdenum for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.36e-03	5.70e-03	2.26e-03	2.63e-03	1.24e-02	6.61e-03
Cujo Outflow	1.15e-03	1.08e-03	4.10e-04	5.16e-04	2.27e-03	1.20e-03
Christine-Lac du Sauvage	5.60e-05	9.53e-05	3.79e-05	4.37e-05	2.08e-04	1.11e-04
Nanuq Outflow	2.50e-05	NA	NA	NA	NA	NA
Counts Outflow	2.50e-05	NA	NA	NA	NA	NA
Vulture-Polar	2.50e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Molybdenum	August	King-Cujo	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar	log e	Tobit regression	#1 separate intercepts & slopes	19.38	Cujo Outflow

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

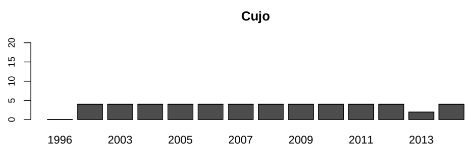
Analysis of April Total Nickel in Lakes of the King-Cujo Watershed and Lac du Sauvage

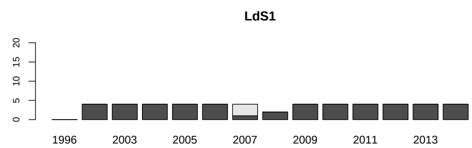
November 19, 2014

1 Censored Values:

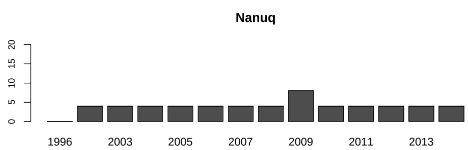
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

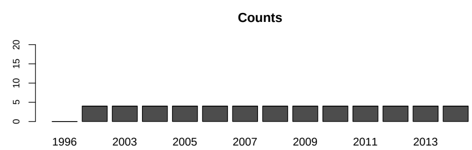
1.1 Monitored

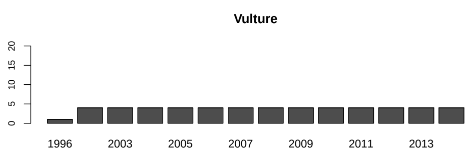




1.2 Reference

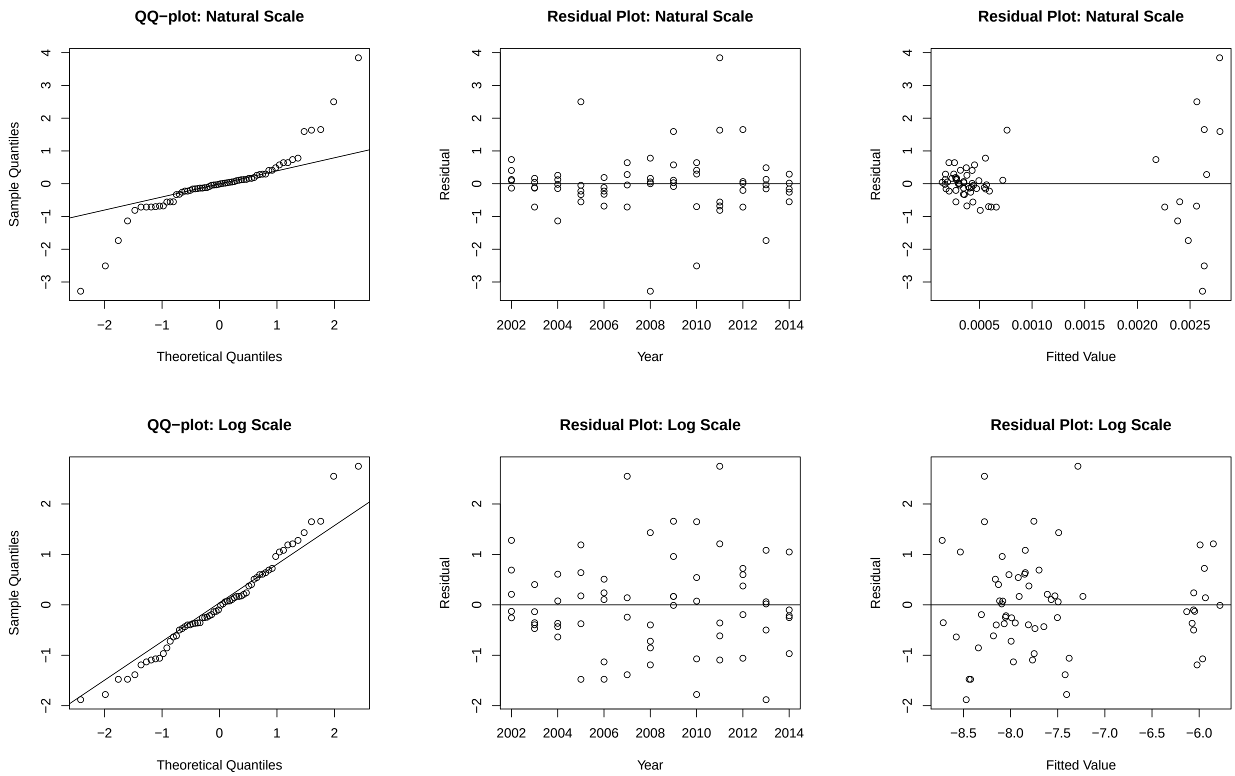






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
57	Cujo	2008	0.00	0.00	-3.28
60	Cujo	2011	0.00	0.00	3.84

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	2.46E-192	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
7377.59	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
6.84	4.00	0.14

- Conclusions:
  The slopes do not differ significantly among reference lakes.

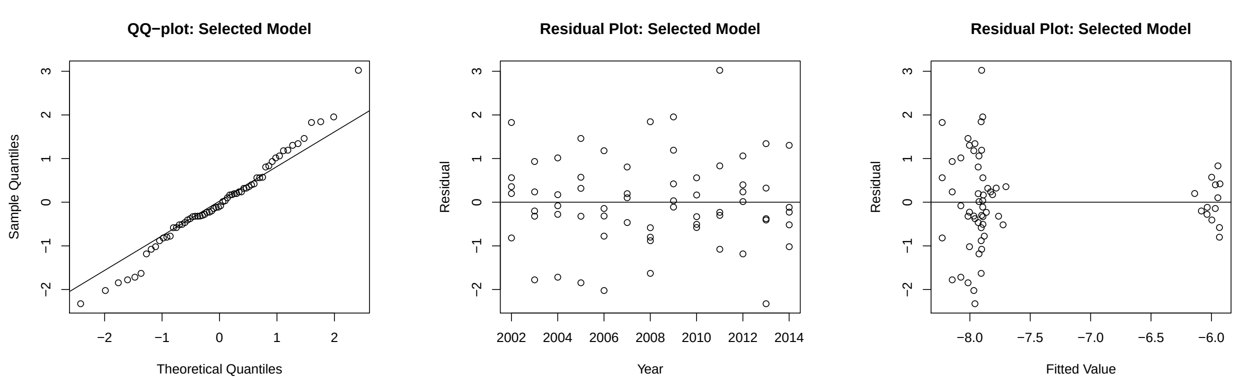
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
39	Counts	2011	0.00	-7.90	3.02

Conclusion:
The reduced model shows some dependence on fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	0.08	2.00	0.96
LdS1	1.14	2.00	0.57

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

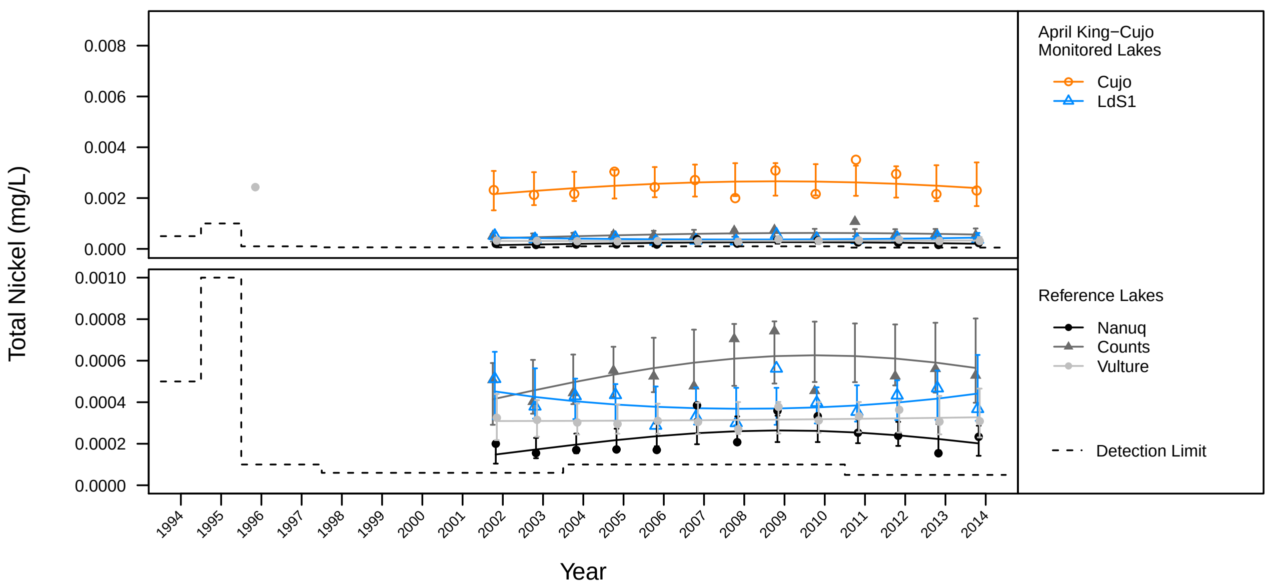
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0520
Monitored Lake	Cujo	0.1290
Monitored Lake	LdS1	0.1230

- Conclusions:
  Model fit for pooled reference lakes, Cujo Lake, and LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nickel for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	2.30e-03	2.39e-03	4.30e-04	1.68e-03	3.40e-03	1.26e-03
LdS1	3.68e-04	4.42e-04	7.92e-05	3.11e-04	6.28e-04	2.32e-04
Nanuq	2.33e-04	2.02e-04	3.62e-05	1.42e-04	2.87e-04	NA
Counts	5.29e-04	5.65e-04	1.01e-04	3.98e-04	8.03e-04	NA
Vulture	3.08e-04	3.28e-04	5.88e-05	2.30e-04	4.66e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Nickel	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	hardness-dependent	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

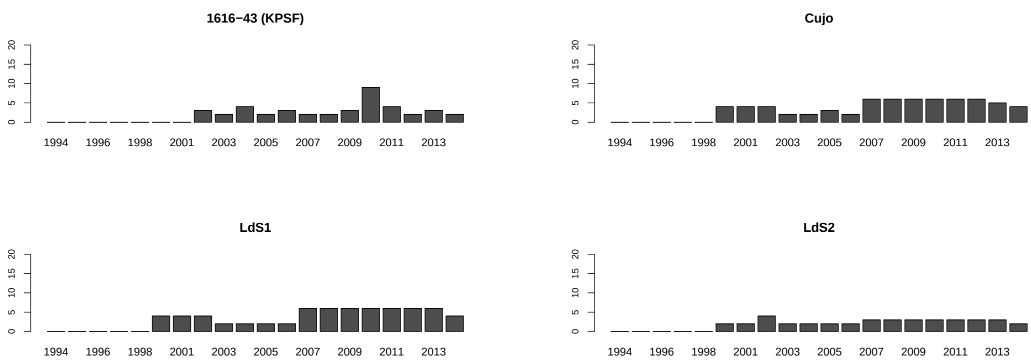
Analysis of August Total Nickel in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 19, 2014

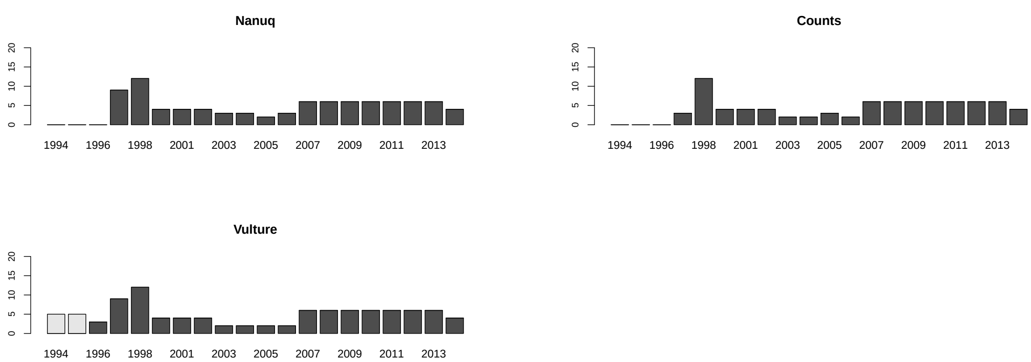
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

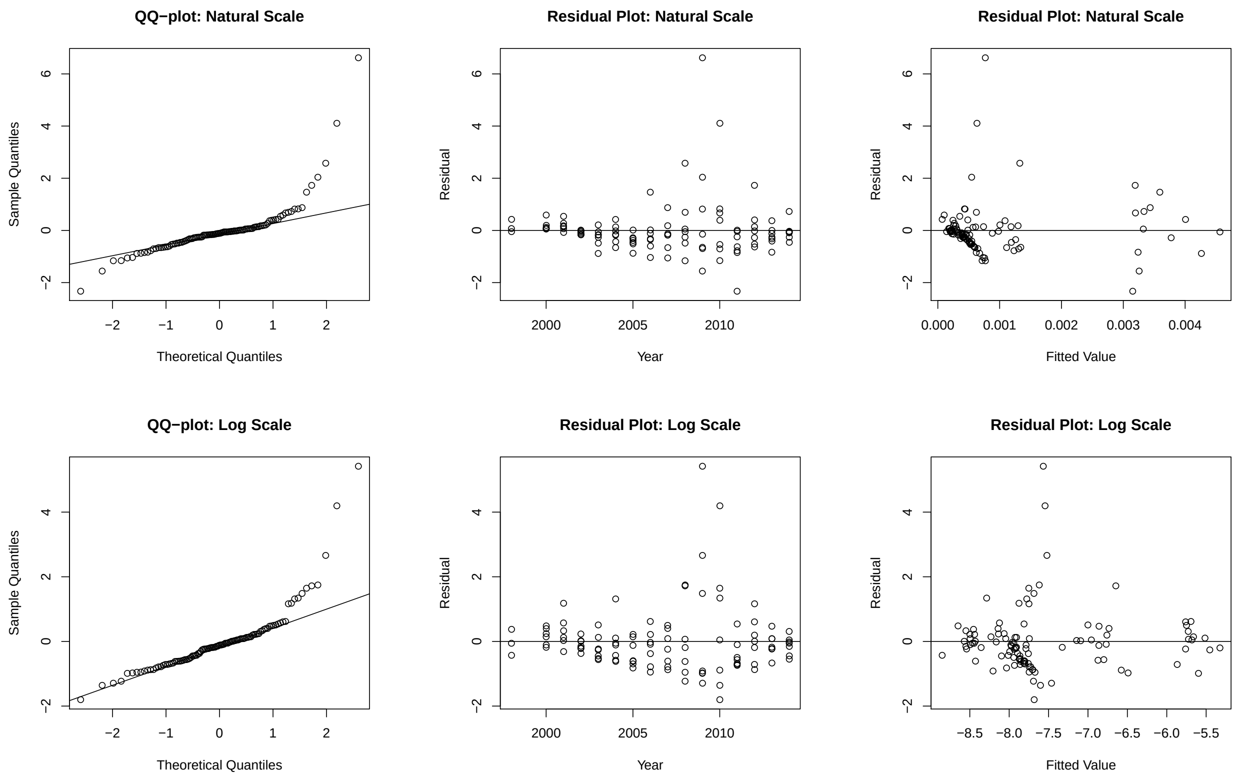


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
79	LdS1	2009	0.00	0.00	6.62
143	Vulture	2010	0.00	0.00	4.11

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
79	LdS1	2009	0.00	-7.57	5.42
143	Vulture	2010	0.00	-7.54	4.20

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
31.44	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
0.76	4.00	0.94

- Conclusions:
  The slopes do not differ significantly among reference lakes.

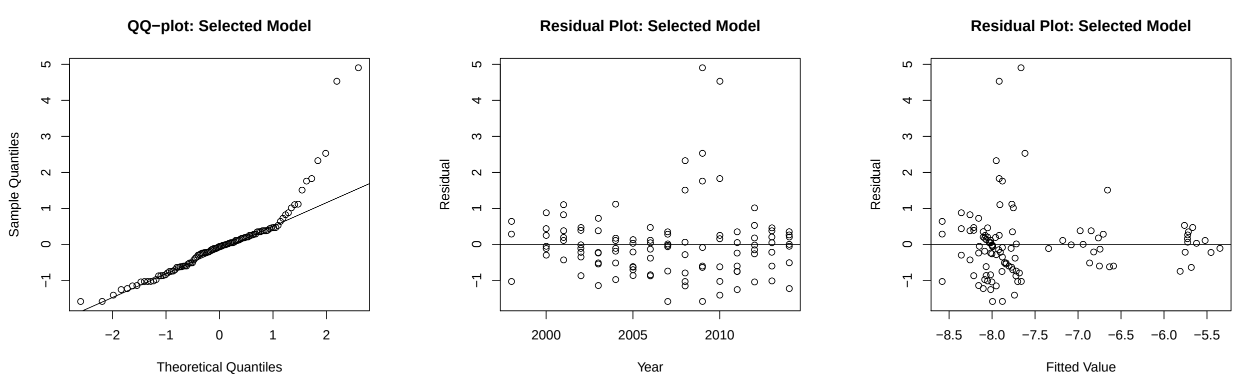
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.999	0.000	0.001	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
79	LdS1	2009	0.00	-7.66	4.91
143	Vulture	2010	0.00	-7.92	4.53

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	0.7788	2	0.6775
Cujo	0.5119	2	0.7742
LdS1	0.8747	2	0.6458
LdS2	0.1004	2	0.9510

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

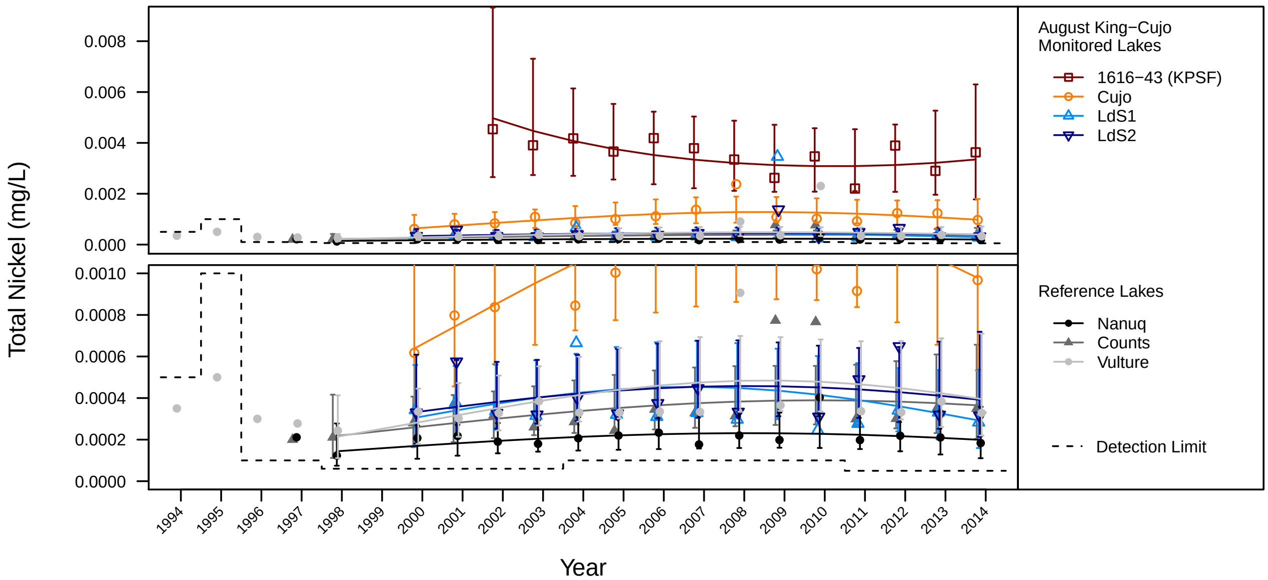
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1290
Monitored Lake	1616-43 (KPSF)	0.4520
Monitored Lake	Cujo	0.4820
Monitored Lake	LdS1	0.0520
Monitored Lake	LdS2	0.0560

- Conclusions:
  Model fit for 1616-43 (KPSF) and Cujo Lake is weak. Model fit for pooled reference lakes, LdS1, and LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nickel for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	3.63e-03	3.35e-03	1.08e-03	1.78e-03	6.30e-03	3.16e-03
Cujo	9.68e-04	9.78e-04	3.03e-04	5.33e-04	1.80e-03	8.87e-04
LdS2	3.14e-04	3.92e-04	1.21e-04	2.13e-04	7.19e-04	3.55e-04
LdS1	2.83e-04	2.92e-04	9.06e-05	1.59e-04	5.37e-04	2.65e-04
Nanuq	1.84e-04	1.99e-04	5.95e-05	1.11e-04	3.58e-04	NA
Counts	3.49e-04	3.65e-04	1.09e-04	2.03e-04	6.57e-04	NA
Vulture	3.29e-04	3.95e-04	1.18e-04	2.20e-04	7.10e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Nickel	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	hardness-dependent	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

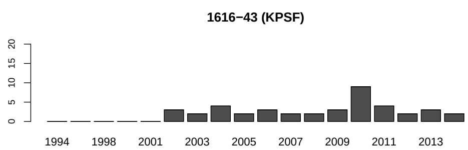
Analysis of August Total Nickel in King-Cujo Watershed Streams

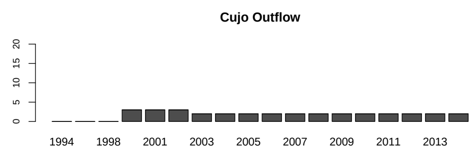
November 19, 2014

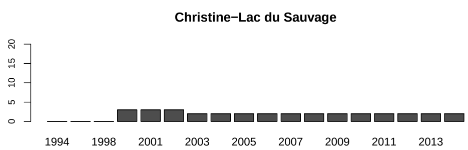
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

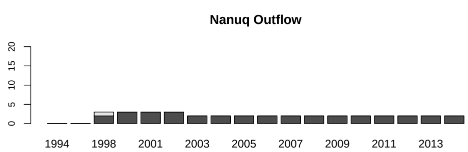
1.1 Monitored

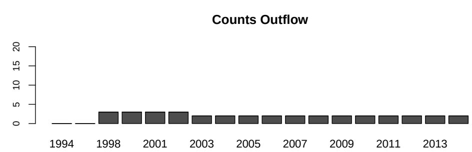


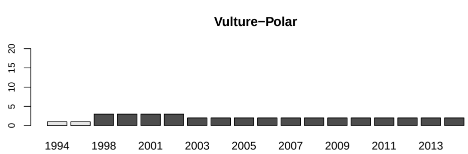




1.2 Reference

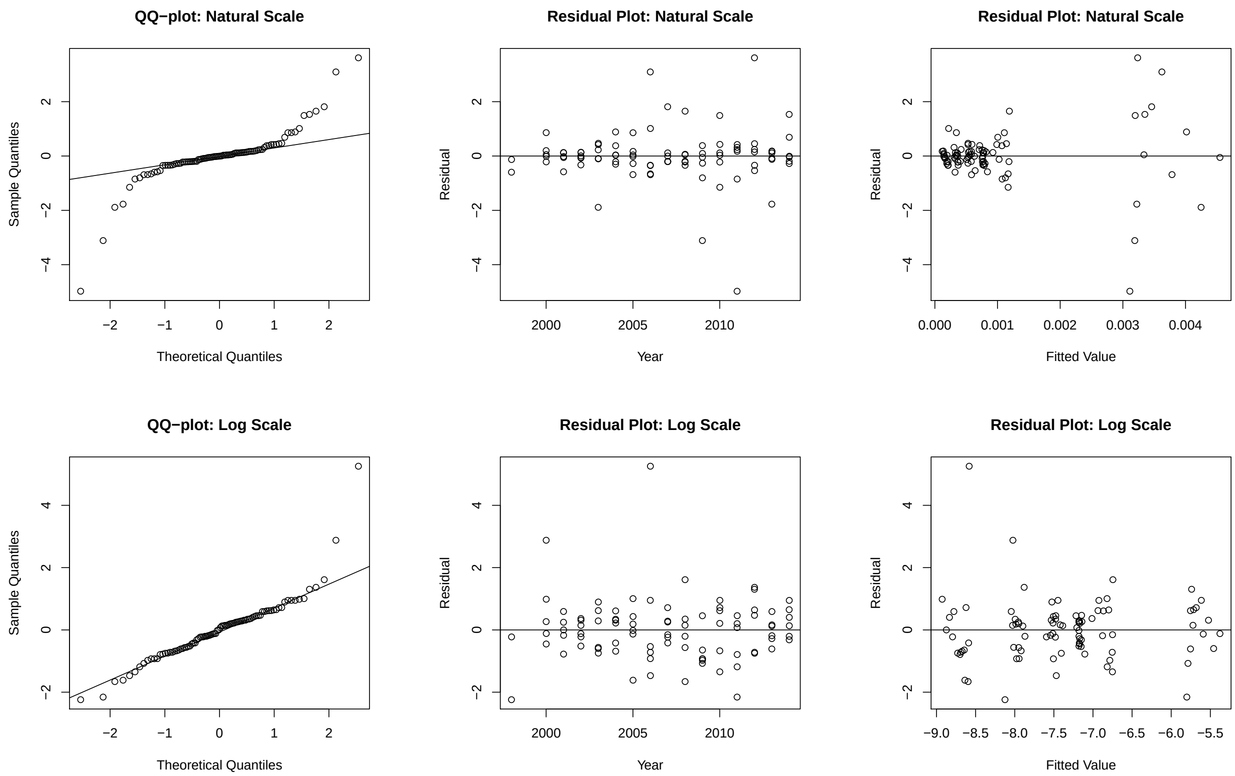






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
13	1616-43 (KPSF)	2006	0.00	0.00	3.10
16	1616-43 (KPSF)	2009	0.00	0.00	-3.11
18	1616-43 (KPSF)	2011	0.00	0.00	-4.98
19	1616-43 (KPSF)	2012	0.00	0.00	3.62

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
97	Nanuq Outflow	2006	0.00	-8.58	5.26

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
600.47	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
10.81	4.00	0.03

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	8.7714	2	0.0125
Cujo Outflow	3.0824	2	0.2141
Christine-Lac du Sauvage	0.0063	2	0.9969

- Conclusions:
  1616-43 (KPSF) shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)-vs-Nanuq Outflow	841.8857	3	0.0000
1616-43 (KPSF)-vs-Counts Outflow	438.4371	3	0.0000
1616-43 (KPSF)-vs-Vulture-Polar	302.0681	3	0.0000

- Conclusions:
  1616-43 (KPSF) shows significant deviation from the slopes of individual reference streams.

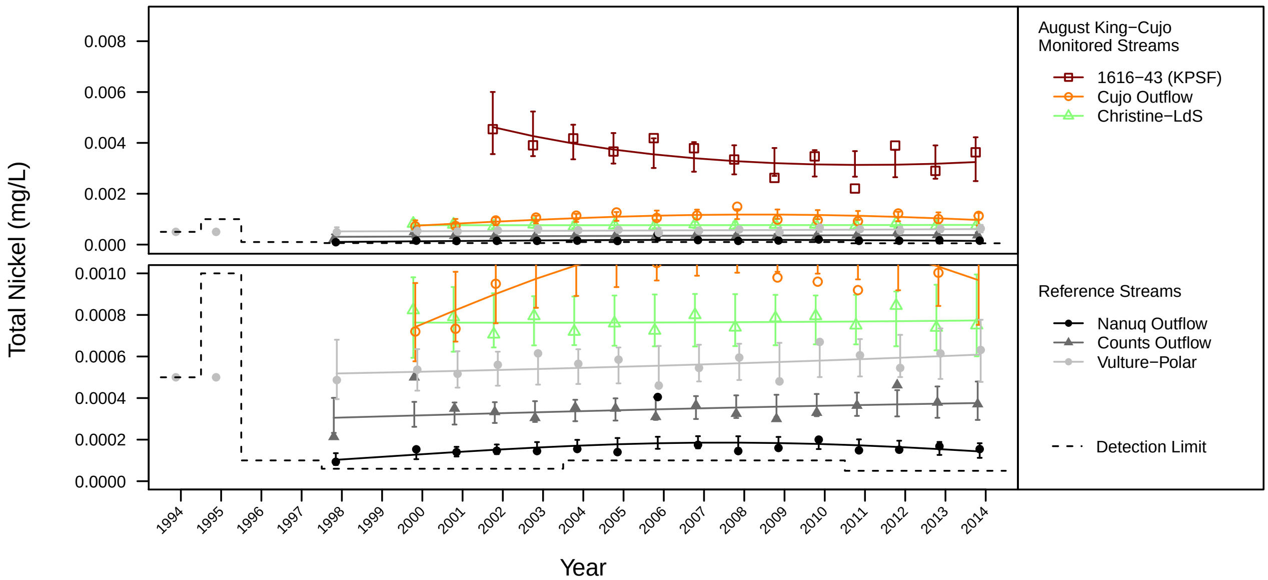
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.1130
Reference Stream	Nanuq Outflow	0.3070
Reference Stream	Vulture-Polar	0.2210
Monitored Stream	1616-43 (KPSF)	0.4080
Monitored Stream	Christine-Lac du Sauvage	0.0090
Monitored Stream	Cujo Outflow	0.5060

- Conclusions:
  Model fit for Nanuq Outflow, Vulture-Polar, and 1616-43 (KPSF) is weak. Model fit for Counts Outflow and Christine-Lac du Sauvage is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nickel for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	3.63e-03	3.25e-03	4.35e-04	2.50e-03	4.22e-03	1.27e-03
Cujo Outflow	1.13e-03	9.67e-04	1.24e-04	7.52e-04	1.24e-03	3.63e-04
Christine-Lac du Sauvage	7.51e-04	7.73e-04	9.93e-05	6.01e-04	9.95e-04	2.91e-04
Nanuq Outflow	1.55e-04	1.43e-04	1.78e-05	1.12e-04	1.83e-04	NA
Counts Outflow	3.71e-04	3.76e-04	4.66e-05	2.95e-04	4.80e-04	NA
Vulture-Polar	6.32e-04	6.09e-04	7.55e-05	4.78e-04	7.77e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Nickel	August	King-Cujo	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	hardness-dependent	1616-43 (KPSF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

Analysis of April Total Selenium in Lakes of the King-Cujo Watershed and Lac du Sauvage

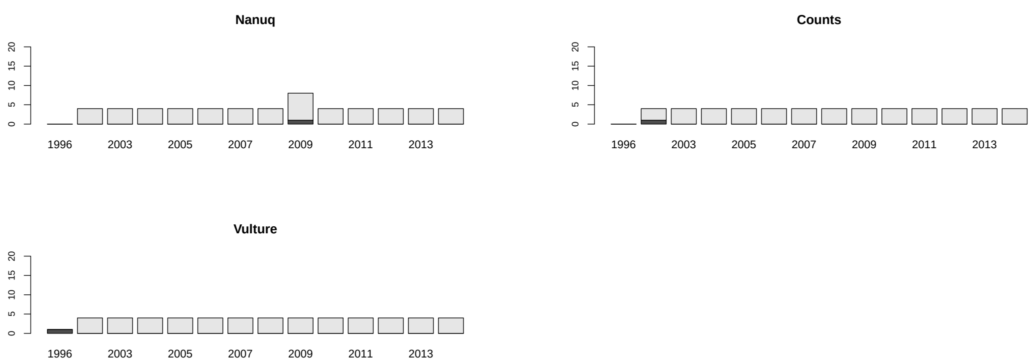
November 20, 2014

1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

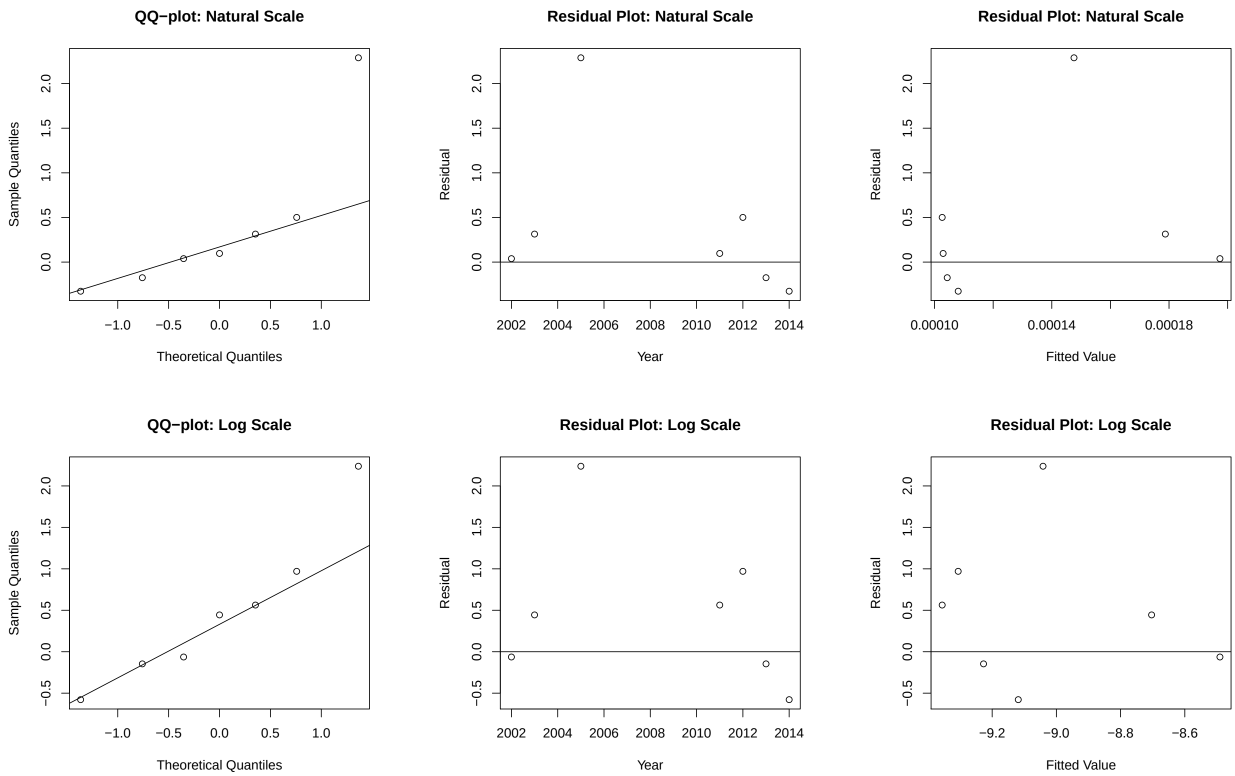
1.1 Monitored

1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and LdS1 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Cujo Lake was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	1.11E-25	natural model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	2.5983	2	0.2728

- Conclusions:
  No significant deviation was found when comparing Cujo Lake to a constant slope of zero.

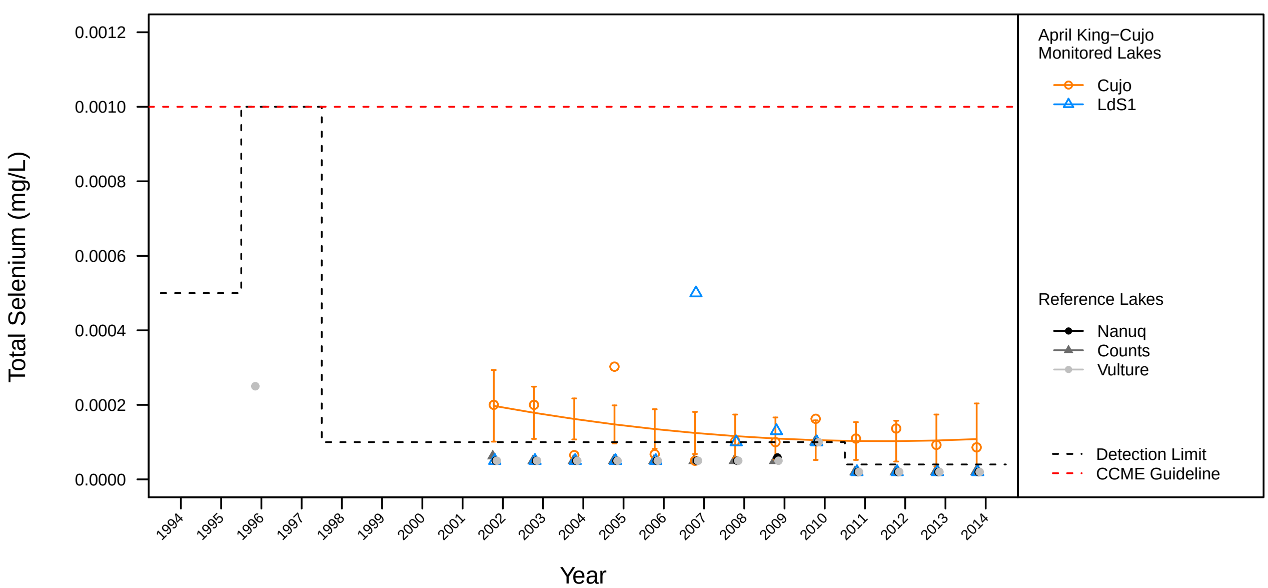
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	Cujo	0.1980

- Conclusions:
  Model fit for Cujo Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total selenium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	8.6e-05	1.08e-04	4.88e-05	1.24e-05	2.04e-04	1.43e-04
LdS1	2.0e-05	NA	NA	NA	NA	NA
Nanuq	2.0e-05	NA	NA	NA	NA	NA
Counts	2.0e-05	NA	NA	NA	NA	NA
Vulture	2.0e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Selenium	April	King-Cujo	Lake	Water	Counts Nanuq Vulture LdS1	none	Tobit regression	#1a slope of zero	0.001	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

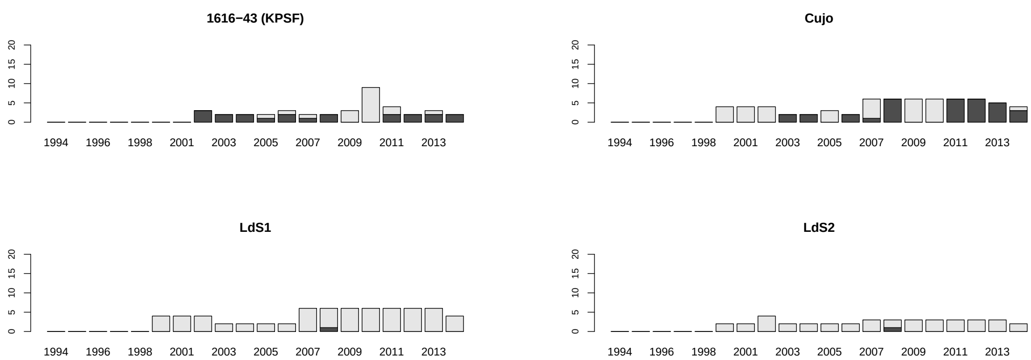
Analysis of August Total Selenium in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 20, 2014

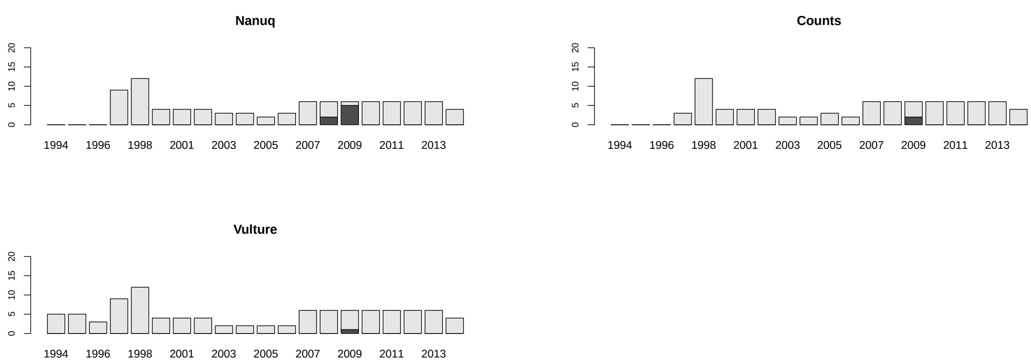
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

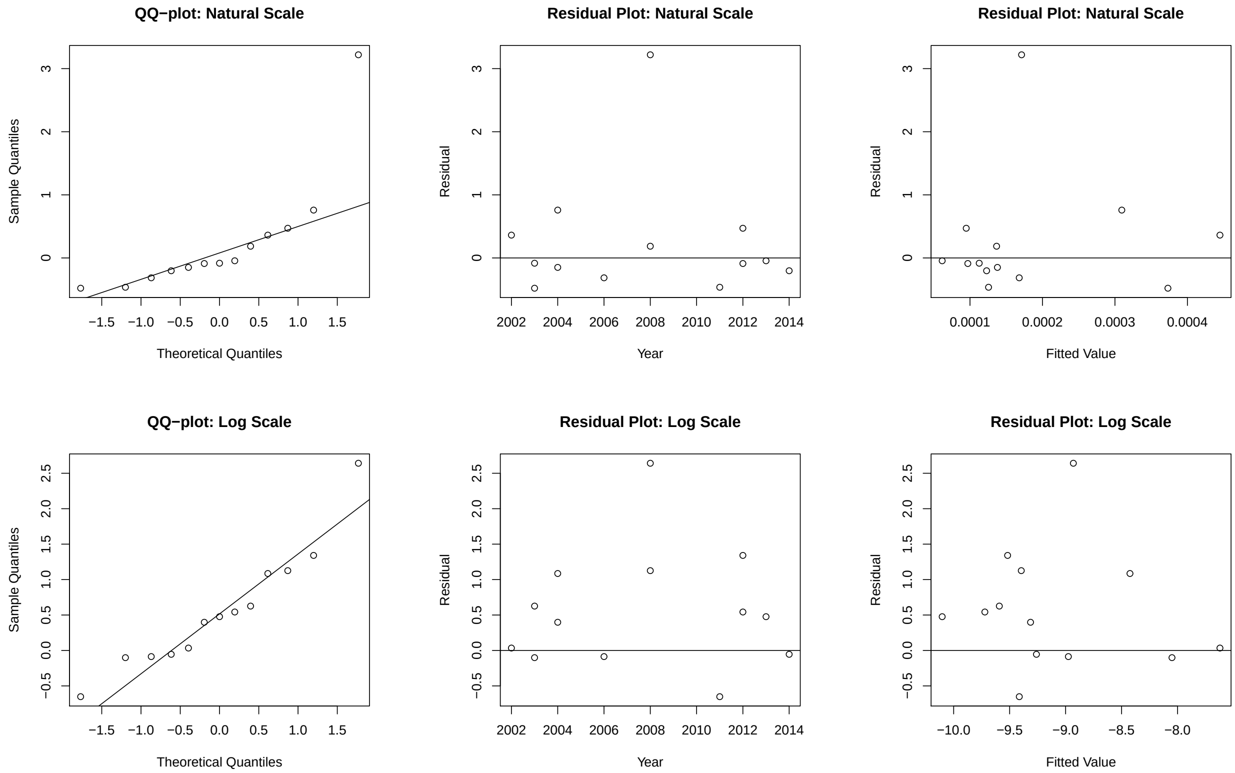


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, LdS1 and LdS2 was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in 1616-43 (KPSF) and Cujo Lake was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
57	Cujo	2008	0.00	0.00	3.22

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	6.8585	2	0.0324
Cujo	1.9905	2	0.3696

- Conclusions:
  1616-43 (KPSF) shows significant deviation from a slope of zero.

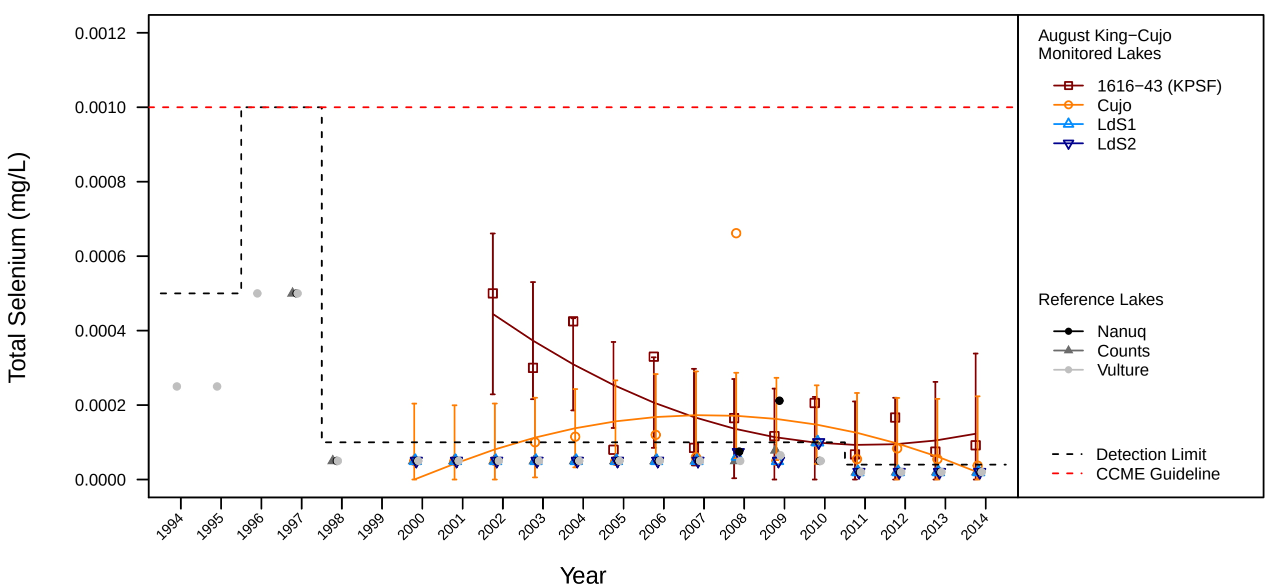
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-43 (KPSF)	0.6380
Monitored Lake	Cujo	0.1390

- Conclusions:
  Model fit for Cujo Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total selenium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	9.20e-05	1.23e-04	1.10e-04	0e+00	3.38e-04	3.22e-04
Cujo	3.72e-05	1.96e-05	1.04e-04	0e+00	2.24e-04	3.04e-04
LdS2	2.00e-05	NA	NA	NA	NA	NA
LdS1	2.00e-05	NA	NA	NA	NA	NA
Nanuq	2.00e-05	NA	NA	NA	NA	NA
Counts	2.00e-05	NA	NA	NA	NA	NA
Vulture	2.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Selenium	August	King-Cujo	Lake	Water	Counts Nanuq Vulture LdS1 LdS2	none	Tobit regression	#1a slope of zero	0.001	1616-43 (KPSF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

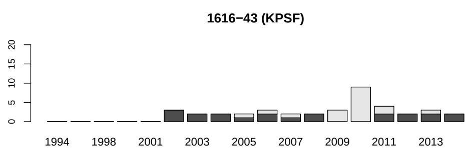
Analysis of August Total Selenium in King-Cujo Watershed Streams

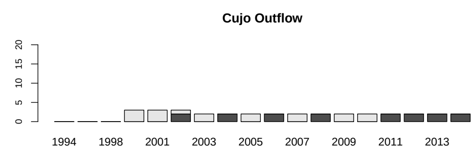
November 20, 2014

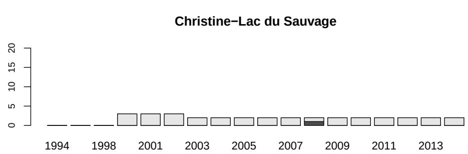
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

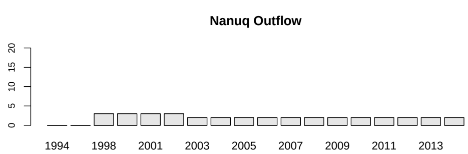
1.1 Monitored

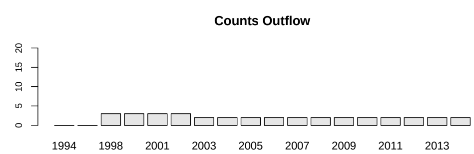


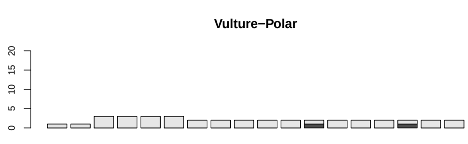




1.2 Reference

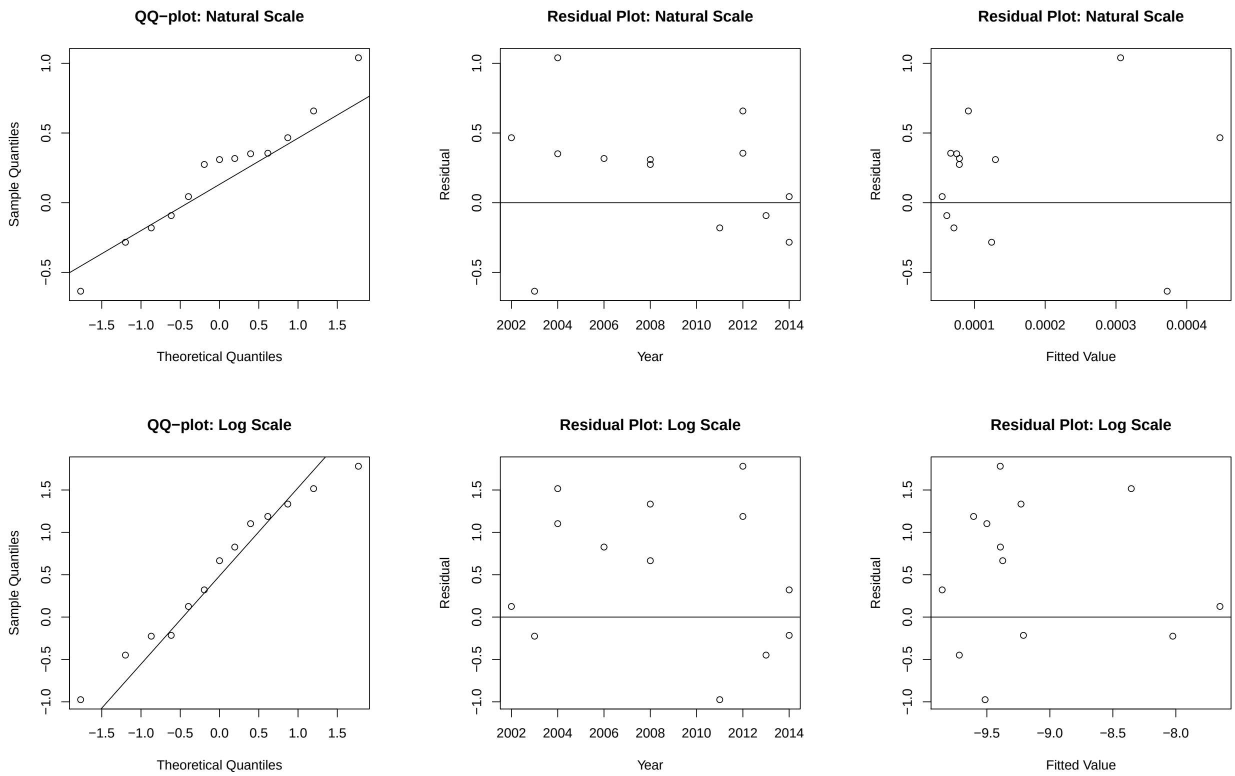






Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar, and Christine-Lac du Sauvage was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in 1616-43 (KPSF) and Cujo Outflow was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

All reference streams removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored stream against a slope of 0.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	21.6459	2	0.0000
Cujo Outflow	1.7743	2	0.4118

- Conclusions:
  1616-43 (KPSF) show significant deviation from a slope of zero.

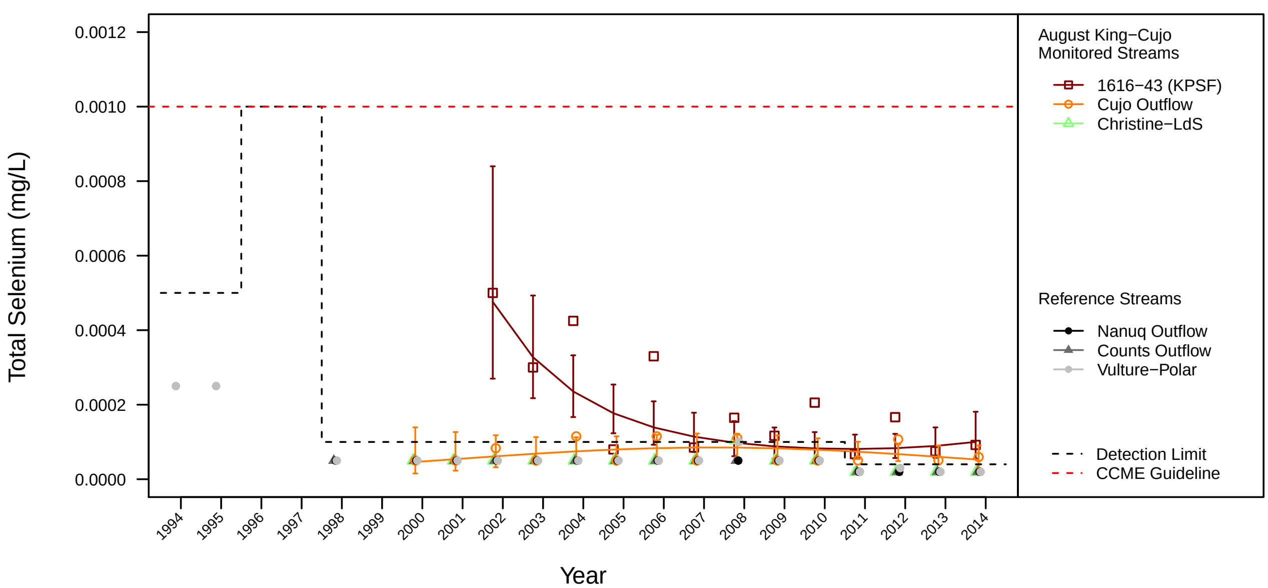
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Monitored Stream	1616-43 (KPSF)	0.5570
Monitored Stream	Cujo Outflow	0.2350

- Conclusions:
  Model fit for Cujo Outflow is weak.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total selenium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	9.20e-05	1.00e-04	3.03e-05	5.53e-05	1.81e-04	8.86e-05
Cujo Outflow	5.95e-05	5.25e-05	1.46e-05	3.04e-05	9.06e-05	4.28e-05
Christine-Lac du Sauvage	2.00e-05	NA	NA	NA	NA	NA
Nanuq Outflow	2.00e-05	NA	NA	NA	NA	NA
Counts Outflow	2.00e-05	NA	NA	NA	NA	NA
Vulture-Polar	2.00e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Selenium	August	King-Cujo	Stream	Water	Counts Outflow Nanuq Outflow Vulture-Polar Christine-Lac du Sauvage	log e	Tobit regression	#1a slope of zero	0.001	1616-43 (KPSF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

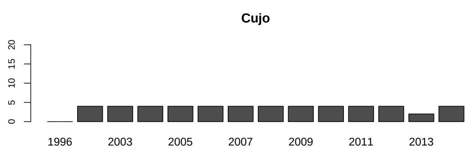
Analysis of April Total Strontium in Lakes of the King-Cujo Watershed and Lac du Sauvage

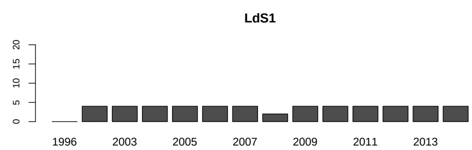
November 19, 2014

1 Censored Values:

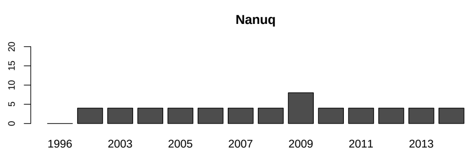
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

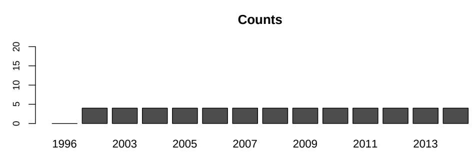
1.1 Monitored

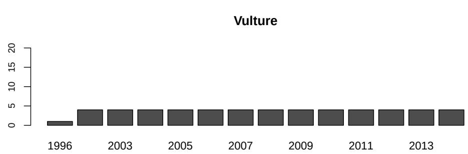




1.2 Reference

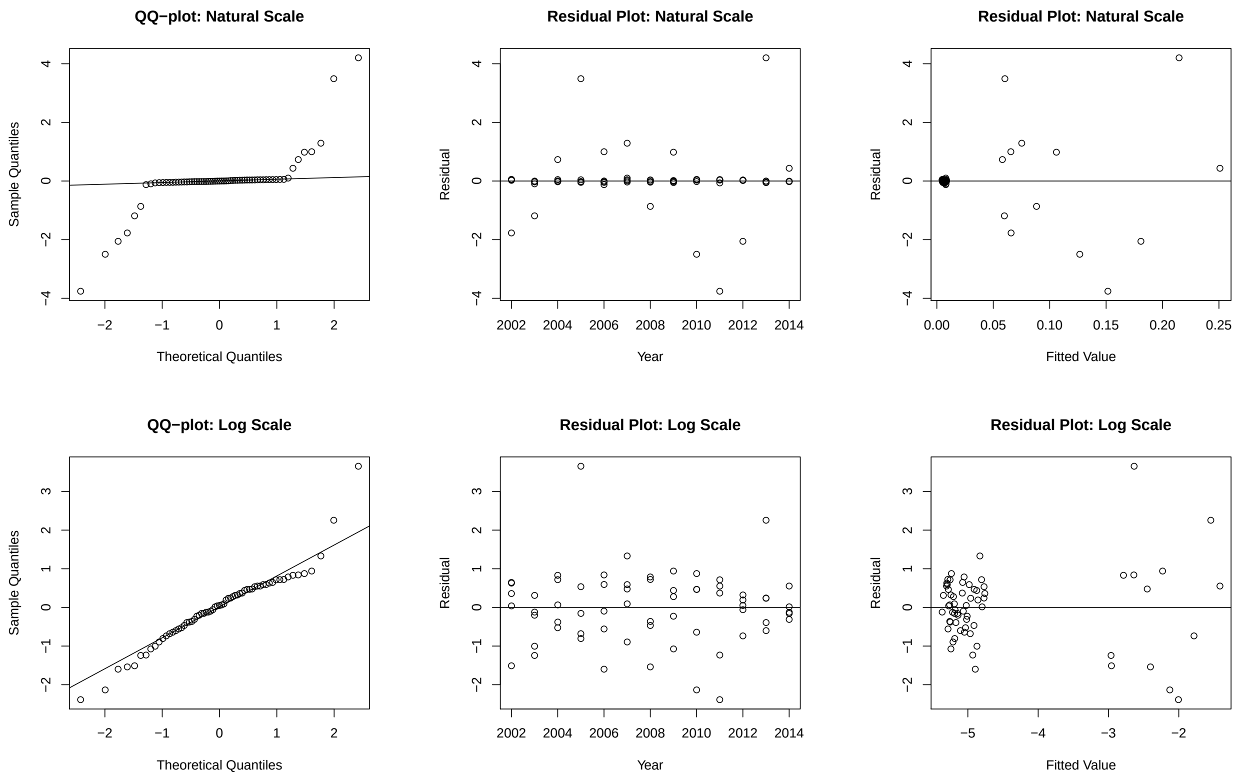






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	0.10	0.06	3.49
60	Cujo	2011	0.11	0.15	-3.76
62	Cujo	2013	0.26	0.21	4.20

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	0.10	-2.63	3.65

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	3.32E-62	natural model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
7654.19	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.78	4.00	0.94

- Conclusions:
  The slopes do not differ significantly among reference lakes.

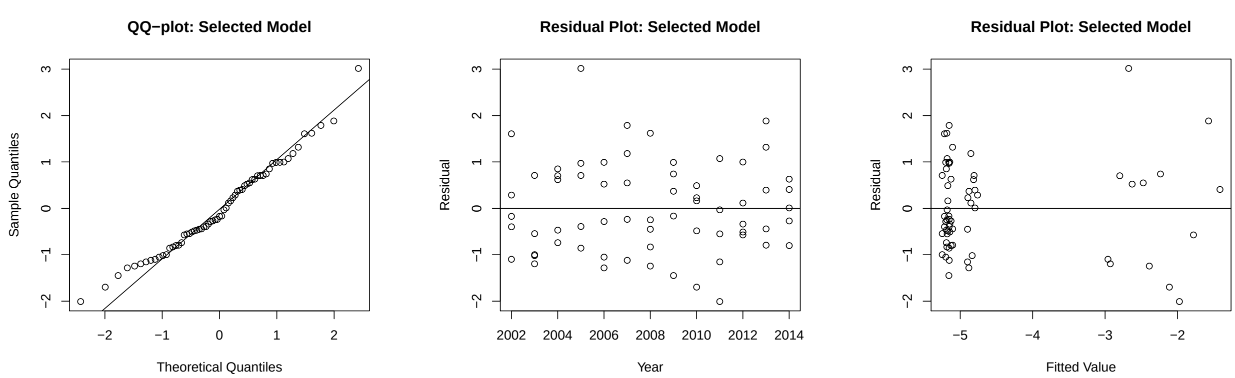
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	0.10	-2.67	3.02

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and allowing for differences in intercept (reference model 2). Proceeding with remaining analyses using reference model 2.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	69.22	2.00	0.00
LdS1	0.97	2.00	0.62

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

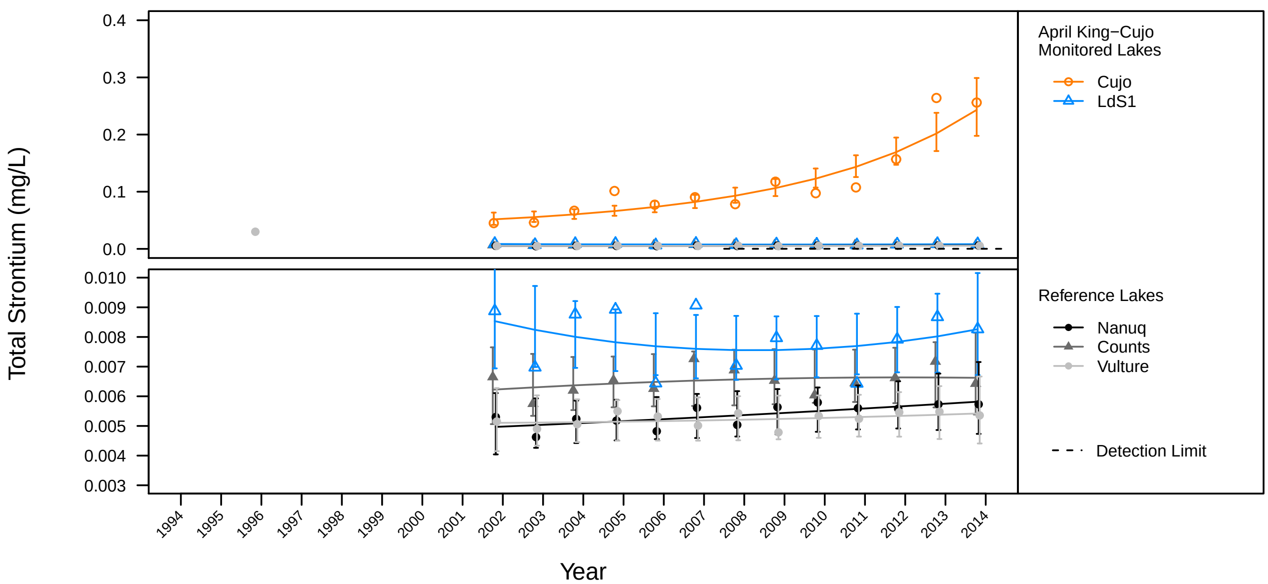
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0650
Monitored Lake	Cujo	0.8570
Monitored Lake	LdS1	0.1010

- Conclusions:
  Model fit for pooled reference lakes and LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total strontium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	2.56e-01	2.43e-01	2.56e-02	1.98e-01	2.99e-01	7.50e-02
LdS1	8.26e-03	8.26e-03	8.71e-04	6.72e-03	1.02e-02	2.55e-03
Nanuq	5.73e-03	5.82e-03	6.13e-04	4.73e-03	7.15e-03	NA
Counts	6.43e-03	6.62e-03	6.98e-04	5.39e-03	8.14e-03	NA
Vulture	5.36e-03	5.42e-03	5.71e-04	4.41e-03	6.67e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Strontium	April	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#2 shared slopes	6.242	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

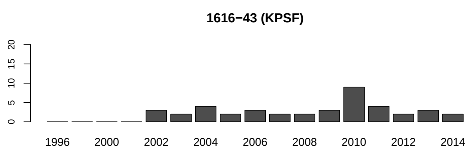
Analysis of August Total Strontium in Lakes of the King-Cujo Watershed and Lac du Sauvage

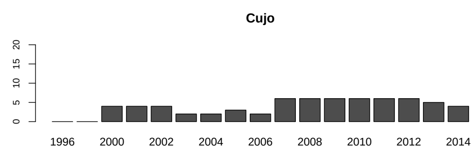
November 19, 2014

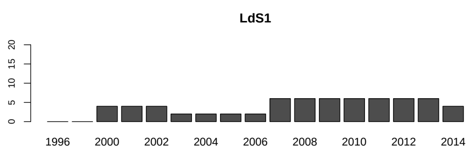
1 Censored Values:

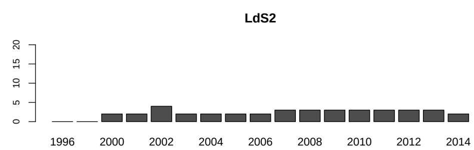
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

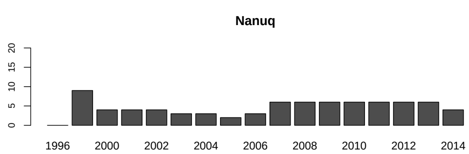


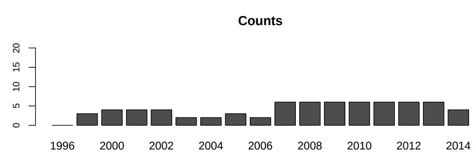


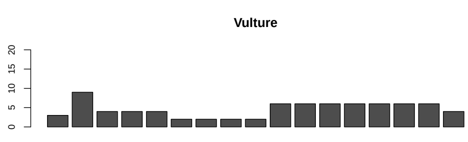




1.2 Reference

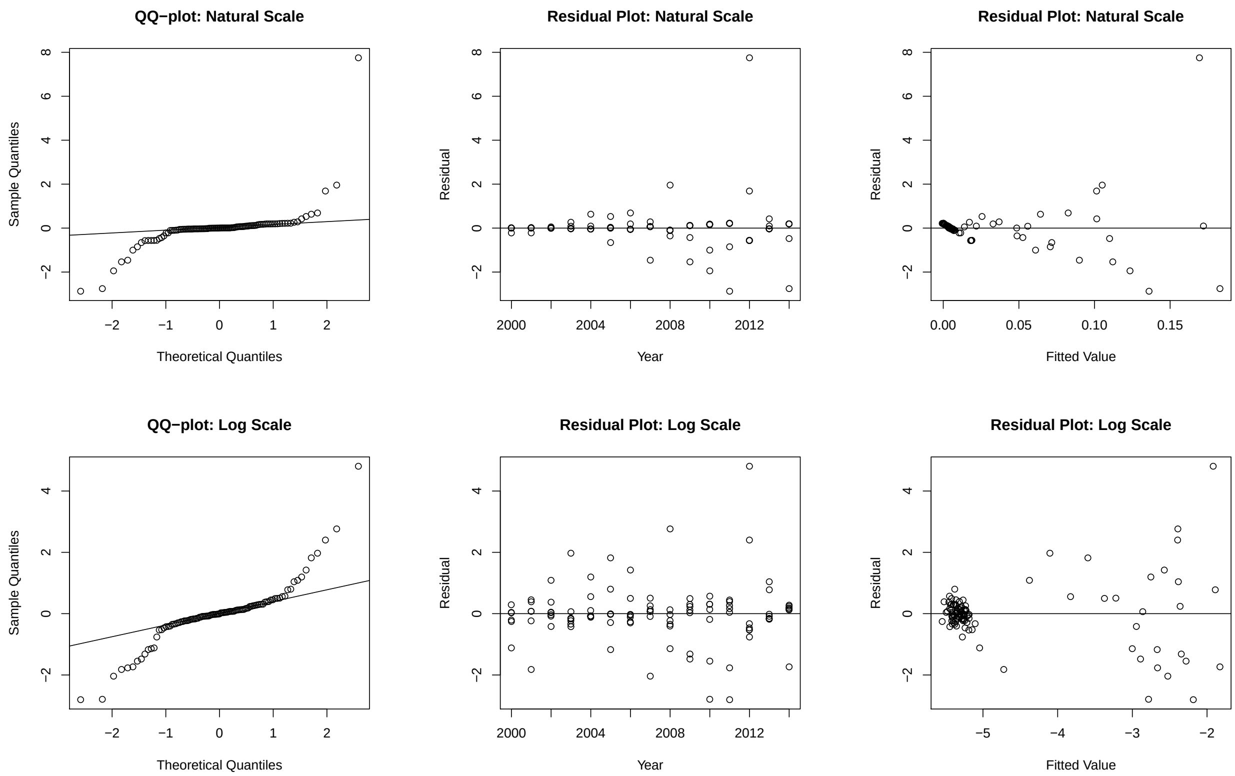






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.35	0.17	7.75

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.35	-1.92	4.81

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
1.75	6.00	0.94

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

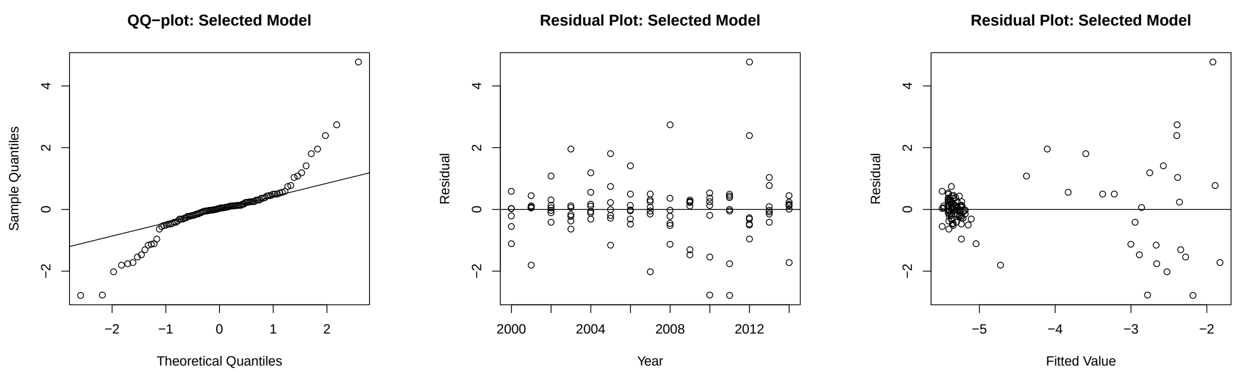
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.006	0.000	0.994	Ref. Model 3

- Conclusions:
AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope and intercept. Proceeding with monitored contrasts using reference model 3.

3.3 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.35	-1.92	4.77

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	178.6059	3	0.0000
Cujo	1515.1987	3	0.0000
LdS1	3.6131	3	0.3064
LdS2	6.1811	3	0.1031

- Conclusions:
1616-43 (KPSF) and Cujo Lake show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	9.1064	2	0.0105
Cujo	207.9213	2	0.0000
LdS1	0.0517	2	0.9745
LdS2	0.1555	2	0.9252

- Conclusions:
  When allowing for differences in intercept, 1616-43 (KPSF) and Cujo Lake show significant deviation from the common slope of reference lakes.

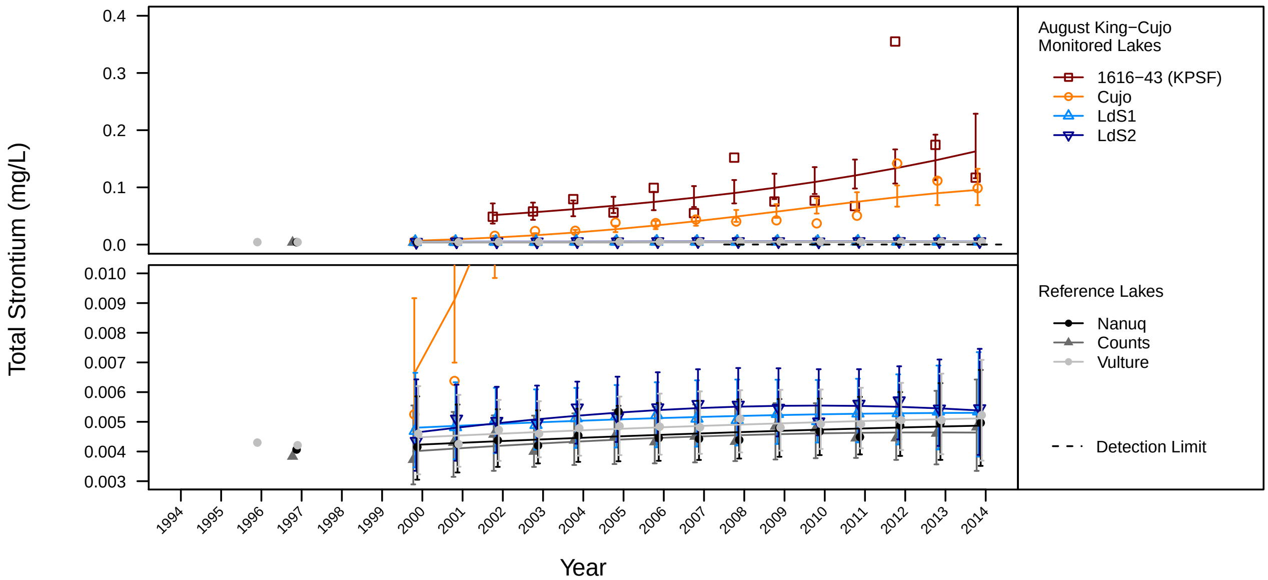
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3770
Monitored Lake	1616-43 (KPSF)	0.4270
Monitored Lake	Cujo	0.8760
Monitored Lake	LdS1	0.7220
Monitored Lake	LdS2	0.6380

- Conclusions:
  Model fit for pooled reference lakes and 1616-43 (KPSF) is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total strontium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.17e-01	1.63e-01	2.82e-02	1.16e-01	2.29e-01	8.25e-02
Cujo	9.86e-02	9.56e-02	1.59e-02	6.90e-02	1.32e-01	4.65e-02
LdS2	5.45e-03	5.38e-03	8.95e-04	3.89e-03	7.46e-03	2.62e-03
LdS1	5.36e-03	5.30e-03	8.82e-04	3.83e-03	7.35e-03	2.58e-03
Nanuq	4.96e-03	4.87e-03	8.10e-04	3.52e-03	6.75e-03	NA
Counts	4.82e-03	4.64e-03	7.71e-04	3.35e-03	6.42e-03	NA
Vulture	5.23e-03	5.12e-03	8.51e-04	3.69e-03	7.09e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Strontium	August	King-Cujo	Lake	Water	none	log e	linear mixed effects regression	#3 shared intercept & slope	6.242	1616-43 (KPSF) Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

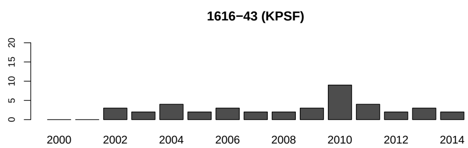
Analysis of August Total Strontium in King-Cujo Watershed Streams

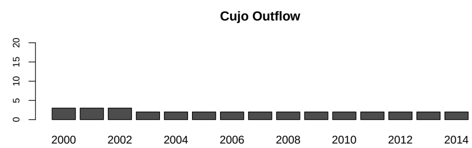
November 19, 2014

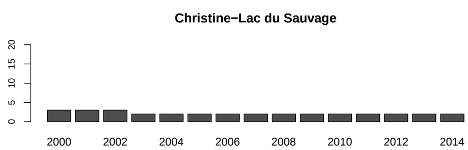
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

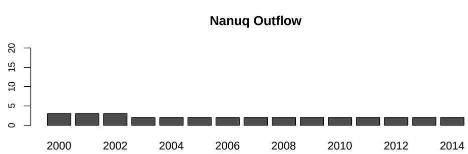
1.1 Monitored

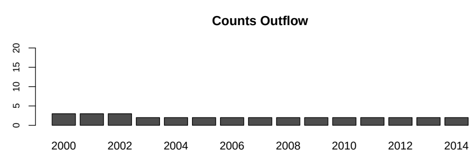


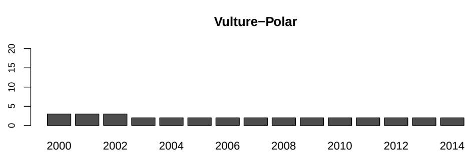




1.2 Reference

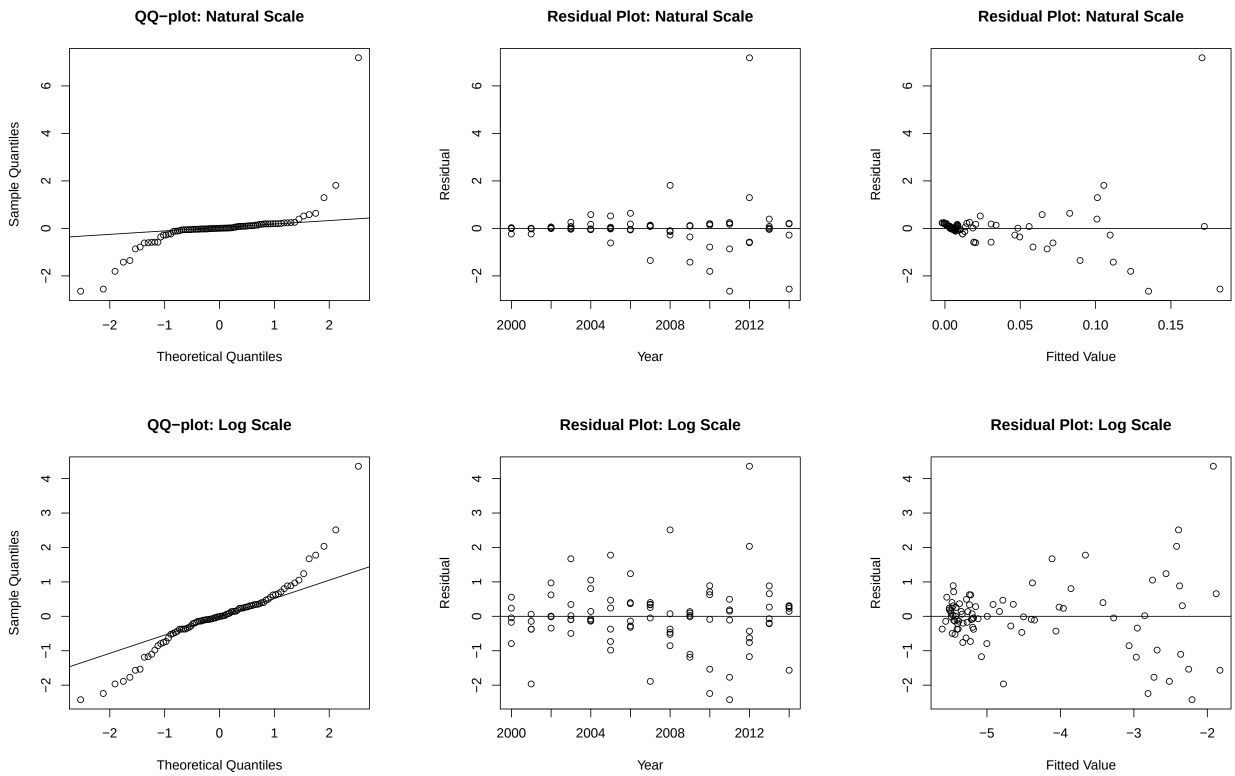






Comment:
None of the streams exhibited greater than 10% of data less than the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.35	0.17	7.18

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.35	-1.92	4.36

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
17.26	6.00	0.01

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
8.51	4.00	0.07

- Conclusions:
  The slopes do not differ significantly among reference streams.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.531	0.000	0.469	Indistinguishable support for 1 & 3; choose Model 3.

- Conclusions:
  Results of AIC do not agree with reference model testing. AIC suggests that reference streams are best modeled using separate slopes and intercepts. Contrasts suggest that reference streams share a common slope; however, these results are marginally significant, suggesting that there may be important differences in reference stream slopes. Proceeding with monitored contrasts using reference model 1b (fitting separate slopes and intercepts for reference streams).

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	37.2530	2	0.0000
Cujo Outflow	80.9910	2	0.0000
Christine-Lac du Sauvage	19.7580	2	0.0001

- Conclusions:
  All monitored streams show significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)-vs-Nanuq Outflow	69.6861	3	0.0000
1616-43 (KPSF)-vs-Counts Outflow	64.5338	3	0.0000
1616-43 (KPSF)-vs-Vulture-Polar	52.4805	3	0.0000
Cujo Outflow-vs-Nanuq Outflow	867.4274	3	0.0000
Cujo Outflow-vs-Counts Outflow	870.5934	3	0.0000
Cujo Outflow-vs-Vulture-Polar	710.4360	3	0.0000
Christine-Lac du Sauvage-vs-Nanuq Outflow	150.6977	3	0.0000
Christine-Lac du Sauvage-vs-Counts Outflow	150.8047	3	0.0000
Christine-Lac du Sauvage-vs-Vulture-Polar	90.1031	3	0.0000

- Conclusions:
  All monitored streams show significant deviation from the slopes of individual reference streams.

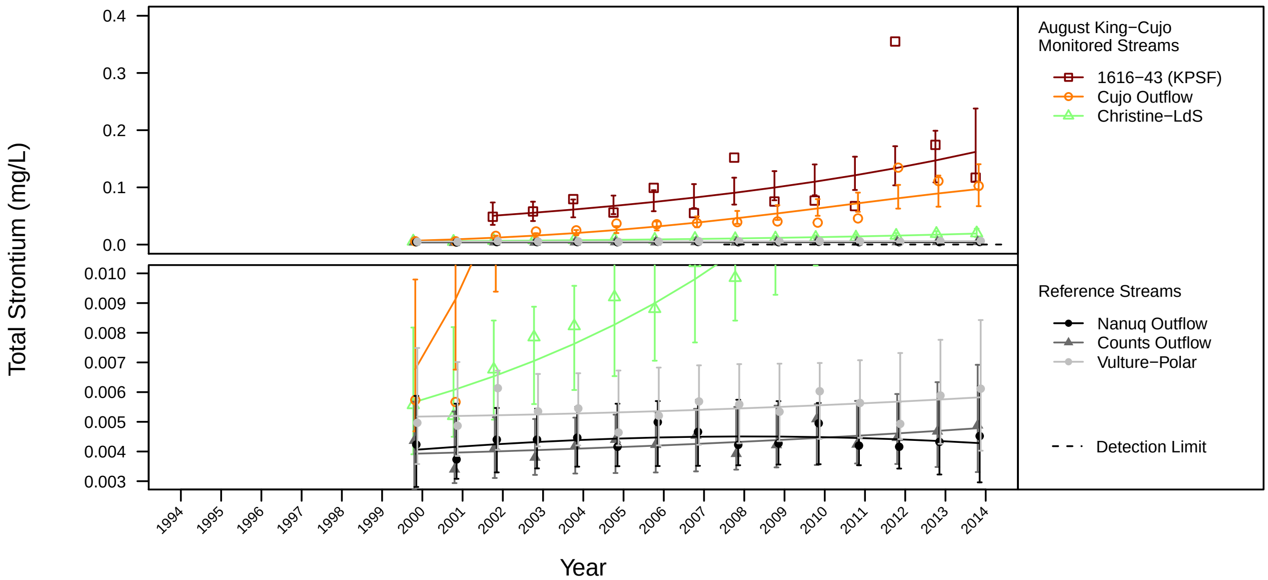
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.4060
Reference Stream	Nanuq Outflow	0.1900
Reference Stream	Vulture-Polar	0.1910
Monitored Stream	1616-43 (KPSF)	0.4330
Monitored Stream	Christine-Lac du Sauvage	0.9570
Monitored Stream	Cujo Outflow	0.8720

- Conclusions:
  Model fit for Counts Outflow and 1616-43 (KPSF) is weak. Model fit for Nanuq Outflow and Vulture-Polar is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total strontium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.17e-01	1.62e-01	3.17e-02	1.10e-01	2.38e-01	9.29e-02
Cujo Outflow	1.02e-01	9.71e-02	1.83e-02	6.71e-02	1.40e-01	5.35e-02
Christine-Lac du Sauvage	2.00e-02	1.92e-02	3.62e-03	1.33e-02	2.78e-02	1.06e-02
Nanuq Outflow	4.52e-03	4.28e-03	8.07e-04	2.96e-03	6.20e-03	NA
Counts Outflow	4.89e-03	4.78e-03	9.01e-04	3.31e-03	6.92e-03	NA
Vulture-Polar	6.11e-03	5.83e-03	1.10e-03	4.03e-03	8.43e-03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Strontium	August	King-Cujo	Stream	Water	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	6.242	1616-43 (KPSF) Cujo Outflow Christine-Lac du Sauvage

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

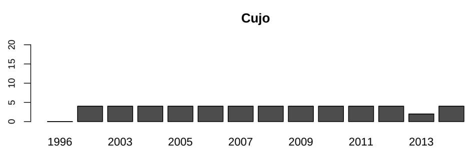
Analysis of April Total Uranium in Lakes of the King-Cujo Watershed and Lac du Sauvage

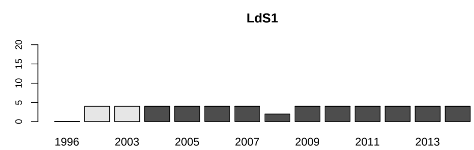
November 20, 2014

1 Censored Values:

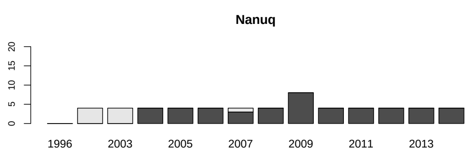
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

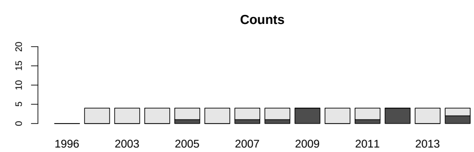
1.1 Monitored

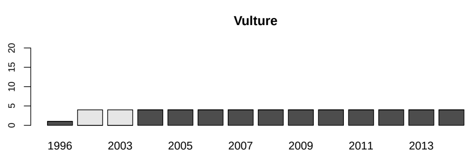




1.2 Reference

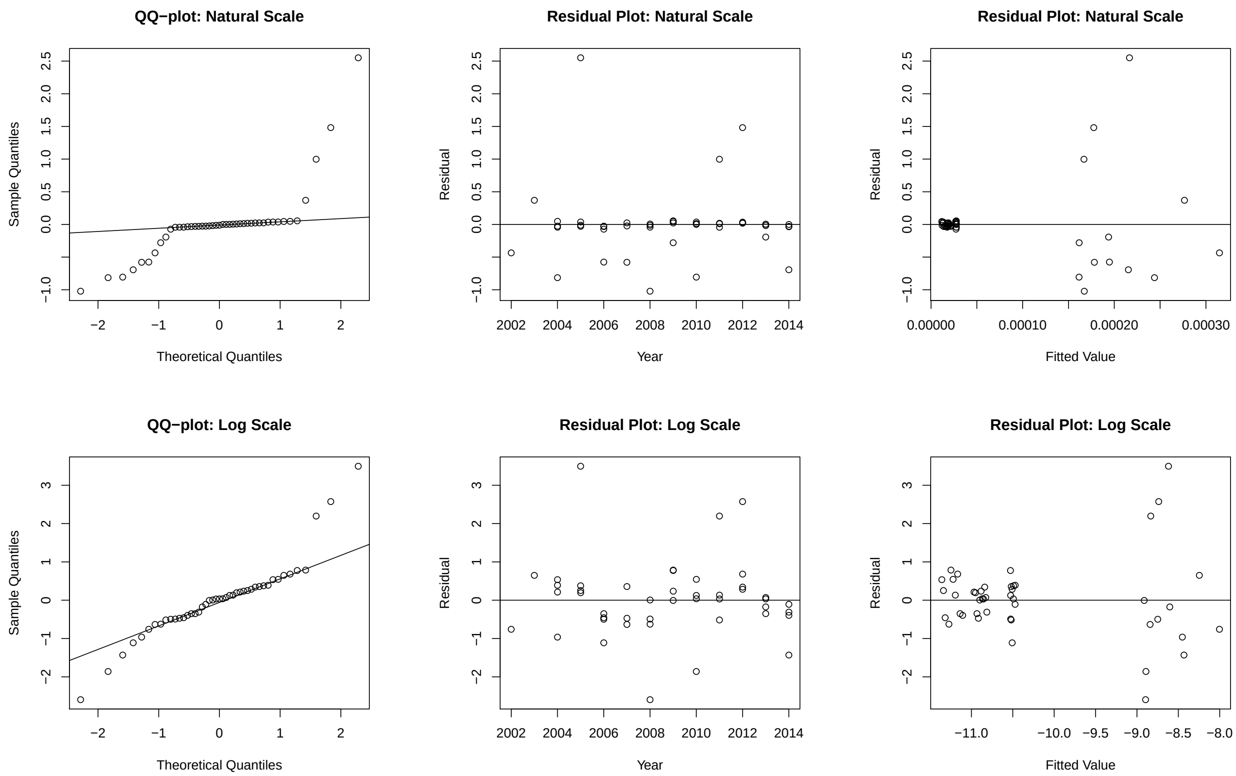






Comment:
Greater than 60% of data in Counts Lake was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in Nanuq, Vulture, and LdS1 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	0.00	-8.62	3.50

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	8.17E-157	natural model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
9.43	3.00	0.02

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
0.07	2.00	0.96

- Conclusions:
  The slopes do not differ significantly among reference lakes.

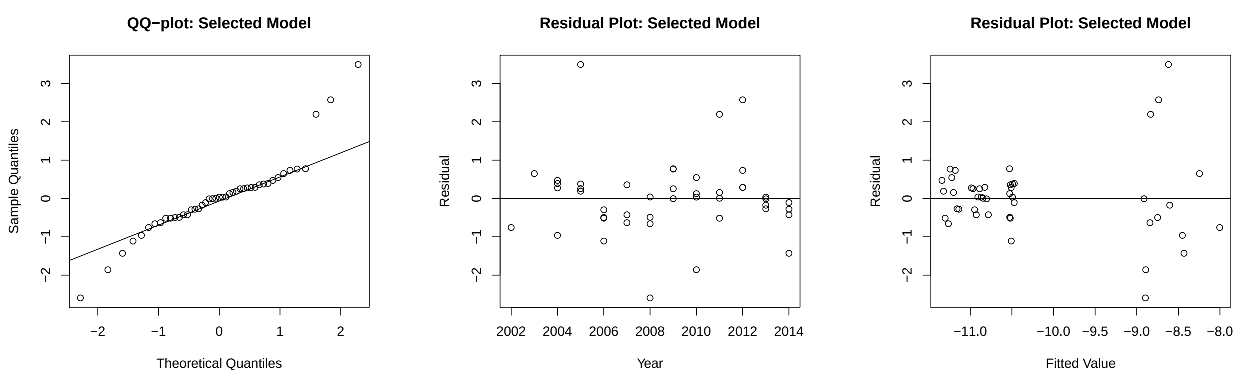
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.258	0.675	0.068	Indistinguishable support for 2 & 1; choose Model 2.

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference lakes are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	0.00	-8.62	3.50

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	5.9883	2	0.0501
LdS1	0.5082	2	0.7756

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

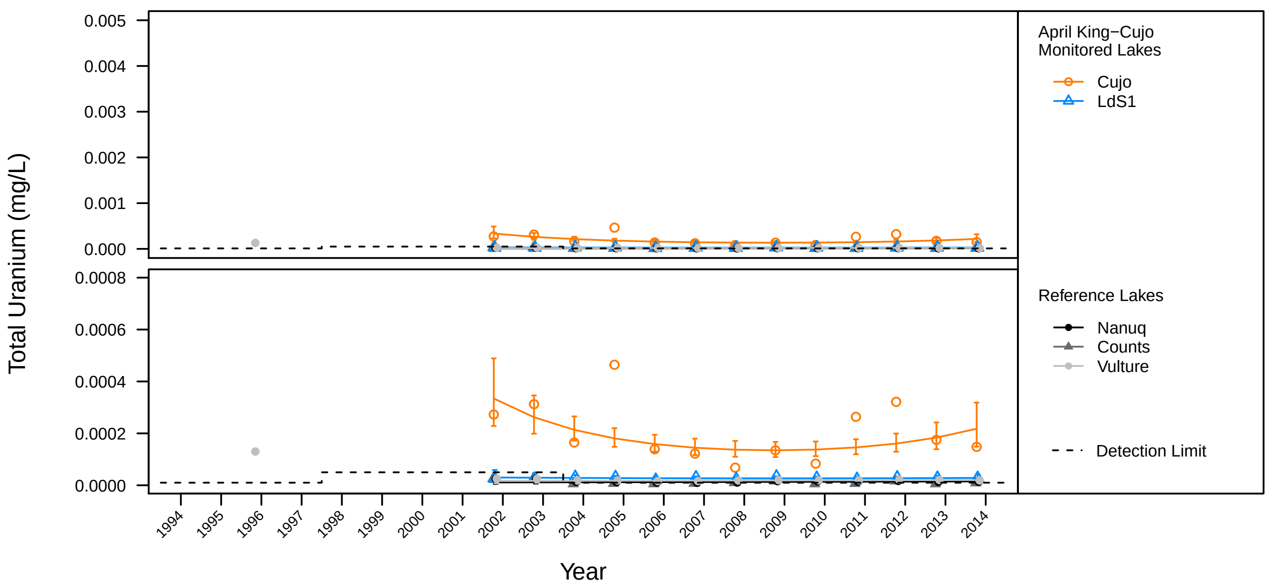
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3920
Monitored Lake	Cujo	0.2510
Monitored Lake	LdS1	0.0740

- Conclusions:
  Model fit for pooled reference lakes and Cujo Lake is weak. Model fit for LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total uranium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.48e-04	2.18e-04	4.22e-05	1.49e-04	3.18e-04	1.24e-04
LdS1	2.75e-05	2.83e-05	5.70e-06	1.91e-05	4.20e-05	1.67e-05
Nanuq	1.35e-05	1.50e-05	3.10e-06	1.00e-05	2.25e-05	NA
Counts	8.50e-06	NA	NA	NA	NA	NA
Vulture	1.85e-05	2.01e-05	4.14e-06	1.34e-05	3.01e-05	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Uranium	April	King-Cujo	Lake	Water	none Counts	log e	Tobit regression	#2 shared slopes	0.015	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

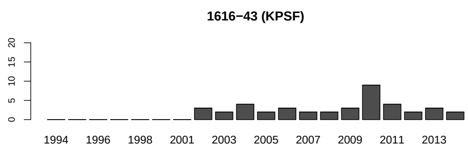
Analysis of August Total Uranium in Lakes of the King-Cujo Watershed and Lac du Sauvage

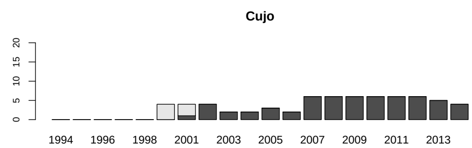
November 20, 2014

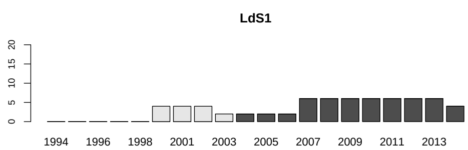
1 Censored Values:

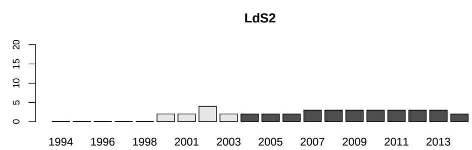
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

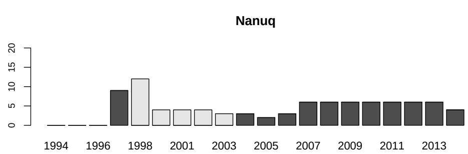


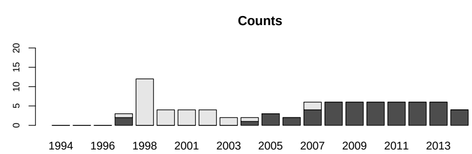


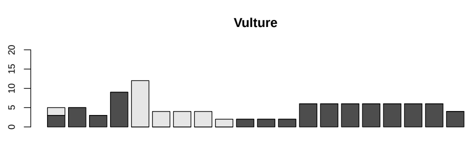




1.2 Reference

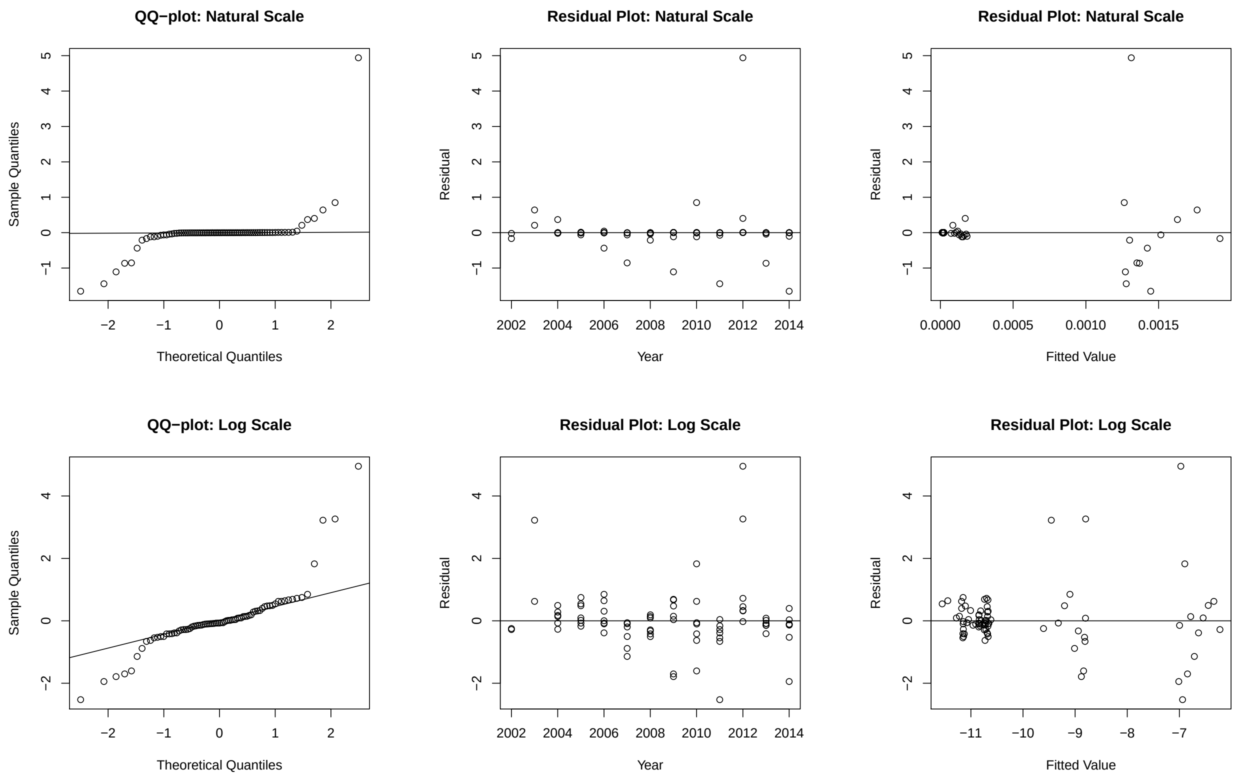






Comment:
10-60% of data in Counts, Nanuq, Vulture, Cujo, LdS1, and LdS2 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.00	0.00	4.94

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.00	-6.97	4.95
52	Cujo	2003	0.00	-9.46	3.22
61	Cujo	2012	0.00	-8.80	3.26

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-squared	DF	P-value
5.19	6.00	0.52

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-squared	DF	P-value
1.61	4.00	0.81

- Conclusions:
  The slopes do not differ significantly among reference lakes.

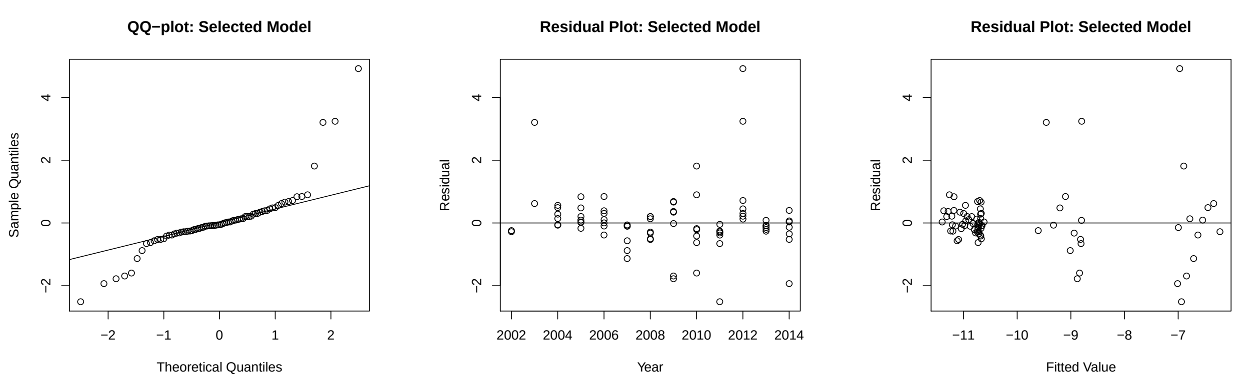
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.039	0.944	0.017	Ref. Model 2

- Conclusions:
  Results of AIC do not agree with reference model testing. Although results of contrasts suggest that reference lakes share a common slope and intercept, AIC reveals that reference lakes are best modeled with separate intercepts. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.00	-6.97	4.92
52	Cujo	2003	0.00	-9.46	3.21
61	Cujo	2012	0.00	-8.80	3.24

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	9.1357	2	0.0104
Cujo	2.2782	2	0.3201
LdS1	0.6252	2	0.7316
LdS2	0.8363	2	0.6583

- Conclusions:
  1616-43 (KPSF) shows significant deviation from the common slope of reference lakes.

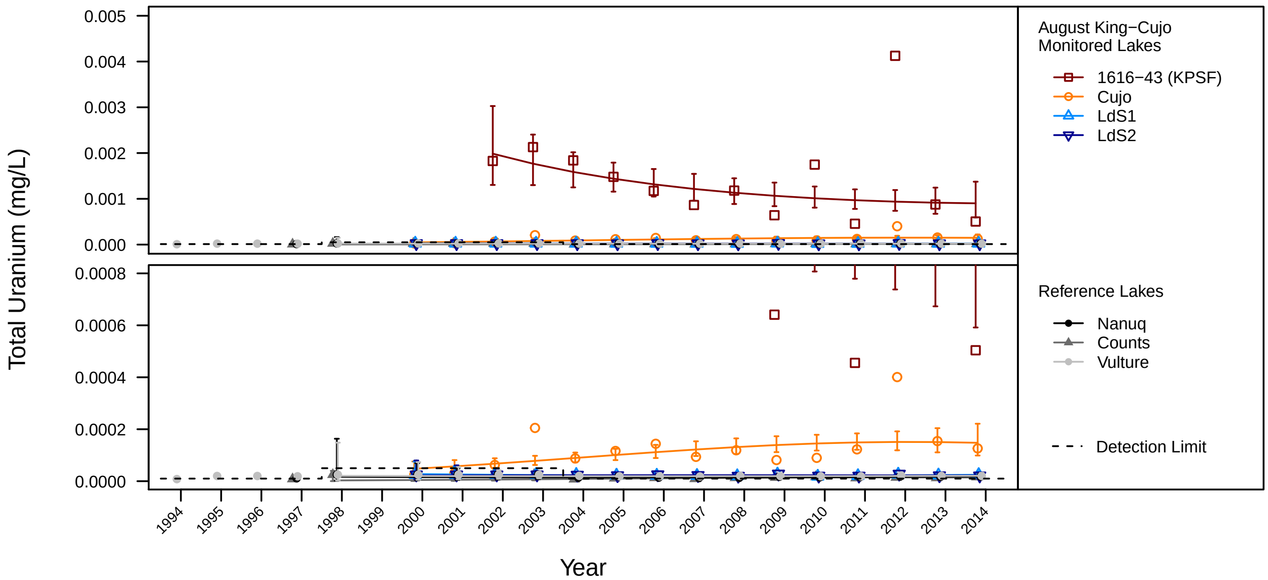
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.3620
Monitored Lake	1616-43 (KPSF)	0.1770
Monitored Lake	Cujo	0.3820
Monitored Lake	LdS1	0.3450
Monitored Lake	LdS2	0.0960

- Conclusions:
  Model fit for pooled reference lakes, Cujo Lake, and LdS1 is weak. Model fit for 1616-43 (KPSF) and LdS2 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total uranium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.04e-04	9.02e-04	1.94e-04	5.92e-04	1.37e-03	5.67e-04
Cujo	1.26e-04	1.48e-04	3.04e-05	9.88e-05	2.21e-04	8.90e-05
LdS2	2.10e-05	2.19e-05	4.85e-06	1.42e-05	3.38e-05	1.42e-05
LdS1	2.47e-05	2.45e-05	5.26e-06	1.61e-05	3.73e-05	1.54e-05
Nanuq	1.78e-05	1.83e-05	4.15e-06	1.17e-05	2.86e-05	NA
Counts	1.57e-05	1.40e-05	3.23e-06	8.90e-06	2.20e-05	NA
Vulture	2.00e-05	2.07e-05	4.57e-06	1.34e-05	3.19e-05	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Uranium	August	King-Cujo	Lake	Water	none	log e	Tobit regression	#2 shared slopes	0.015	1616-43 (KPSF)

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

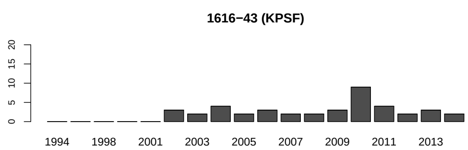
Analysis of August Total Uranium in King-Cujo Watershed Streams

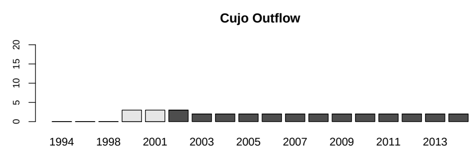
November 19, 2014

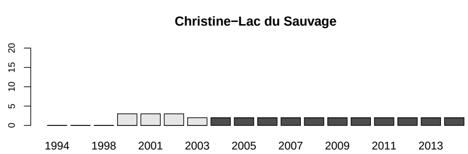
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

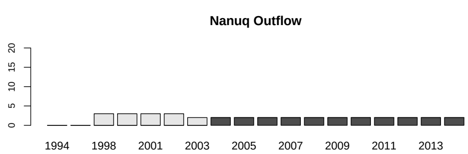
1.1 Monitored

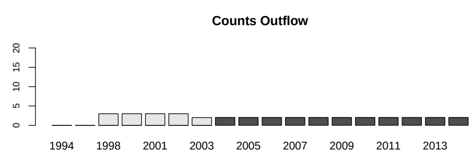


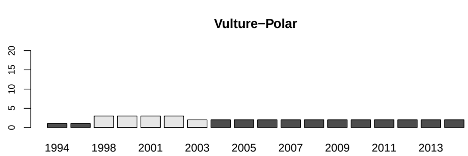




1.2 Reference

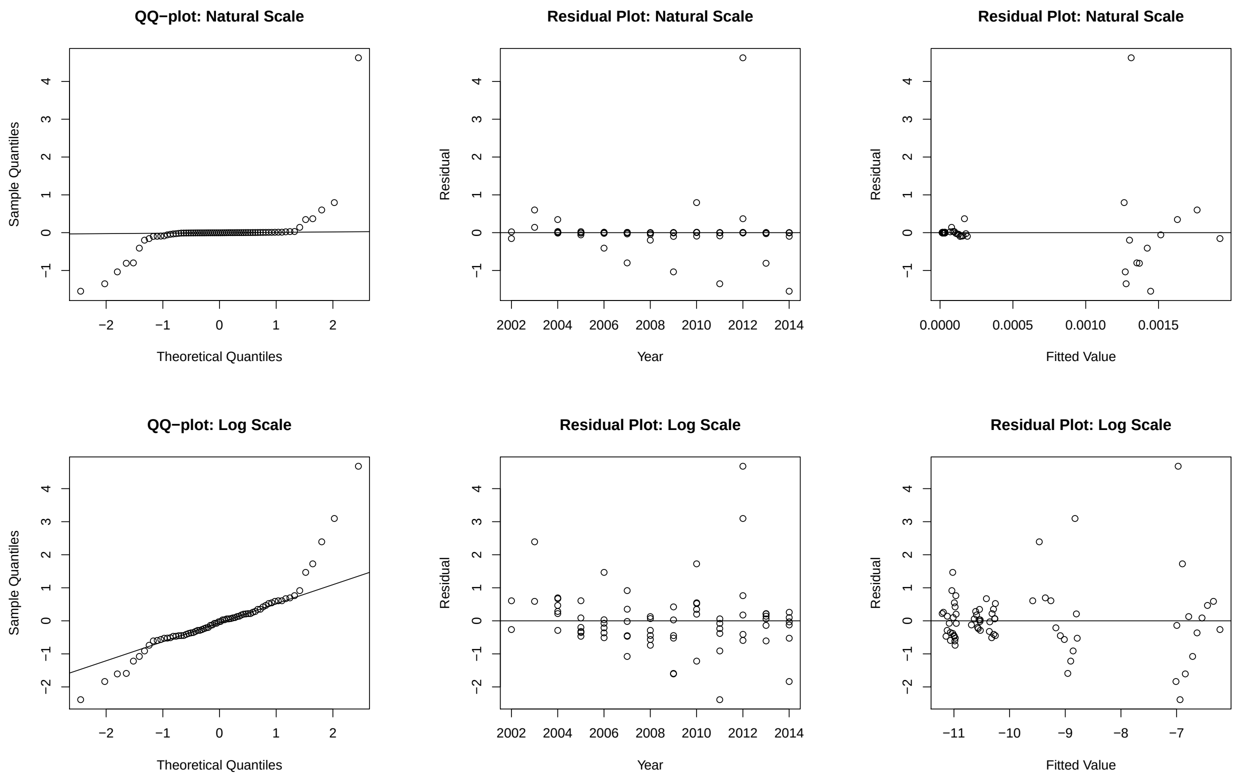






Comment:
10-60% of data in Counts Outflow, Nanuq Outflow, Vulture-Polar, Cujo Outflow, and Christine-Lac du Sauvage was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.00	0.00	4.63

Outliers on log scale:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.00	-6.97	4.68
82	Cujo Outflow	2012	0.00	-8.82	3.10

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-squared	DF	P-value
12.57	6.00	0.05

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-squared	DF	P-value
0.41	4.00	0.98

- Conclusions:
  The slopes do not differ significantly among reference streams.

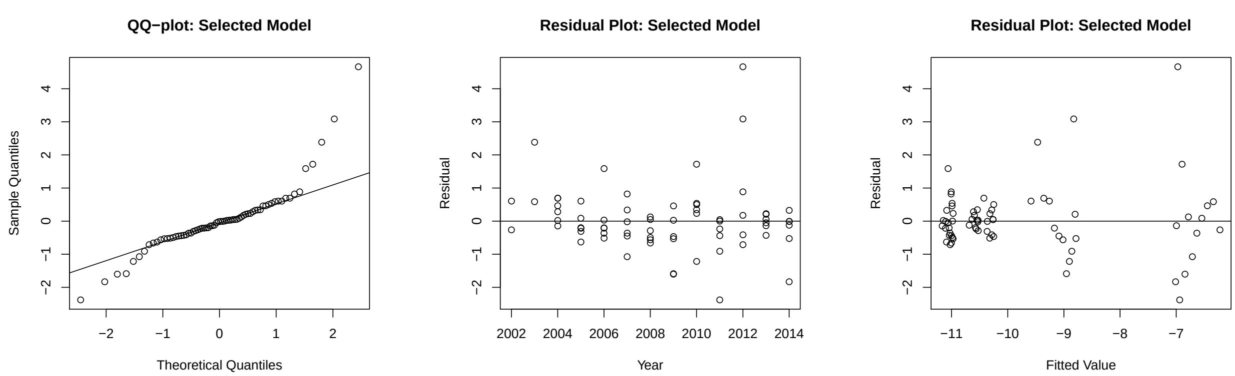
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.022	0.978	0.000	Ref. Model 2

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with a common slope. Proceeding with monitored contrasts using reference model 2.

3.4 Assess Fit of Reduced Model



Outliers:

	Stream	Year	Impute	Fitted	Std. Resid.
19	1616-43 (KPSF)	2012	0.00	-6.97	4.66
82	Cujo Outflow	2012	0.00	-8.82	3.09

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Streams

4.1 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to a common slope fitted to all reference streams (reference model 2). This contrast does not test for differences in intercepts between reference and monitored streams.

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	7.7351	2	0.0209
Cujo Outflow	2.8407	2	0.2416
Christine-Lac du Sauvage	0.1796	2	0.9141

- Conclusions:
  1616-43 (KPSF) shows significant deviation from the common slope of reference streams.

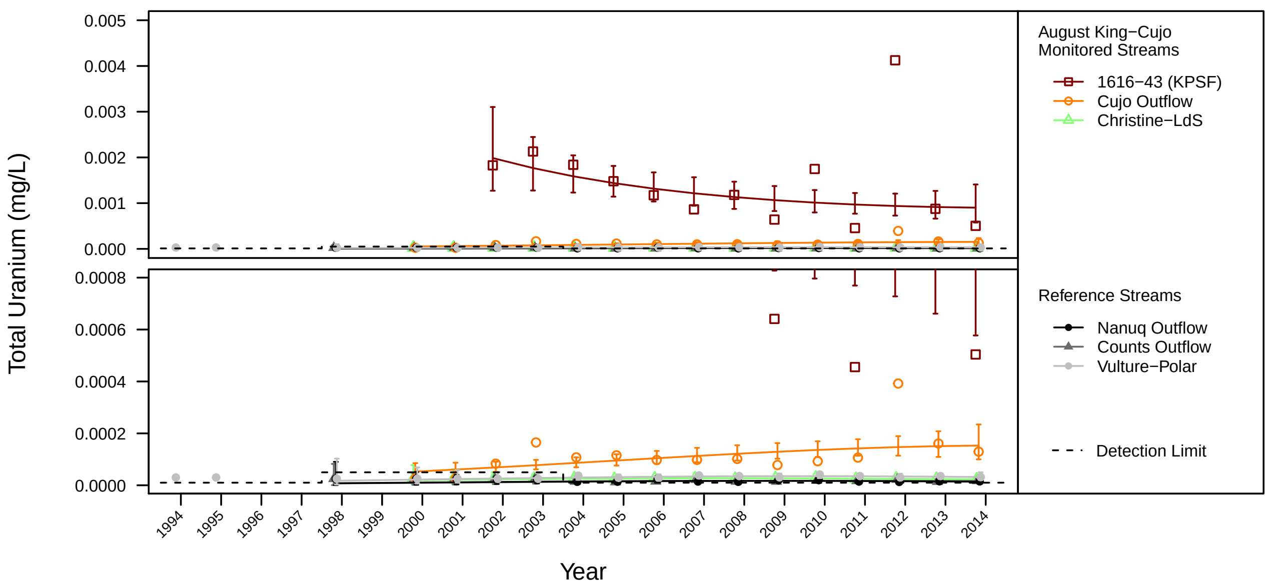
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Pooled Ref. Streams	(more than one)	0.5310
Monitored Stream	1616-43 (KPSF)	0.1770
Monitored Stream	Christine-Lac du Sauvage	0.5060
Monitored Stream	Cujo Outflow	0.3310

- Conclusions:
  Model fit for Cujo Outflow is weak. Model fit for 1616-43 (KPSF) is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total uranium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	5.04e-04	9.02e-04	2.05e-04	5.77e-04	1.41e-03	6.00e-04
Cujo Outflow	1.30e-04	1.53e-04	3.32e-05	1.00e-04	2.34e-04	9.73e-05
Christine-Lac du Sauvage	2.20e-05	2.29e-05	5.39e-06	1.44e-05	3.63e-05	1.58e-05
Nanuq Outflow	1.50e-05	1.38e-05	3.33e-06	8.61e-06	2.22e-05	NA
Counts Outflow	1.70e-05	1.65e-05	3.98e-06	1.03e-05	2.64e-05	NA
Vulture-Polar	3.15e-05	3.18e-05	7.32e-06	2.03e-05	4.99e-05	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Uranium	August	King-Cujo	Stream	Water	none	log e	Tobit regression	#2 shared slopes	0.015	1616-43 (KPSF)

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

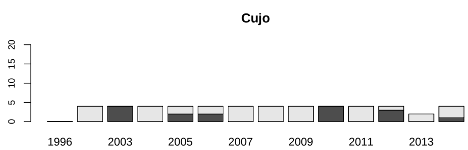
Analysis of April Total Vanadium in Lakes of the King-Cujo Watershed and Lac du Sauvage

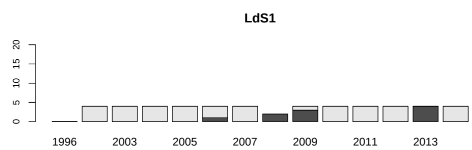
November 20, 2014

1 Censored Values:

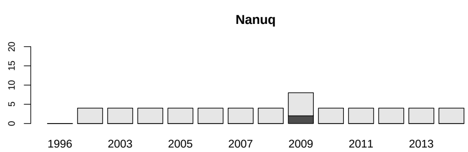
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

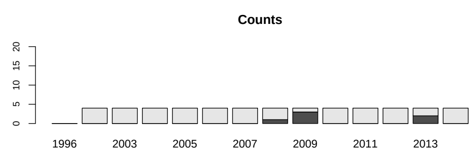
1.1 Monitored

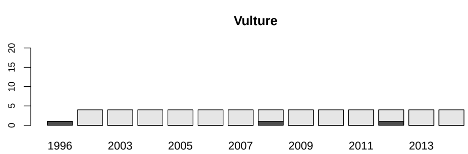




1.2 Reference

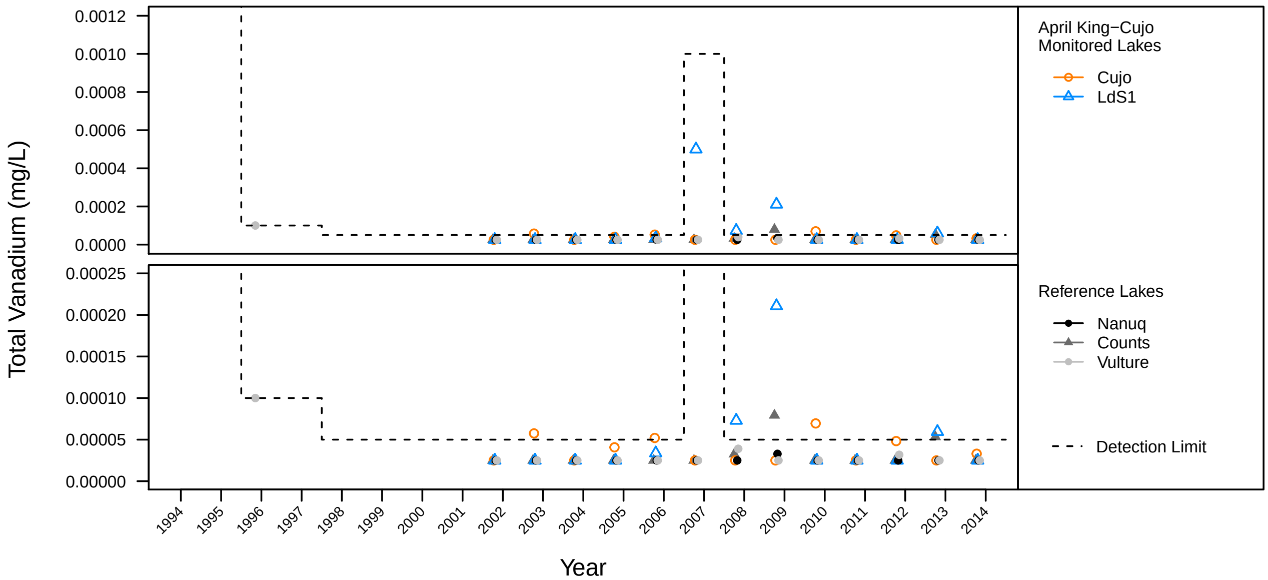






Comment:
Greater than 60% of data in all reference and monitored lakes was less than the detection limit. All lakes were excluded from further analyses. No statistical tests were performed. Note: 1616-43 (KPSF) and LdS2 were not monitored in April.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Vanadium	April	King-Cujo	Lake	Water	ALL	NA	NA	NA	0.03	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

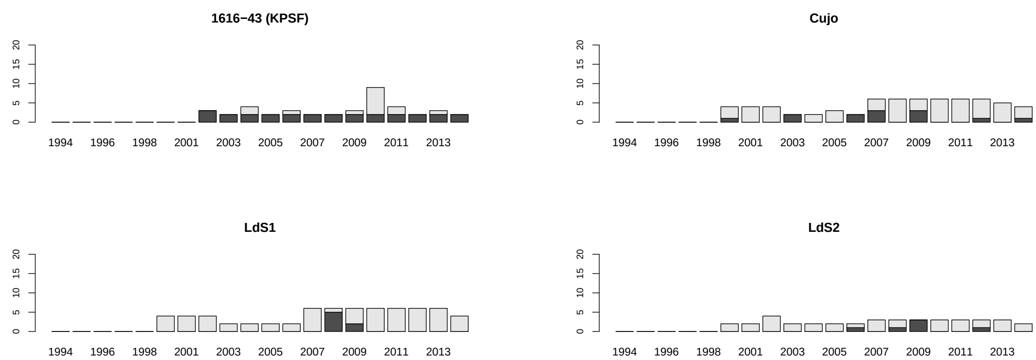
Analysis of August Total Vanadium in Lakes of the King-Cujo Watershed and Lac du Sauvage

November 19, 2014

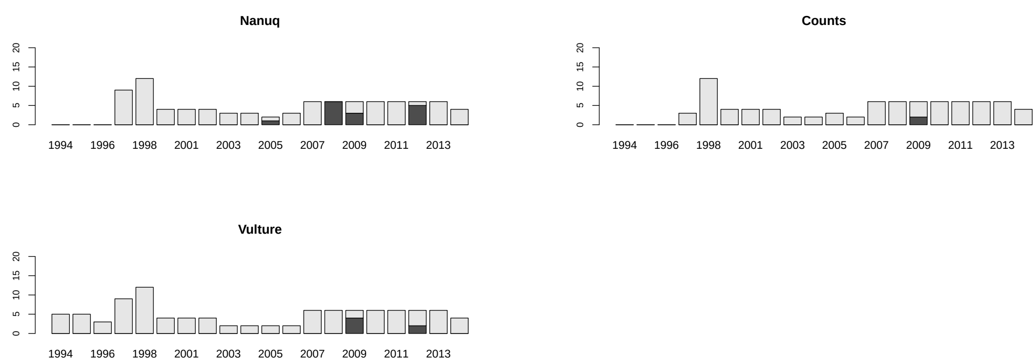
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

1.1 Monitored

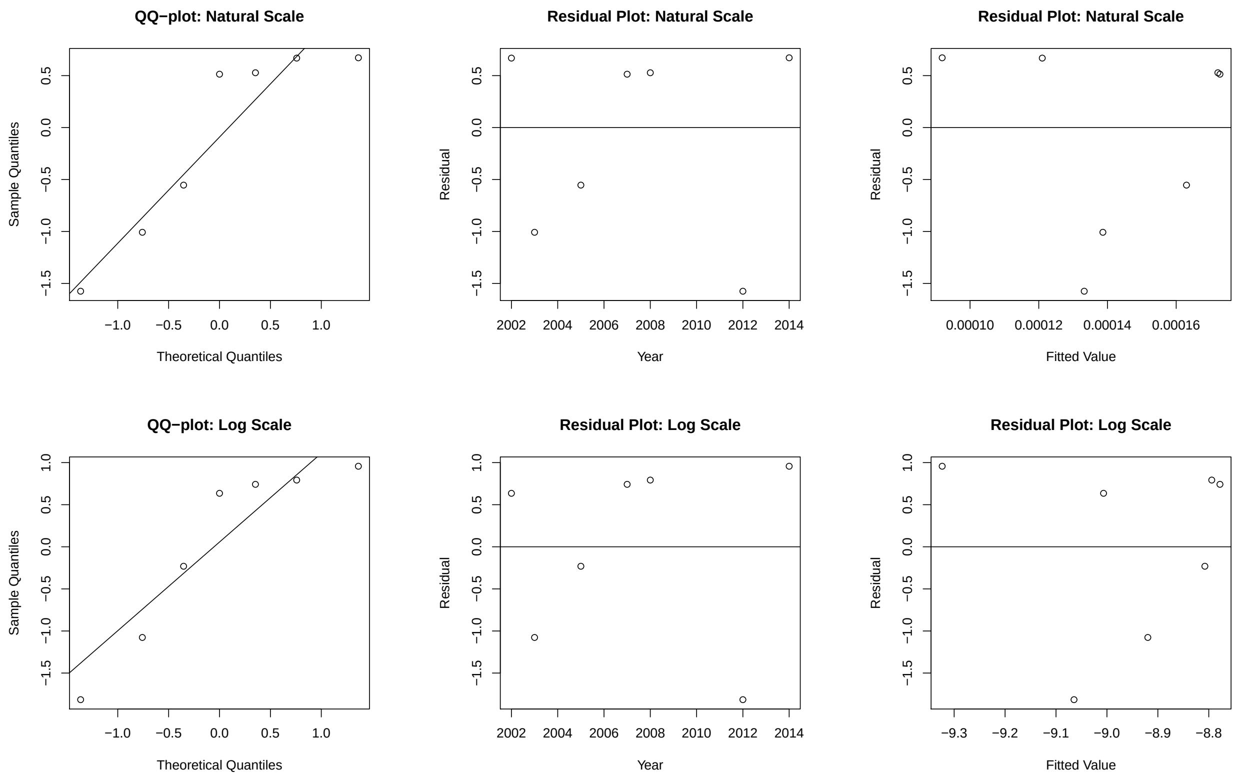


1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, Cujo, LdS1, and LdS2 lakes was less than the detection limit. These lakes were excluded from further analyses. 10-60% of data in 1616-43 (KPSF) was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

All reference lakes removed from analysis. Tests not performed. Proceeding with analysis using reference model 1a, comparing slopes of each monitored lake against a slope of 0.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	3.1508	2	0.2069

- Conclusions:
  No significant deviations was found when comparing 1616-43 (KPSF) to a constant slope of zero.

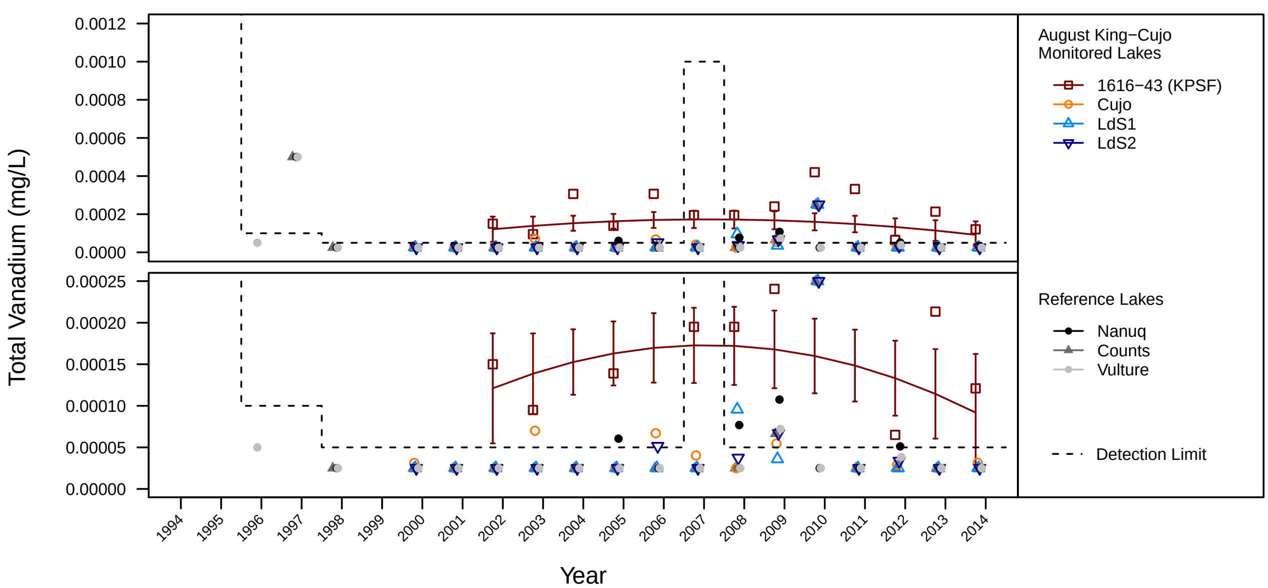
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Monitored Lake	1616-43 (KPSF)	0.2830

- Conclusions:
  Model fit for 1616-43 (KPSF) weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total vanadium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.21e-04	9.19e-05	3.6e-05	2.14e-05	1.62e-04	1.05e-04
Cujo	3.15e-05	NA	NA	NA	NA	NA
LdS2	2.50e-05	NA	NA	NA	NA	NA
LdS1	2.50e-05	NA	NA	NA	NA	NA
Nanuq	2.50e-05	NA	NA	NA	NA	NA
Counts	2.50e-05	NA	NA	NA	NA	NA
Vulture	2.50e-05	NA	NA	NA	NA	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Vanadium	August	King-Cujo	Lake	Water	Counts Nanuq Vulture LdS1 LdS2 Cujo	none	Tobit regression	#1a slope of zero	0.03	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

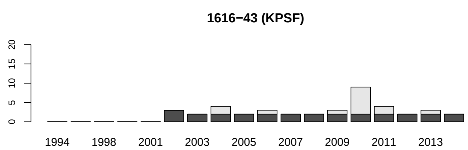
Analysis of August Total Vanadium in King-Cujo Watershed Streams

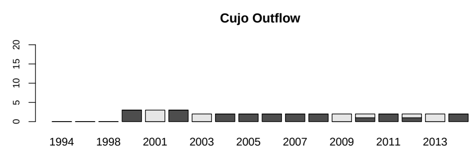
November 20, 2014

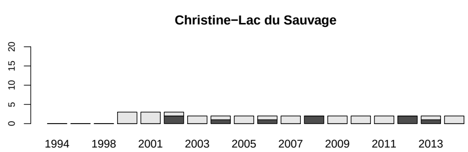
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each stream that were less than the detection limit (grey) or greater than the detection limit (black).

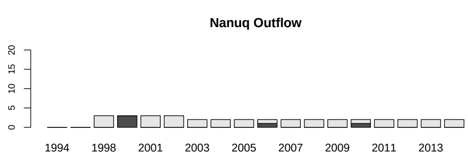
1.1 Monitored

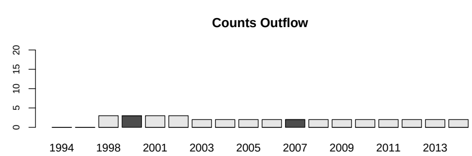


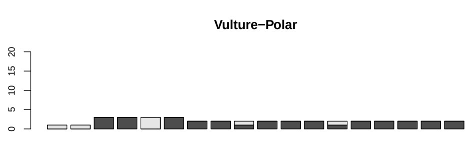




1.2 Reference

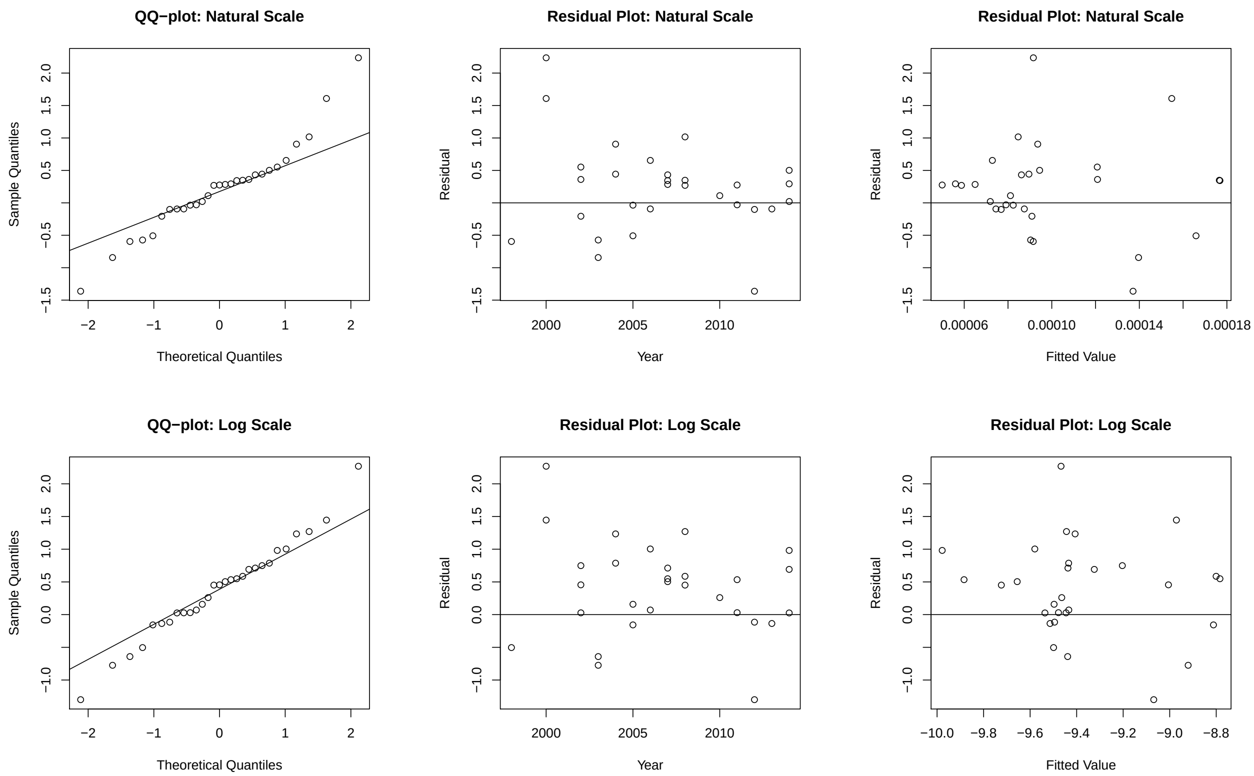






Comment:
Greater than 60% of data in Counts Outflow, Nanuq Outflow, and Christine-Lac du Sauvage was less than the detection limit. These streams were excluded from further analyses. 10-60% of data in Vulture-Polar, 1616-43 (KPSF), and Cujo Outflow was less than the detection limit. We proceeded with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	1.000	0.000	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Streams

Two of three reference streams were removed from the analysis. Tests could not be performed. Proceeding with analysis using reference model 1.

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)	1.1826	2	0.5536
Cujo Outflow	6.7264	2	0.0346

- Conclusions:
  Cujo Outflow shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
1616-43 (KPSF)-vs-Vulture-Polar	6.5856	3	0.0863
Cujo Outflow-vs-Vulture-Polar	4.1141	3	0.2494

- Conclusions:
  No significant deviations were found when comparing Cujo Outflow to the one reference stream.

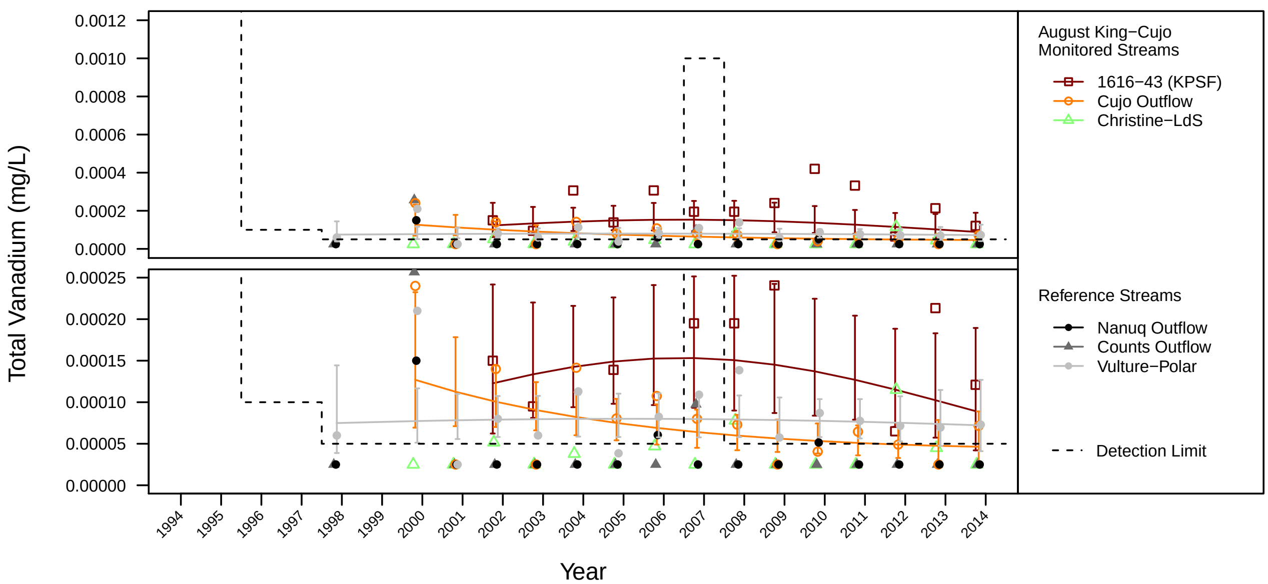
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Vulture-Polar	0.0070
Monitored Stream	1616-43 (KPSF)	0.3080
Monitored Stream	Cujo Outflow	0.2030

- Conclusions:
  Model fit for 1616-43 (KPSF) and Cujo Outflow is weak. Model fit for Vulture-Polar is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total vanadium for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
1616-43 (KPSF)	1.21e-04	8.92e-05	3.43e-05	4.20e-05	1.89e-04	1.00e-04
Cujo Outflow	7.15e-05	4.64e-05	1.54e-05	2.42e-05	8.89e-05	4.51e-05
Christine-Lac du Sauvage	2.50e-05	NA	NA	NA	NA	NA
Nanuq Outflow	2.50e-05	NA	NA	NA	NA	NA
Counts Outflow	2.50e-05	NA	NA	NA	NA	NA
Vulture-Polar	7.30e-05	7.22e-05	2.08e-05	4.11e-05	1.27e-04	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Vanadium	August	King-Cujo	Stream	Water	Counts Outflow Nanuq Outflow Christine-Lac du Sauvage	log e	Tobit regression	#1b separate intercepts & slopes	0.03	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.

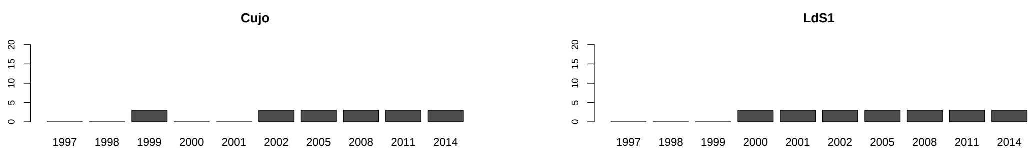
Analysis of Total Organic Carbon in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

December 31, 2014

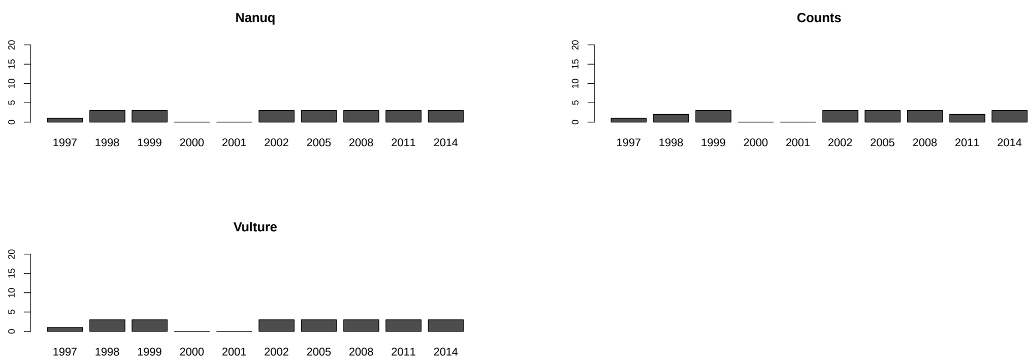
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

1.1 Monitored

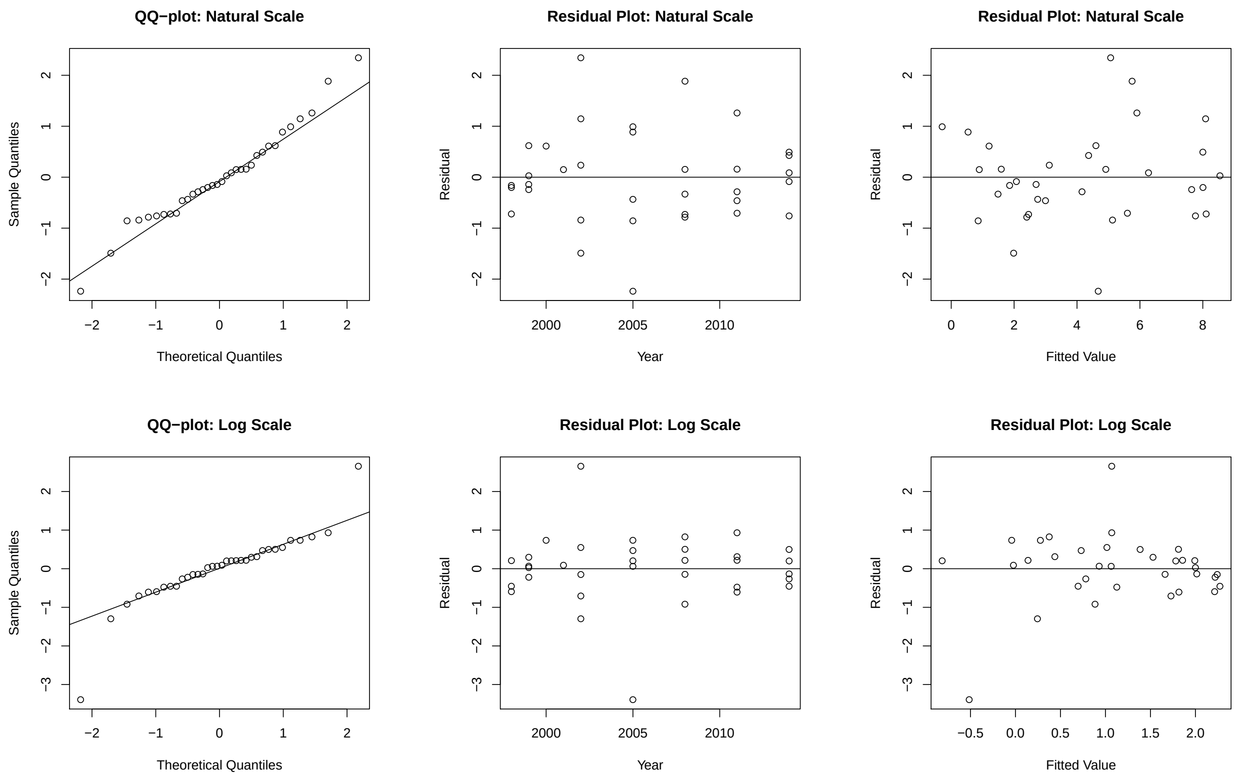


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
75	Nanuq	2005	0.20	-0.51	-3.39

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.49E-13	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
579.44	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
32.33	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	8.4928	2	0.0143
LdS1	0.9356	2	0.6264

- Conclusions:
  Cujo Lake shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Cujo-vs-Nanuq	22.4851	3	0.0001
Cujo-vs-Counts	9.8905	3	0.0195
Cujo-vs-Vulture	4.6052	3	0.2031

- Conclusions:
  Cujo Lake shows significant deviation from the slopes of individual reference lakes.

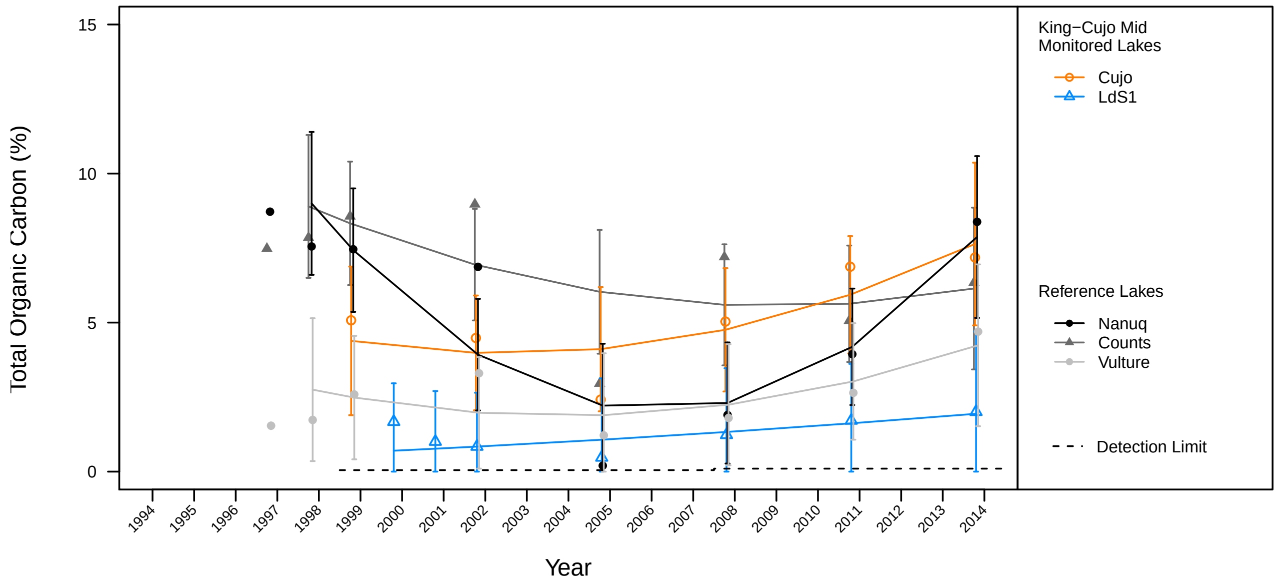
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.3760
Reference Lake	Nanuq	0.7520
Reference Lake	Vulture	0.5090
Monitored Lake	Cujo	0.6780
Monitored Lake	LdS1	0.5010

- Conclusions:
  Model fit for Counts Lake is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total organic carbon for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	7.18e+00	7.63e+00	1.39e+00	4.91e+00	1.04e+01	4.08e+00
LdS1	2.01e+00	1.94e+00	1.41e+00	0.00e+00	4.70e+00	4.12e+00
Nanuq	8.38e+00	7.87e+00	1.38e+00	5.16e+00	1.06e+01	NA
Counts	6.34e+00	6.14e+00	1.38e+00	3.43e+00	8.86e+00	NA
Vulture	4.70e+00	4.24e+00	1.38e+00	1.52e+00	6.95e+00	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
TOC	Summer	King-Cujo	Lake	Sediment	none	none	linear mixed effects regression	#1b separate intercepts & slopes	NA	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

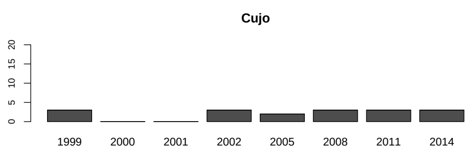
Analysis of Available Phosphorus in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

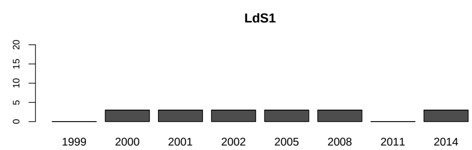
December 31, 2014

1 Censored Values:

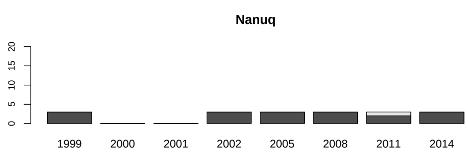
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

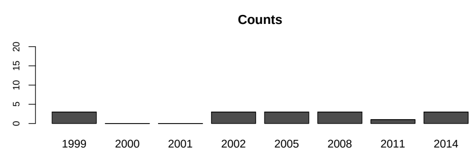
1.1 Monitored

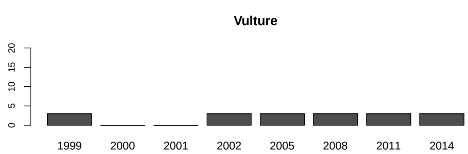




1.2 Reference

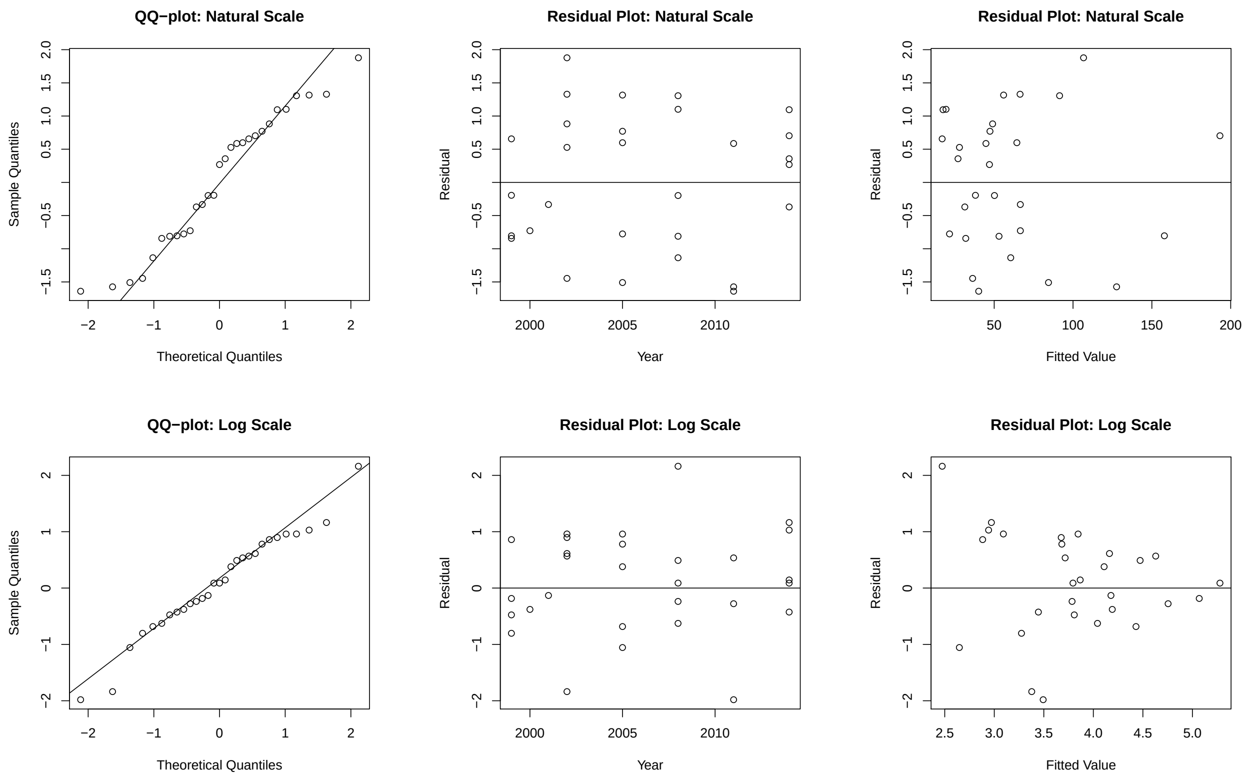






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
5.41E-46	1.00E+00	log model

Conclusion:
The natural and log-transformed models show dependence on fitted value. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
306.50	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
4.91	4.00	0.30

- Conclusions:
  The slopes do not differ significantly among reference lakes.

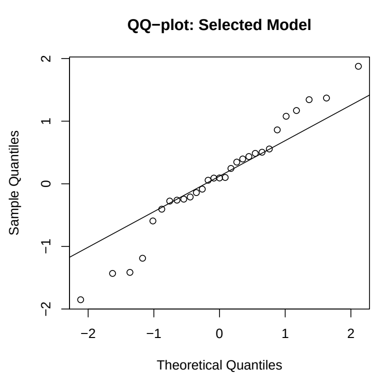
3.3 Compare Reference Models using AIC Weights

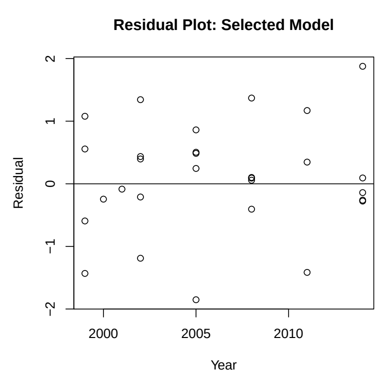
- Results:

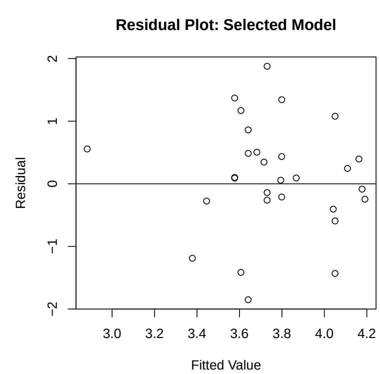
	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.999	0.000	0.001	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model







Outliers:

None

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	0.7729	2	0.6795
LdS1	0.0565	2	0.9722

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

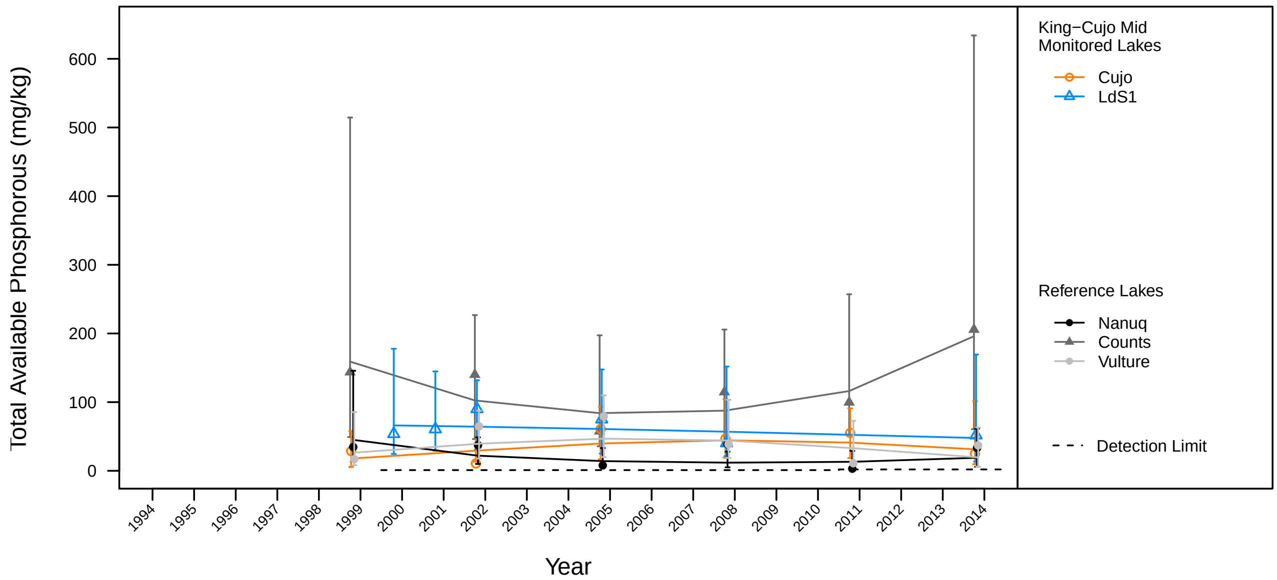
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0230
Monitored Lake	Cujo	0.2640
Monitored Lake	LdS1	0.1860

- Conclusions:
  Model fit for Cujo Lake is weak. Model fit for pooled reference lakes and site LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean available phosphorus for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	2.48E+01	3.13E+01	1.88E+01	9.69E+00	1.01E+02	5.50E+01
LdS1	5.18E+01	4.78E+01	3.08E+01	1.35E+01	1.69E+02	9.02E+01
Nanuq	3.34E+01	1.90E+01	1.14E+01	5.86E+00	6.14E+01	
Counts	2.06E+02	1.96E+02	1.17E+02	6.06E+01	6.34E+02	
Vulture	3.70E+01	1.95E+01	1.17E+01	6.03E+00	6.31E+01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Available Phospho-rus	Summer	King-Cujo	Lake	Sediment	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

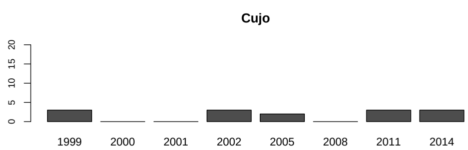
Analysis of Total Nitrogen in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

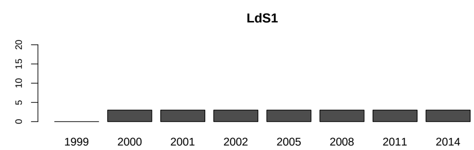
December 31, 2014

1 Censored Values:

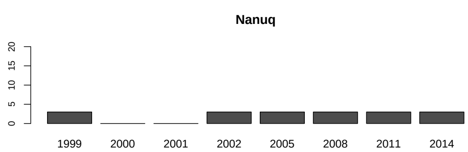
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

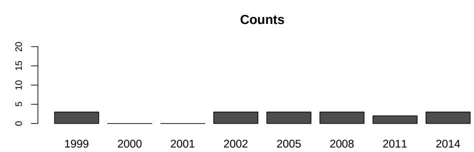
1.1 Monitored

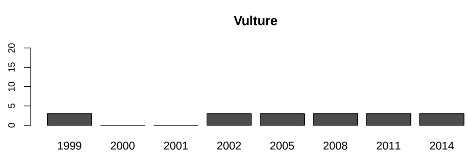




1.2 Reference

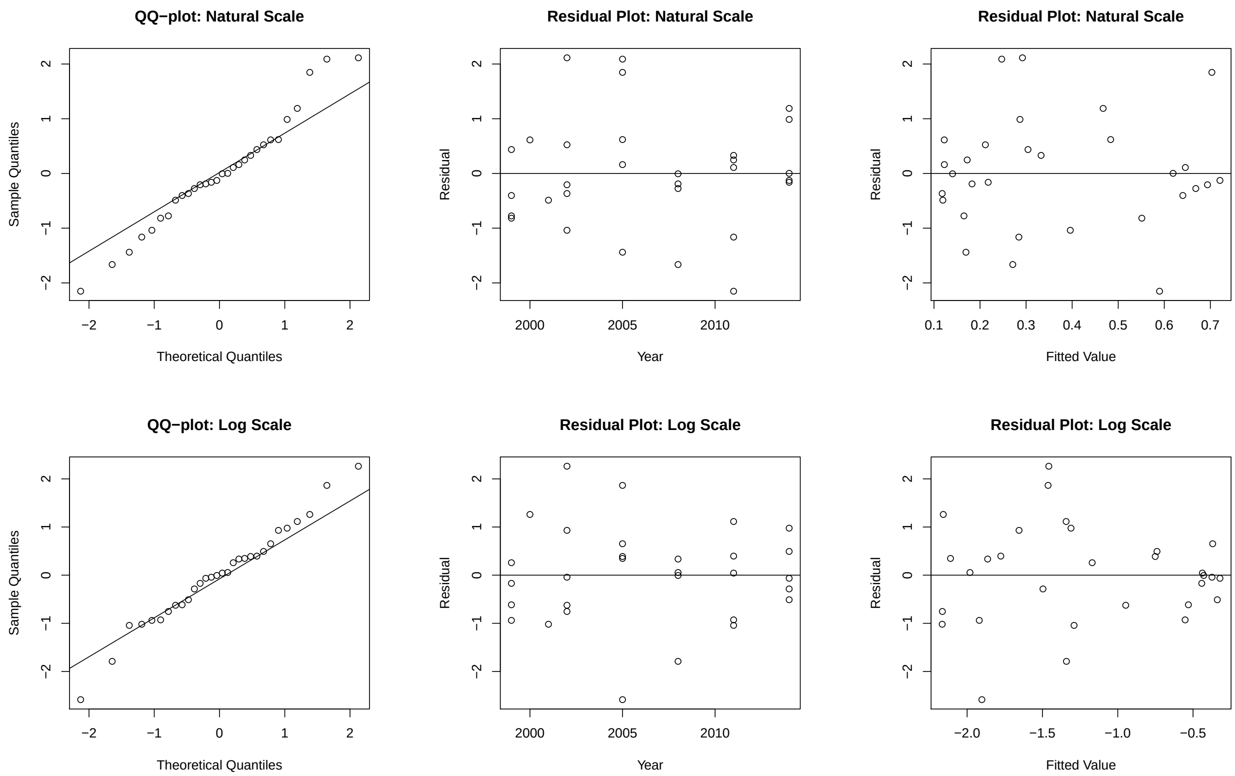






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	3.75E-19	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed and log-transformed models. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
197.63	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
30.77	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	13.4634	2	0.0012
LdS1	0.8917	2	0.6403

- Conclusions:
  Cujo Lake shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Cujo-vs-Nanuq	29.6169	3	0.0000
Cujo-vs-Counts	13.8539	3	0.0031
Cujo-vs-Vulture	3.2407	3	0.3560

- Conclusions:
  Cujo Lake shows significant deviation from the slopes of individual reference lakes.

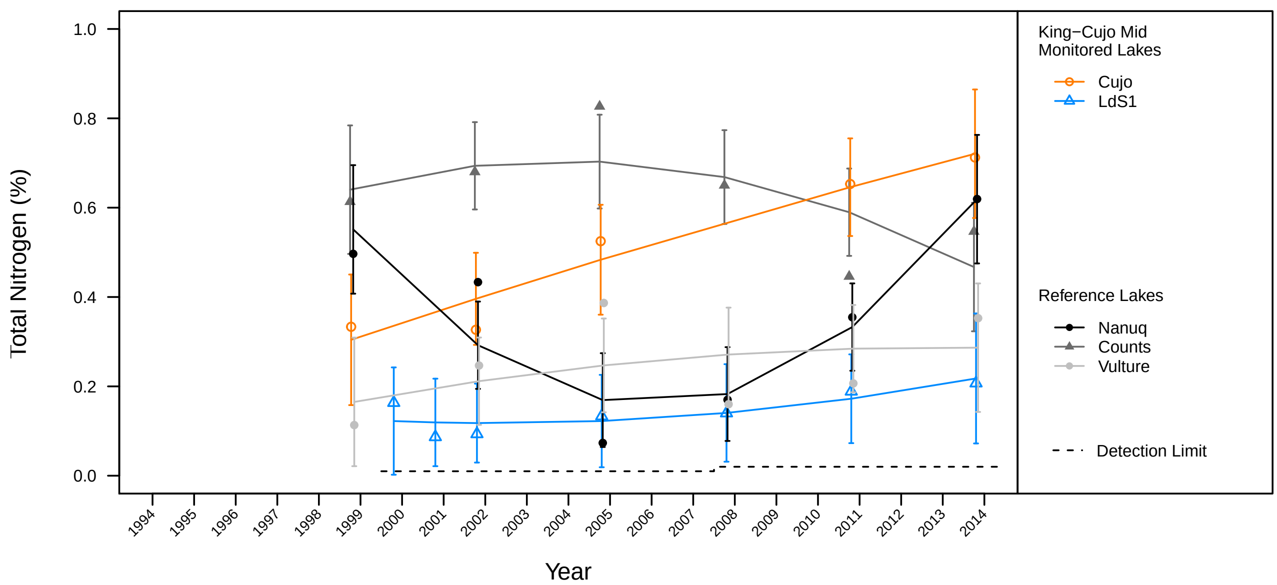
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.4730
Reference Lake	Nanuq	0.8440
Reference Lake	Vulture	0.1990
Monitored Lake	Cujo	0.9410
Monitored Lake	LdS1	0.6880

- Conclusions:
  Model fit for Counts Lake is weak. Model fit for Vulture Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean total nitrogen for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	7.12E-01	7.21E-01	7.34E-02	5.77E-01	8.65E-01	2.15E-01
LdS1	2.07E-01	2.18E-01	7.42E-02	7.22E-02	3.63E-01	2.17E-01
Nanuq	6.19E-01	6.19E-01	7.34E-02	4.75E-01	7.63E-01	
Counts	5.47E-01	4.67E-01	7.34E-02	3.23E-01	6.11E-01	
Vulture	3.53E-01	2.87E-01	7.34E-02	1.43E-01	4.30E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Total_Nitrogen	Summer	King-Cujo	Lake	Sediment	none	none	linear mixed effects regression	#1b separate intercepts & slopes	NA	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

Analysis of Antimony in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

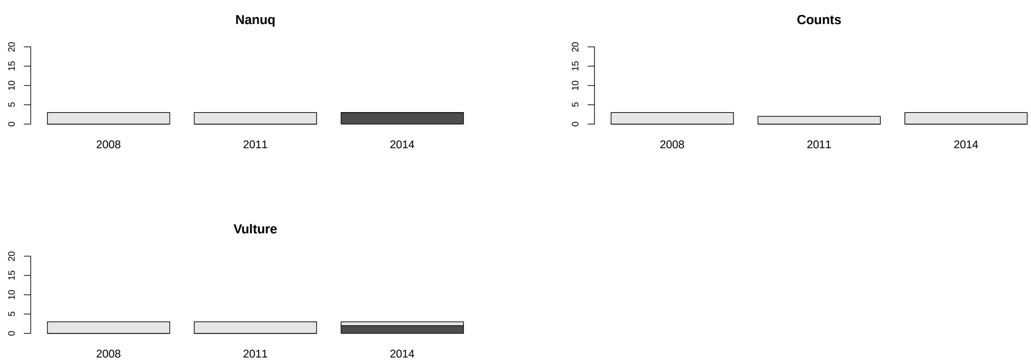
December 31, 2014

1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

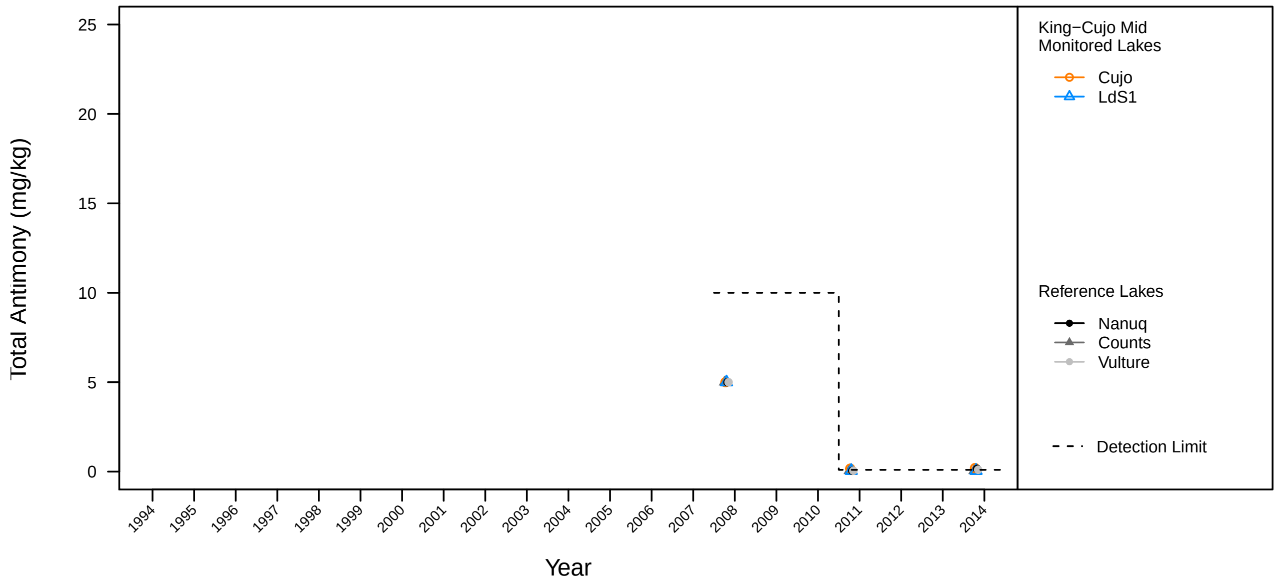
1.1 Monitored

1.2 Reference



Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and LdS1 was less than the detection limit. These lakes were excluded from further analyses. Less than four years of data with observations greater than the detection limit were available in Cujo Lake. This lake was also excluded from further analyses. All monitored and reference lakes were excluded from analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Antimony	Summer	King-Cujo	Lake	Sediment	ALL	NA	NA	NA	NA	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

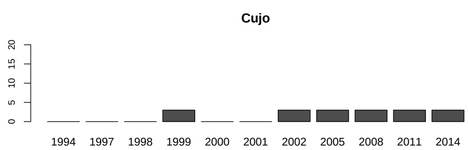
Analysis of Arsenic in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

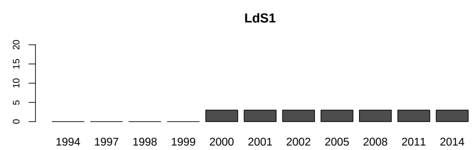
February 11, 2015

1 Censored Values:

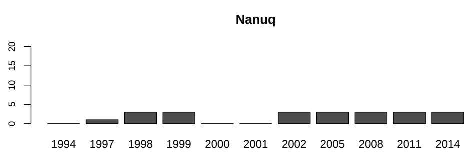
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

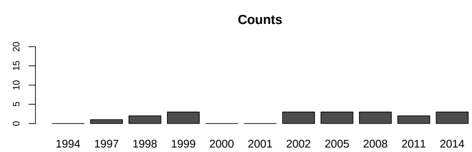
1.1 Monitored

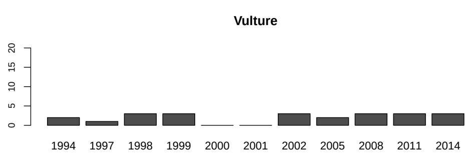




1.2 Reference

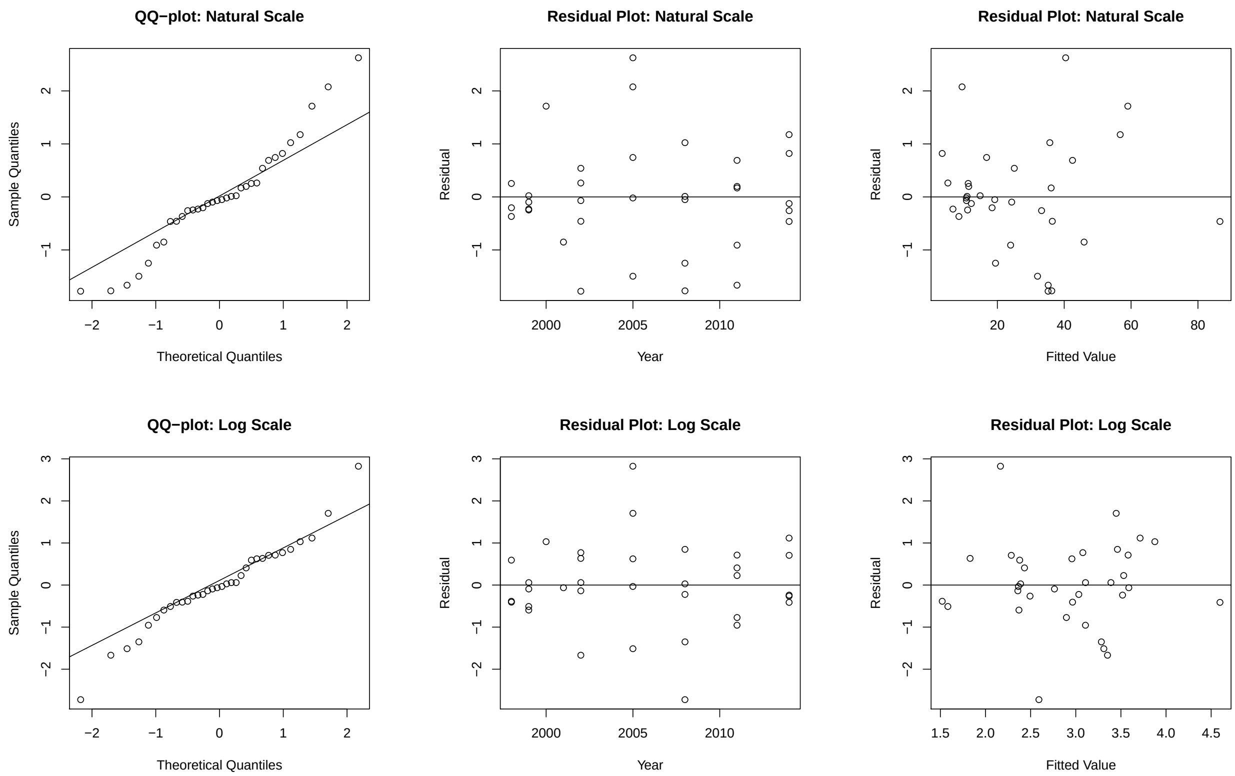






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.46E-48	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
50.30	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
10.29	4.00	0.04

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.964	0.002	0.034	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	1.1386	2	0.5659
LdS1	4.2412	2	0.1200

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

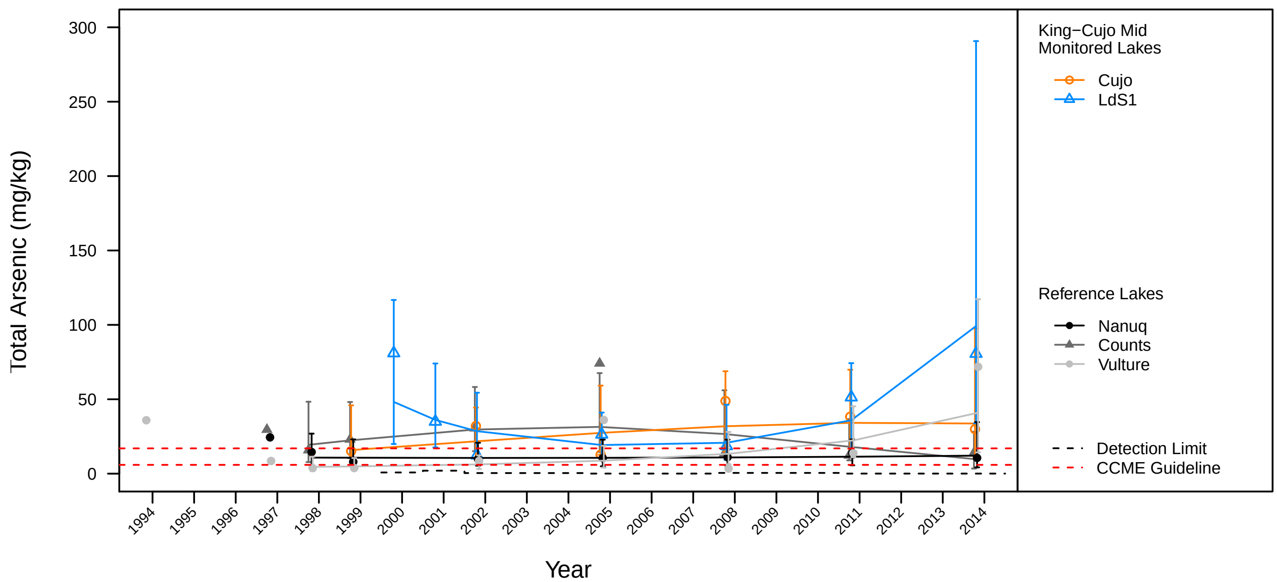
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.3840
Reference Lake	Nanuq	0.0550
Reference Lake	Vulture	0.4670
Monitored Lake	Cujo	0.3280
Monitored Lake	LdS1	0.5970

- Conclusions:
  Model fit for Counts, Vulture, and Cujo lakes is weak. Model fit for Nanuq Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean arsenic for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	2.99E+01	3.37E+01	1.83E+01	1.16E+01	9.76E+01	5.35E+01
LdS1	8.06E+01	9.92E+01	5.44E+01	3.39E+01	2.91E+02	1.59E+02
Nanuq	1.06E+01	1.21E+01	6.49E+00	4.23E+00	3.46E+01	
Counts	1.40E+01	9.83E+00	5.27E+00	3.43E+00	2.81E+01	
Vulture	7.18E+01	4.10E+01	2.20E+01	1.43E+01	1.17E+02	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Arsenic	Summer	King-Cujo	Lake	Sediment	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	5.9/ 17	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

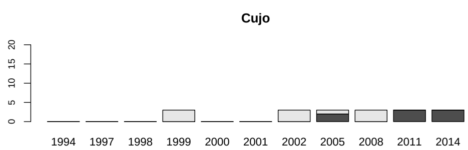
Analysis of Cadmium in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

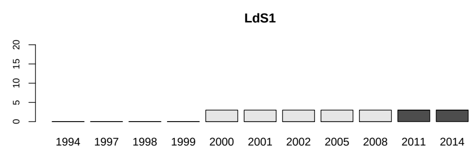
February 11, 2015

1 Censored Values:

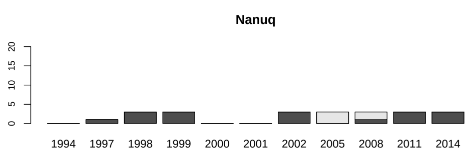
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

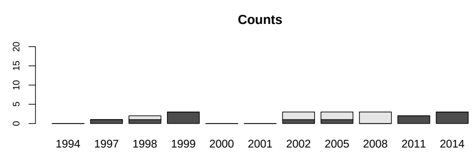
1.1 Monitored

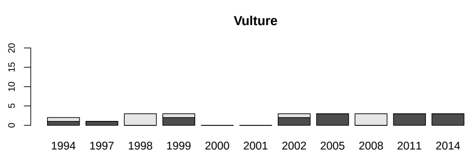




1.2 Reference

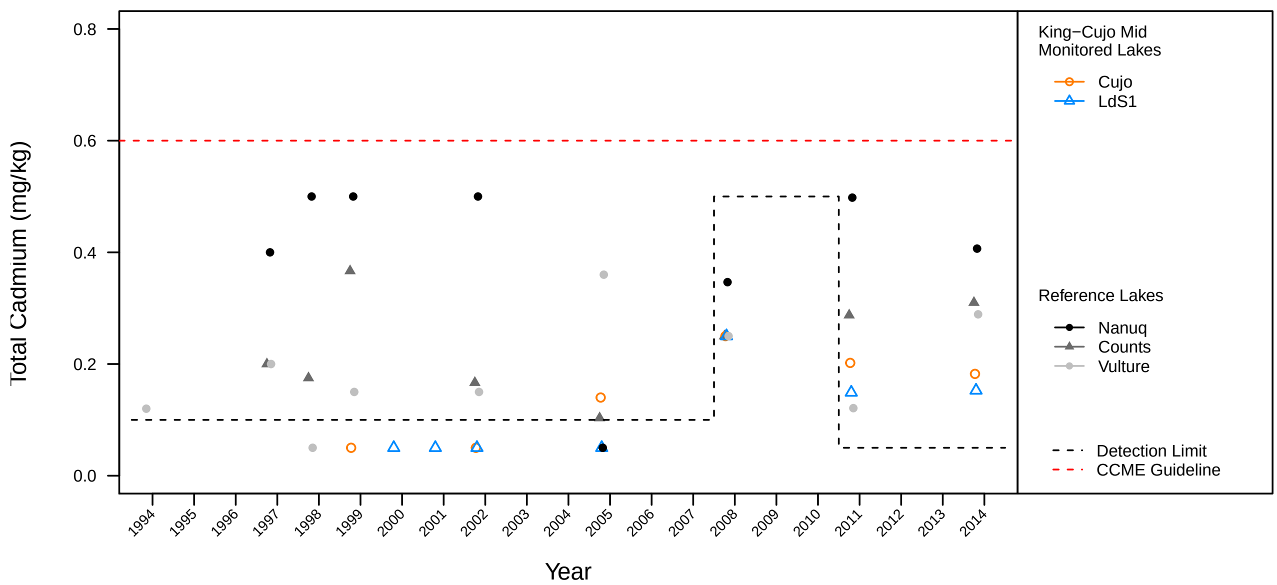






Comment:
Less than four years of data with observations greater than the detection limit were available in all monitored lakes. These lakes were excluded from further analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Cadmium	Summer	King-Cujo	Lake	Sediment	Cujo LdS1	NA	NA	NA	0.6/3.5	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

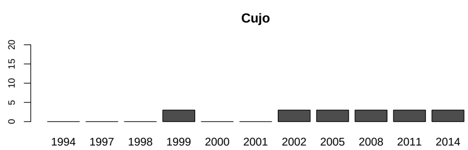
Analysis of Copper in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

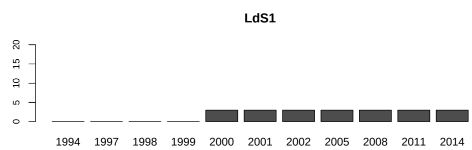
February 11, 2015

1 Censored Values:

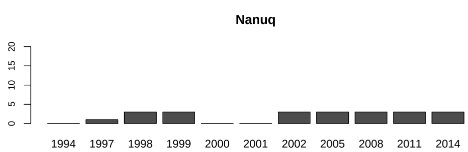
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

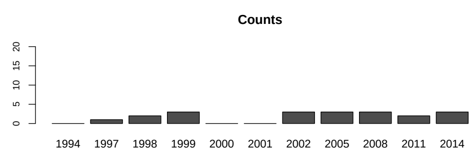
1.1 Monitored

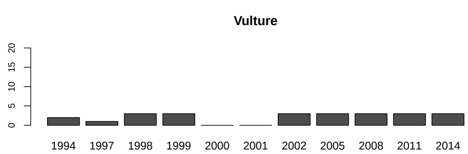




1.2 Reference

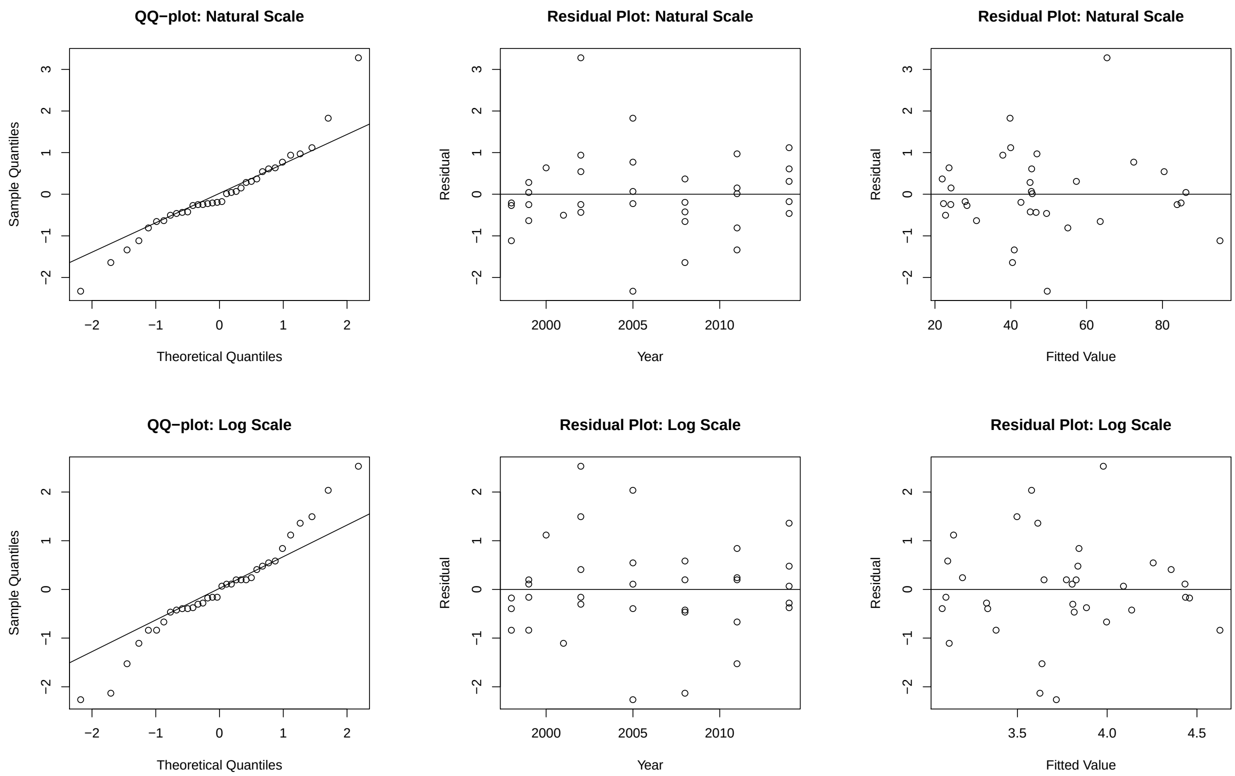






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
72	Nanuq	2002	103.00	65.37	3.28

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
6.45E-57	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
175.82	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
15.99	4.00	0.00

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	0.0427	2	0.9789
LdS1	0.0715	2	0.9649

- Conclusions:
  No significant deviations were found when comparing monitored lakes to a constant slope of zero.

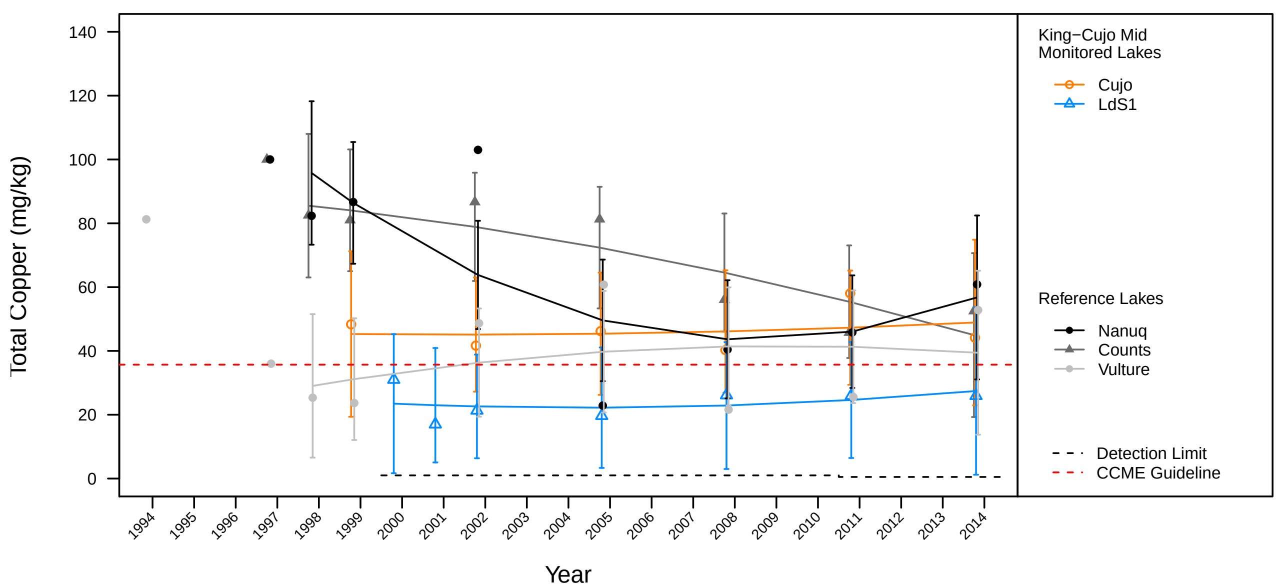
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.7850
Reference Lake	Nanuq	0.5050
Reference Lake	Vulture	0.0910
Monitored Lake	Cujo	0.0540
Monitored Lake	LdS1	0.1450

- Conclusions:
  Model fit for Vulture, Cujo, and LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean copper for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	4.41E+01	4.89E+01	1.32E+01	2.30E+01	7.48E+01	3.87E+01
LdS1	2.59E+01	2.74E+01	1.34E+01	1.20E+00	5.37E+01	3.92E+01
Nanuq	6.08E+01	5.68E+01	1.31E+01	3.11E+01	8.24E+01	
Counts	5.25E+01	4.50E+01	1.31E+01	1.93E+01	7.07E+01	
Vulture	5.28E+01	3.94E+01	1.31E+01	1.37E+01	6.51E+01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Copper	Summer	King-Cujo	Lake	Sediment	none	none	linear mixed effects regression	#1b separate intercepts & slopes	35.7/ 197	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

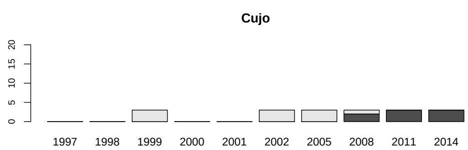
Analysis of Molybdenum in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

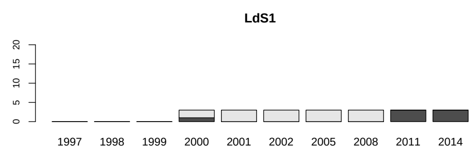
December 31, 2014

1 Censored Values:

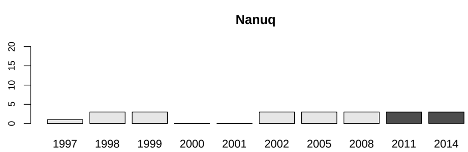
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

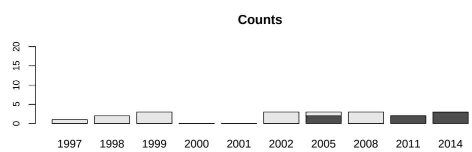
1.1 Monitored

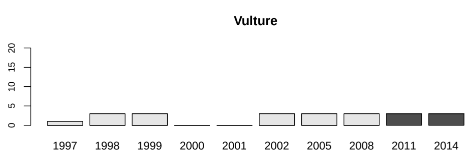




1.2 Reference

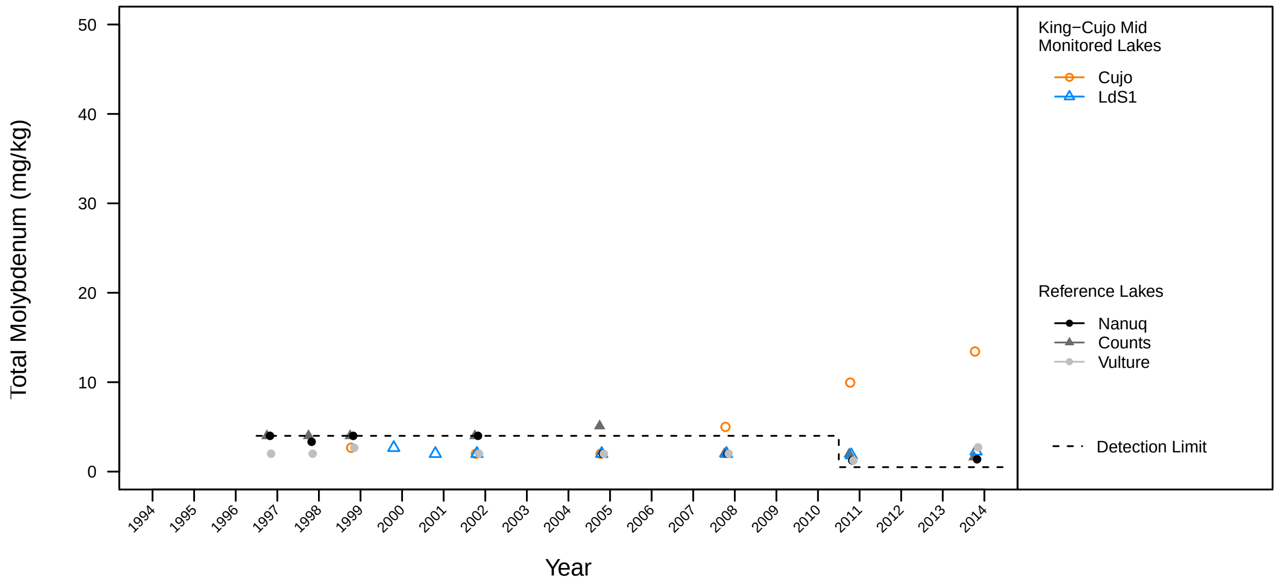






Comment:
Greater than 60% of data in Counts, Nanuq, Vulture, and LdS1 was less than the detection limit. These lakes were excluded from further analyses. Less than four years of data with observations greater than the detection limit were available for Cujo Lake. This lake was also excluded from analyses. All monitored and reference lakes were excluded from analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Molybdenum	Summer	King-Cujo	Lake	Sediment	ALL	NA	NA	NA	NA	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

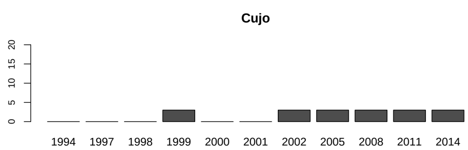
Analysis of Nickel in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

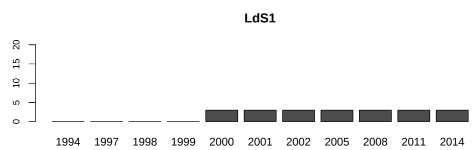
December 31, 2014

1 Censored Values:

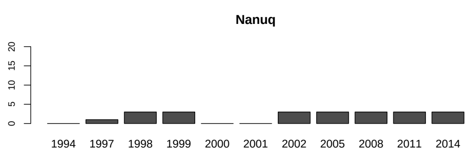
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

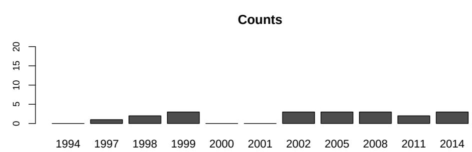
1.1 Monitored

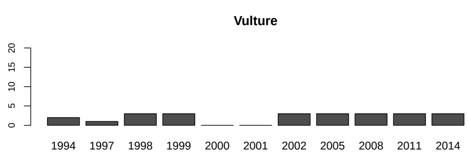




1.2 Reference

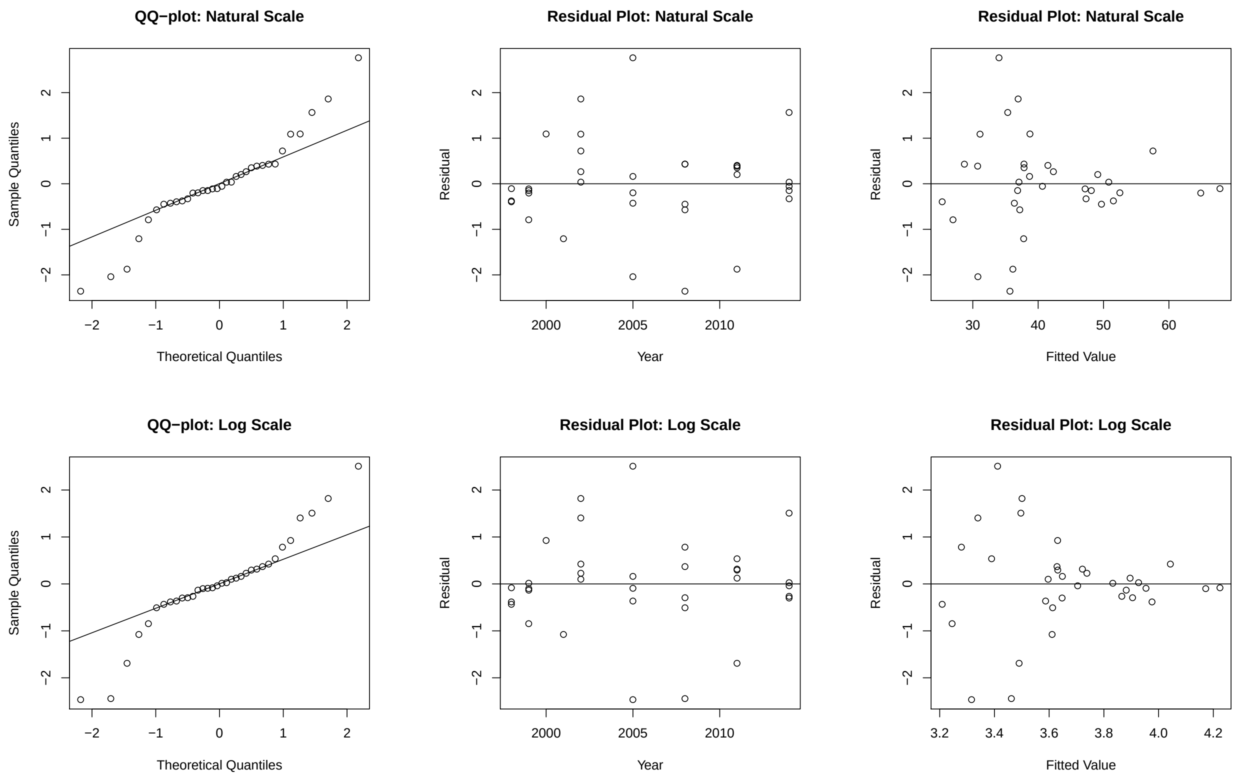






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
7.56E-52	1.00E+00	log model

Conclusion:
The natural and log-transformed models show dependence on year and fitted value. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
729.39	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
7.37	4.00	0.12

- Conclusions:
  The slopes do not differ significantly among reference lakes.

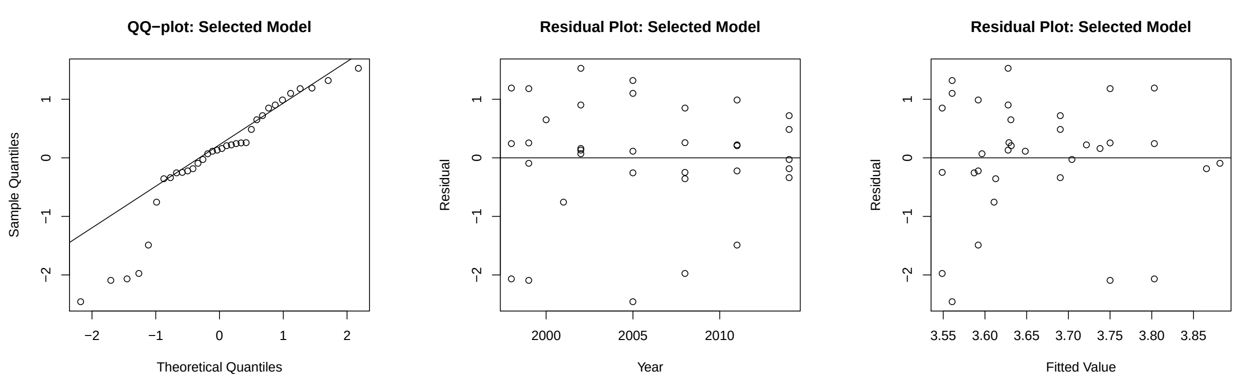
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.997	0.000	0.003	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	0.0420	2	0.9792
LdS1	0.2245	2	0.8938

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

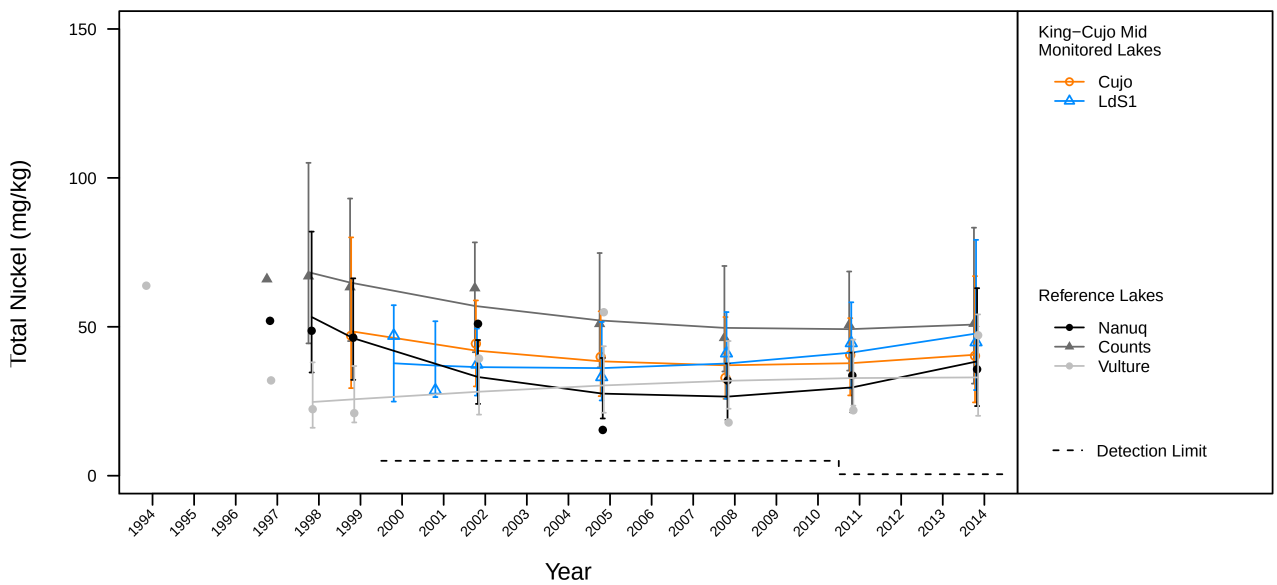
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0440
Monitored Lake	Cujo	0.6660
Monitored Lake	LdS1	0.3010

- Conclusions:
  Model fit for site LdS1 is weak. Model fit for pooled reference lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean nickel for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	4.02E+01	4.06E+01	1.04E+01	2.46E+01	6.70E+01	3.04E+01
LdS1	4.48E+01	4.77E+01	1.23E+01	2.88E+01	7.92E+01	3.61E+01
Nanuq	3.57E+01	3.84E+01	9.70E+00	2.34E+01	6.30E+01	
Counts	5.11E+01	5.08E+01	1.28E+01	3.09E+01	8.33E+01	
Vulture	4.72E+01	3.30E+01	8.34E+00	2.01E+01	5.42E+01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Nickel	Summer	King-Cujo	Lake	Sediment	none	log e	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

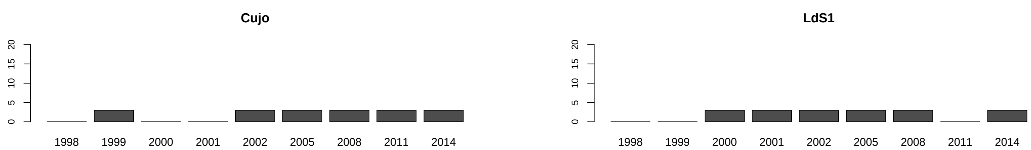
Analysis of Phosphorus in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

December 31, 2014

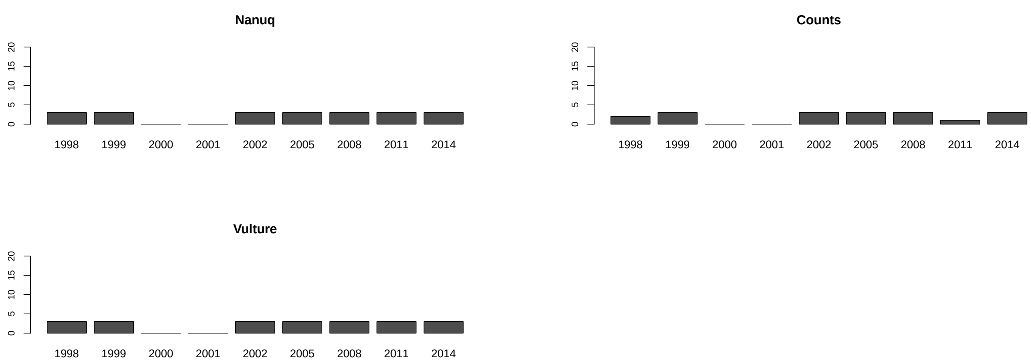
1 Censored Values:

The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

1.1 Monitored

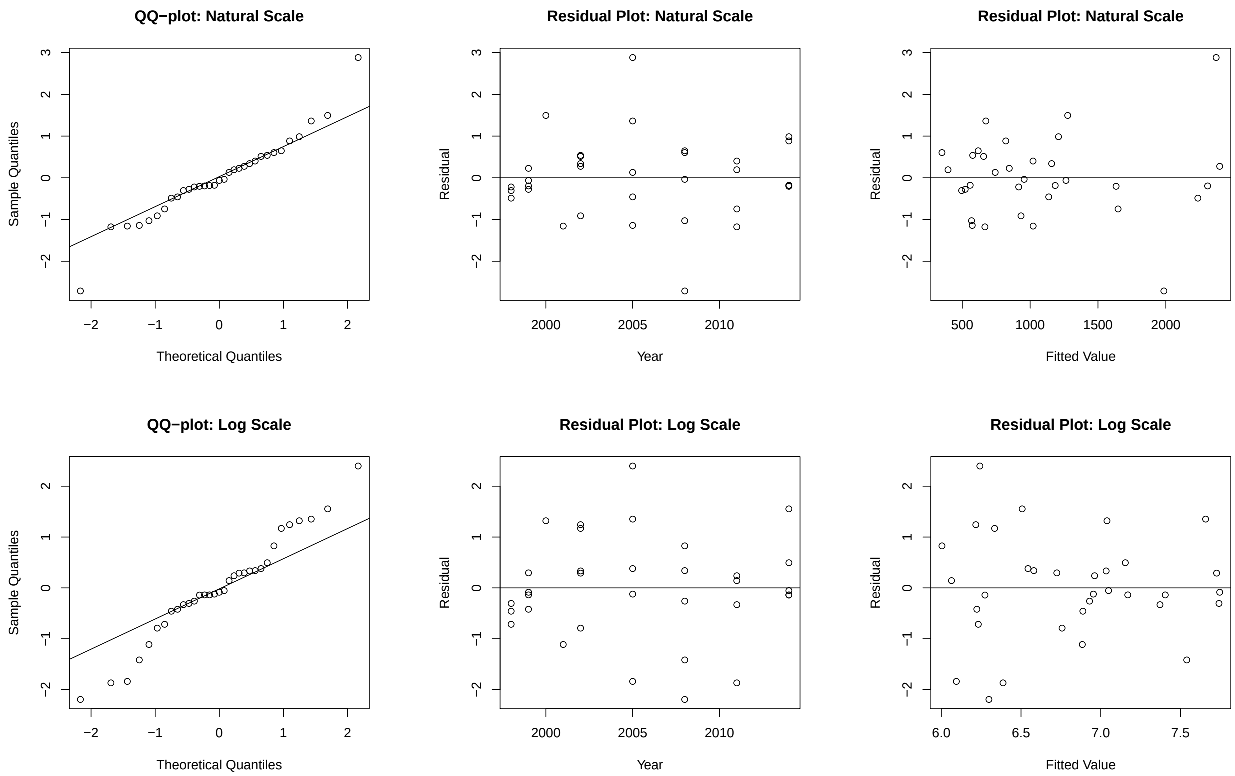


1.2 Reference



Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
2.60E-99	1.00E+00	log model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
204.29	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
6.52	4.00	0.16

- Conclusions:
  The slopes do not differ significantly among reference lakes.

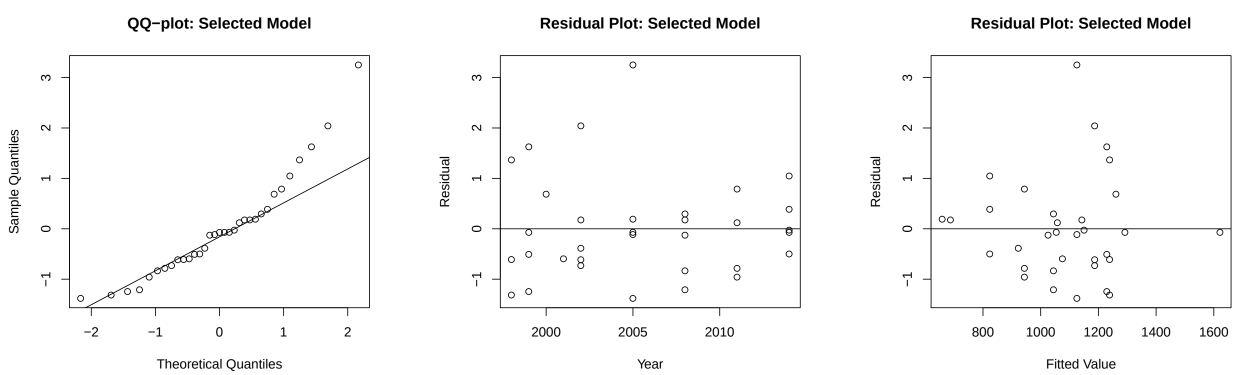
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

	Lake	Year	Impute	Fitted	Std. Resid.
12	Counts	2005	3173.33	1125.42	3.25

Conclusion:
The reduced model shows dependence on year and fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-squared	DF	P-value
Cujo	0.1183	2	0.9426
LdS1	1.2162	2	0.5444

- Conclusions:
  No significant deviations were found when comparing monitored lakes to the common slope of reference lakes.

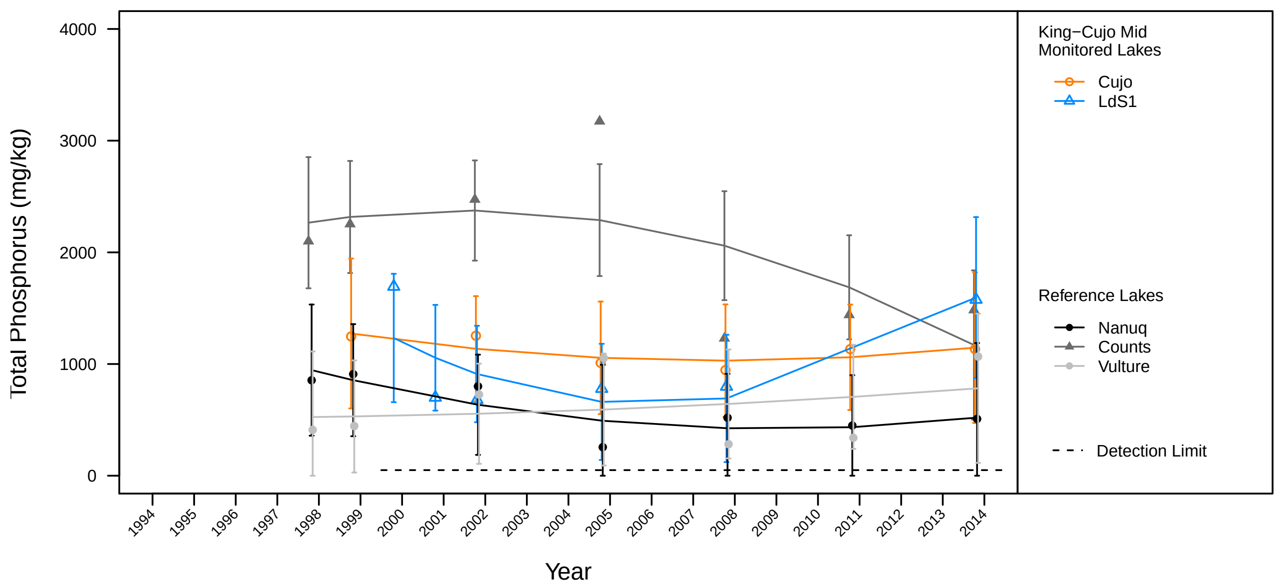
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0340
Monitored Lake	Cujo	0.6270
Monitored Lake	LdS1	0.6180

- Conclusions:
  Model fit for pooled reference lakes is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean phosphorus for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.13e+03	1.15e+03	3.44e+02	4.72e+02	1.82e+03	1.01e+03
LdS1	1.58e+03	1.60e+03	3.68e+02	8.74e+02	2.32e+03	1.08e+03
Nanuq	5.09e+02	5.20e+02	3.41e+02	0.00e+00	1.19e+03	NA
Counts	1.48e+03	1.17e+03	3.41e+02	5.03e+02	1.84e+03	NA
Vulture	1.07e+03	7.82e+02	3.41e+02	1.15e+02	1.45e+03	NA

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Phosphorus	Summer	King-Cujo	Lake	Sediment	none	none	linear mixed effects regression	#2 shared slopes	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

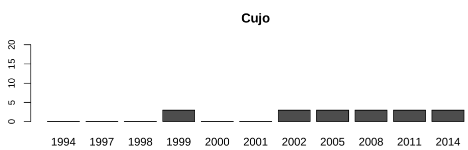
Analysis of Selenium in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

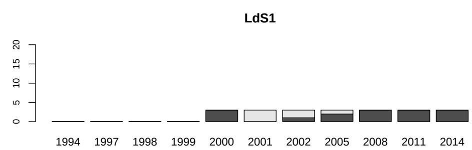
December 31, 2014

1 Censored Values:

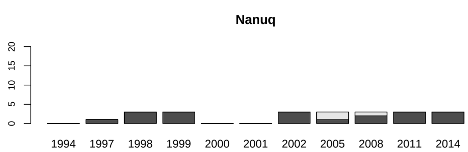
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

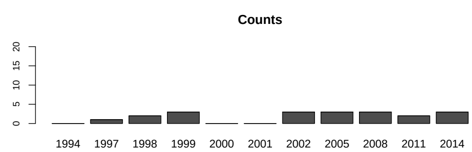
1.1 Monitored

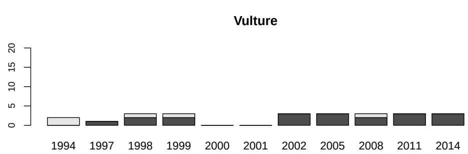




1.2 Reference

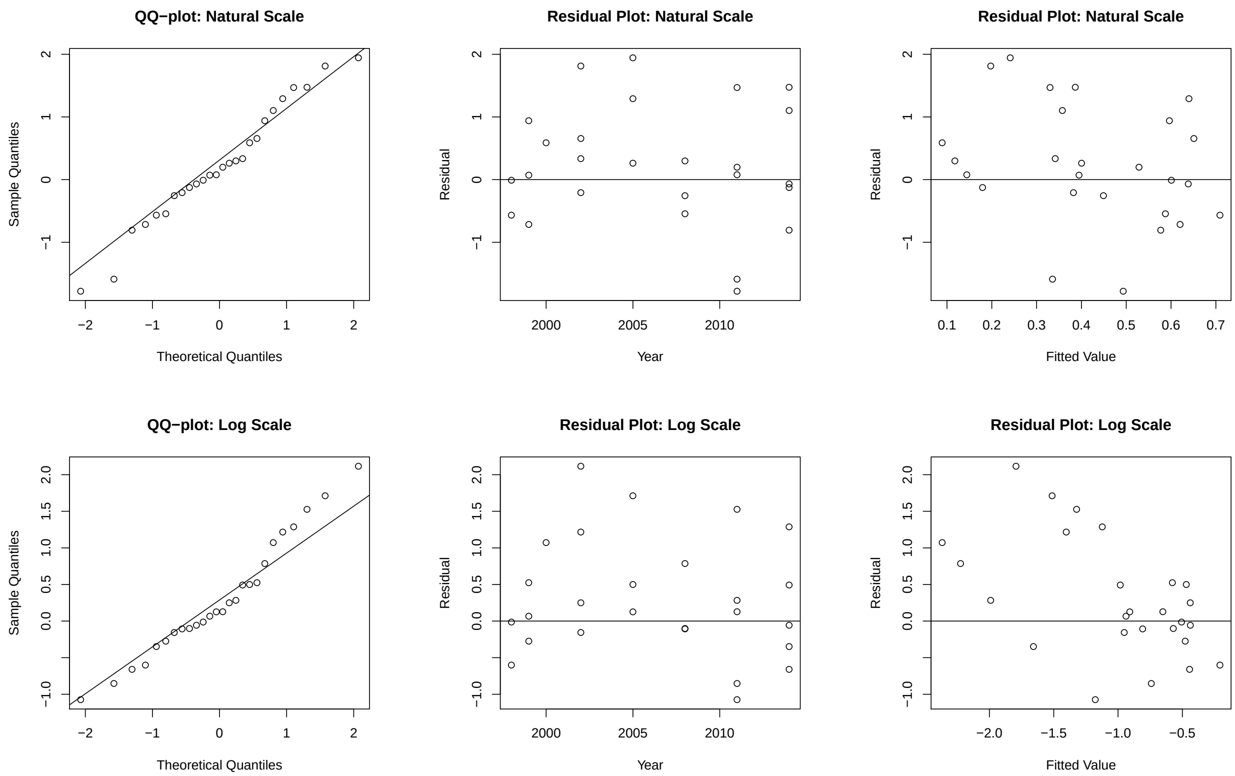






Comment:
10-60% of data in Nanuq, Vulture, and LdS1 was less than the detection limit. Proceeding with Tobit regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

None

Outliers on log scale:

None

AIC weights and model comparison:

Natural Model	Log Model	Best Model
1.00E+00	3.13E-13	natural model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the untransformed natural model. AIC reveals that the data is modeled best with no transformation. Proceeding with analysis using the untransformed "natural model".

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
117.56	6.00	0.00

- Conclusions:
The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
55.86	4.00	0.00

- Conclusions:
The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-squared	DF	P-value
Cujo	8.9882	2	0.0112
LdS1	1.2499	2	0.5353

- Conclusions:
Cujo Lake shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Cujo-vs-Nanuq	18.3187	3	0.0004
Cujo-vs-Counts	25.9994	3	0.0000
Cujo-vs-Vulture	23.4878	3	0.0000

- Conclusions:
  Cujo Lake shows significant deviation from the slopes of individual reference lakes.

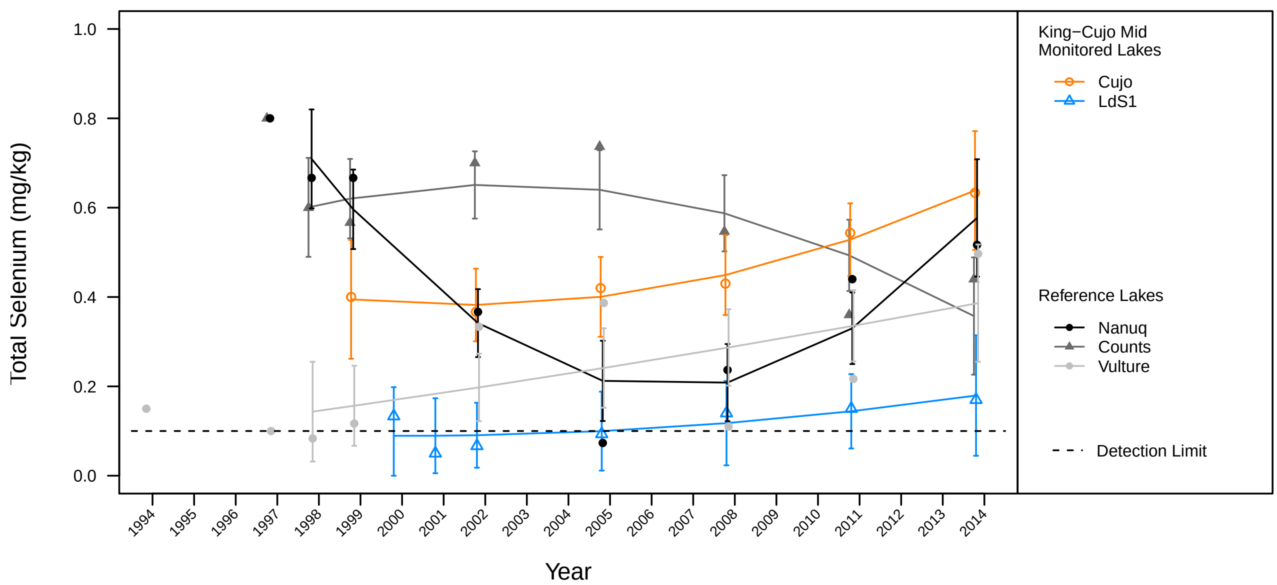
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.6180
Reference Lake	Nanuq	0.8480
Reference Lake	Vulture	0.3290
Monitored Lake	Cujo	0.9750
Monitored Lake	LdS1	0.6020

- Conclusions:
  Model fit for Vulture Lake is weak. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean selenium for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	6.33E-01	6.38E-01	6.78E-02	5.06E-01	7.71E-01	1.99E-01
LdS1	1.70E-01	1.79E-01	6.88E-02	4.46E-02	3.14E-01	2.01E-01
Nanuq	5.17E-01	5.77E-01	6.70E-02	4.46E-01	7.08E-01	
Counts	4.40E-01	3.57E-01	6.70E-02	2.26E-01	4.89E-01	
Vulture	4.97E-01	3.86E-01	6.70E-02	2.55E-01	5.18E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Selenium	Summer	King-Cujo	Lake	Sediment	none	none	Tobit regression	#1b separate intercepts & slopes	NA	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

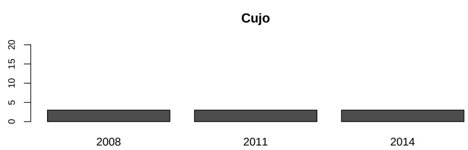
Analysis of Strontium in Sediments in Lakes of the King-Cujo Watershed and Lac du Sauvage

December 31, 2014

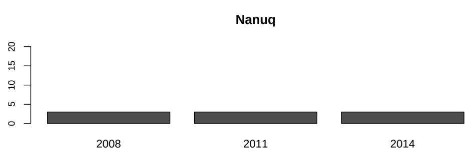
1 Censored Values:

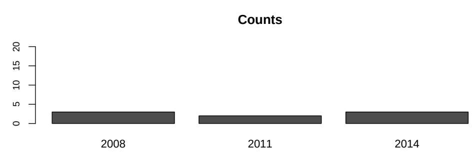
The following charts indicate the number of measurements taken in each year from each lake that were below the detection limit (grey) or above the detection limit (black).

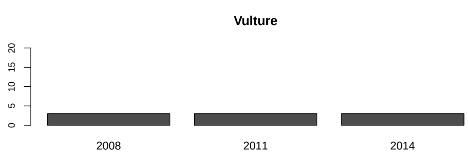
1.1 Monitored



1.2 Reference

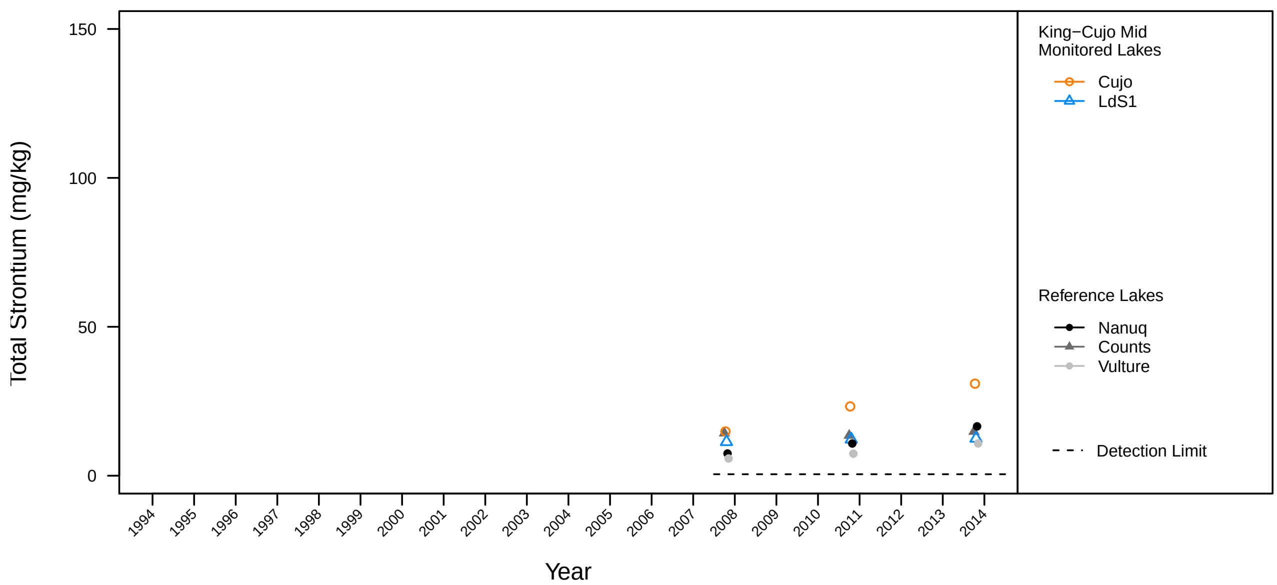






Comment:
Less than four years of data with observations greater than detection limit were available in all monitored and reference lakes. All lakes were excluded from further analyses. No statistical tests were performed.

2 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For parameters where the slope (and intercept) for reference lakes were not statistically different, the regression line and associated 95% CI for the combined reference lake data is shown as Reference-Common. This corresponds to analyses using reference model 2 or 3 only.

3 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Strontium	Summer	King-Cujo	Lake	Sediment	ALL	NA	NA	NA	NA	NA

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

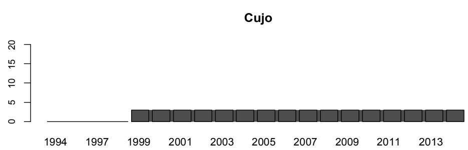
Analysis of August Chlorophyll *a* in Lakes of the King-Cujo Watershed and Lac du Sauvage

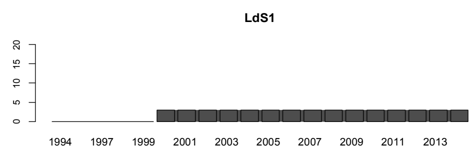
February 10, 2015

1 Censored Values:

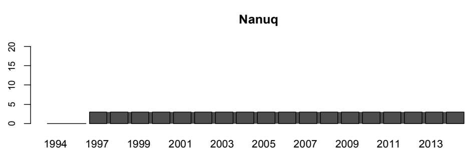
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

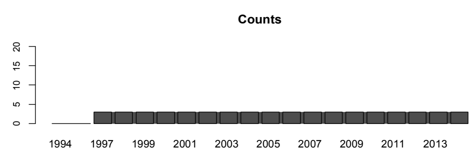
1.1 Monitored

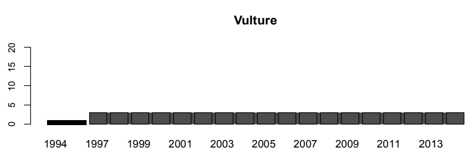




1.2 Reference

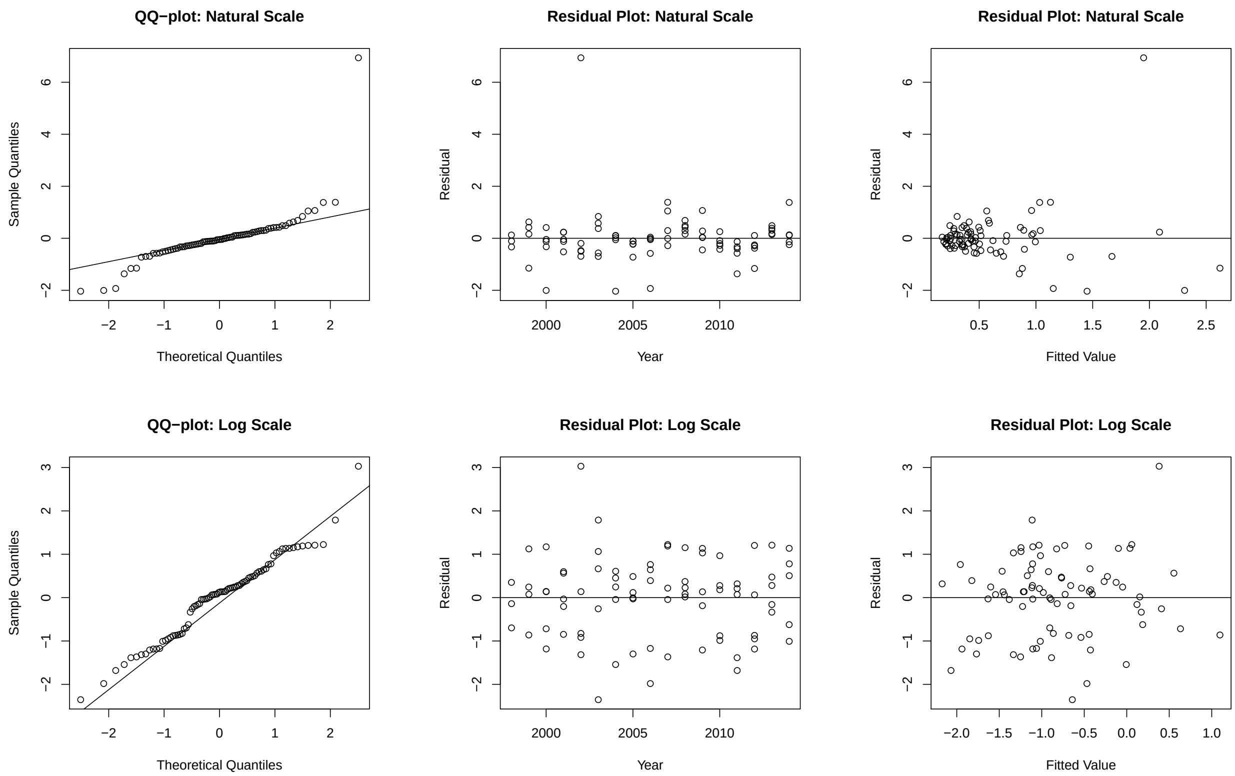






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
30	Cujo	2002	5.10	1.95	6.94

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
30	Cujo	2002	5.10	0.38	3.03

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.859	0.141	Un-transformed Model

Conclusion:
The log-transformed model meets the regression assumptions of normality and equal variance better than the untransformed model. We are proceeding with the remaining analyses using the log-transformed model despite the contradictory AIC results, because AIC is less reliable when data do not meet the assumption of normally distributed errors.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
6.53	6.00	0.37

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

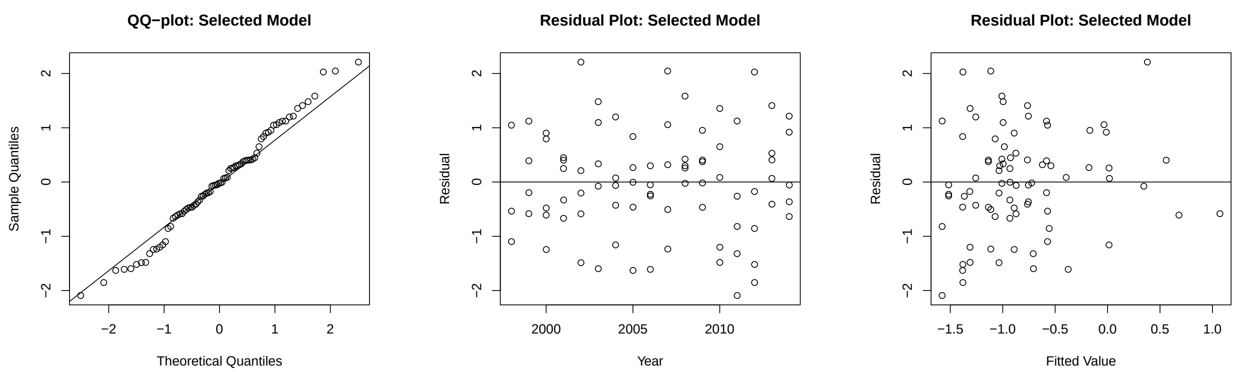
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope and intercept. Proceeding with monitored contrasts using reference model 3 (fitting a common slope and intercept for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.3 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-square	DF	P-value
Cujo	7.4165	3	0.0597
LdS1	1.8936	3	0.5948

- Conclusions:
  No significant deviations were found when comparing monitored lakes to reference lakes.

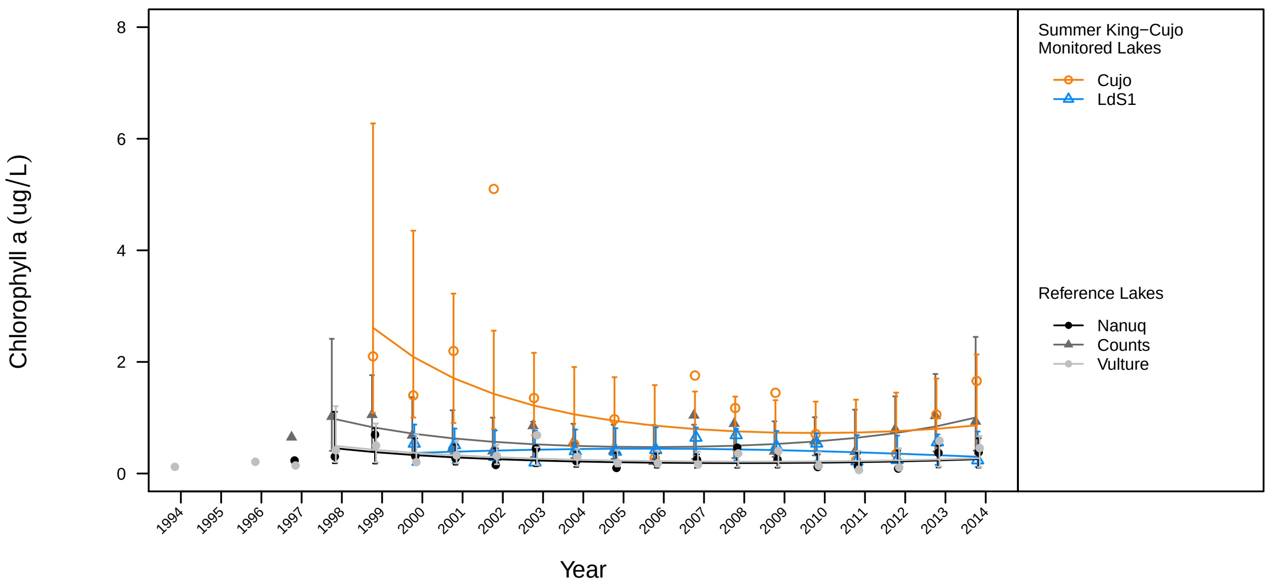
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.1110
Monitored Lake	Cujo	0.2620
Monitored Lake	LdS1	0.0810

- Conclusions:
  Model fit for Cujo Lake is weak. Model fit for pooled reference lakes and LdS1 is poor.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean phytoplankton biomass for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.66E+00	8.63E-01	3.98E-01	3.49E-01	2.13E+00	1.17E+00
LdS1	2.39E-01	3.01E-01	1.41E-01	1.20E-01	7.52E-01	4.12E-01
Nanuq	3.83E-01	2.58E-01	1.18E-01	1.06E-01	6.30E-01	
Counts	9.33E-01	1.00E+00	4.57E-01	4.10E-01	2.45E+00	
Vulture	4.56E-01	2.75E-01	1.25E-01	1.12E-01	6.71E-01	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Biomass	Summer	King-Cujo	Lake	Biology	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

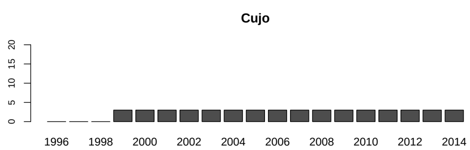
Analysis of August Phytoplankton Density in Lakes of the King-Cujo Watershed and Lac du Sauvage

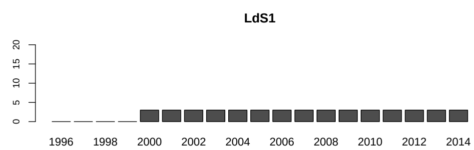
February 11, 2015

1 Censored Values:

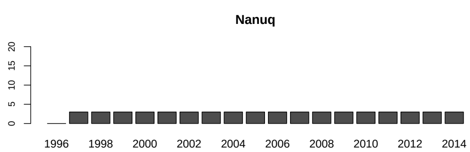
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

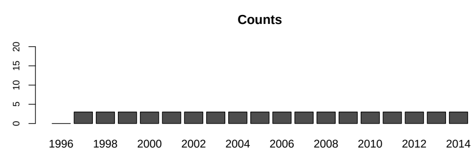
1.1 Monitored

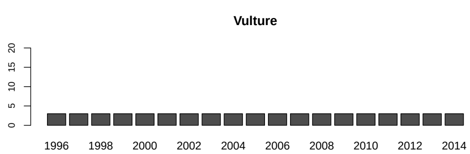




1.2 Reference

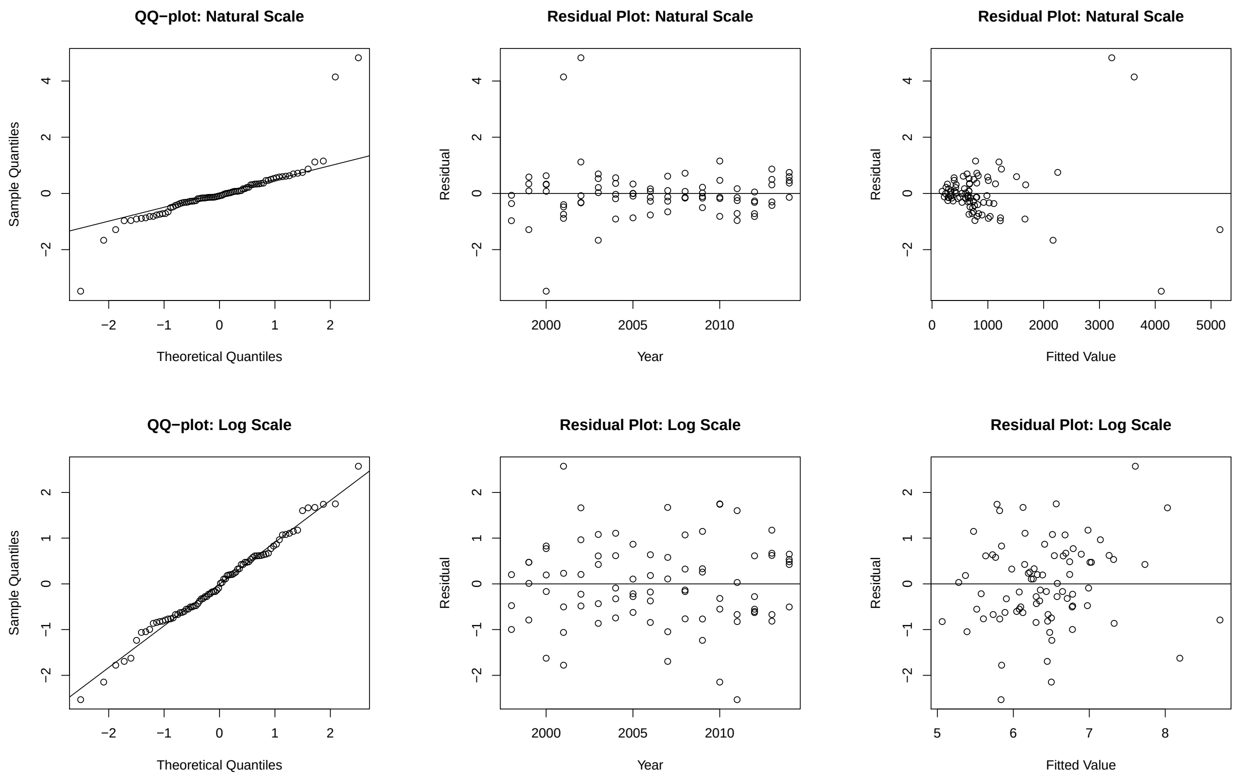






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
28	Cujo	2000	1725.73	4107.94	-3.48
29	Cujo	2001	6461.42	3622.99	4.14
30	Cujo	2002	6526.67	3220.97	4.83

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
4.17	6.00	0.65

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

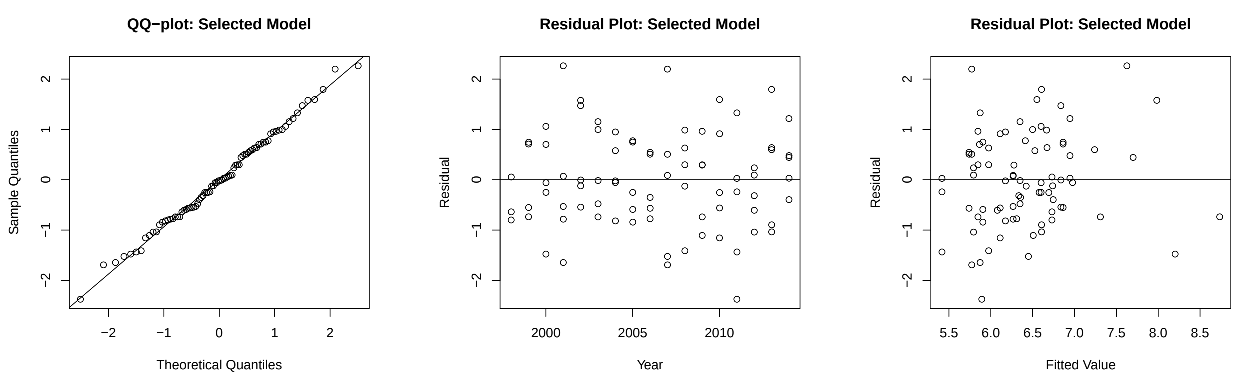
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.759	0.000	0.241	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope and intercept. Proceeding with monitored contrasts using reference model 3 (fitting a common slope and intercept for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.3 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-square	DF	P-value
Cujo	14.0023	3	0.0029
LdS1	7.5308	3	0.0568

- Conclusions:
  All monitored lakes show significant deviation from the common slope and intercept of reference lakes.

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-square	DF	P-value
Cujo	5.2036	2	0.0741
LdS1	5.7961	2	0.0551

- Conclusions:
  When allowing for differences in intercept, site LdS1 shows significant deviation from the common slope of reference lakes.

5 Overall Assessment of Model Fit for Each Lake

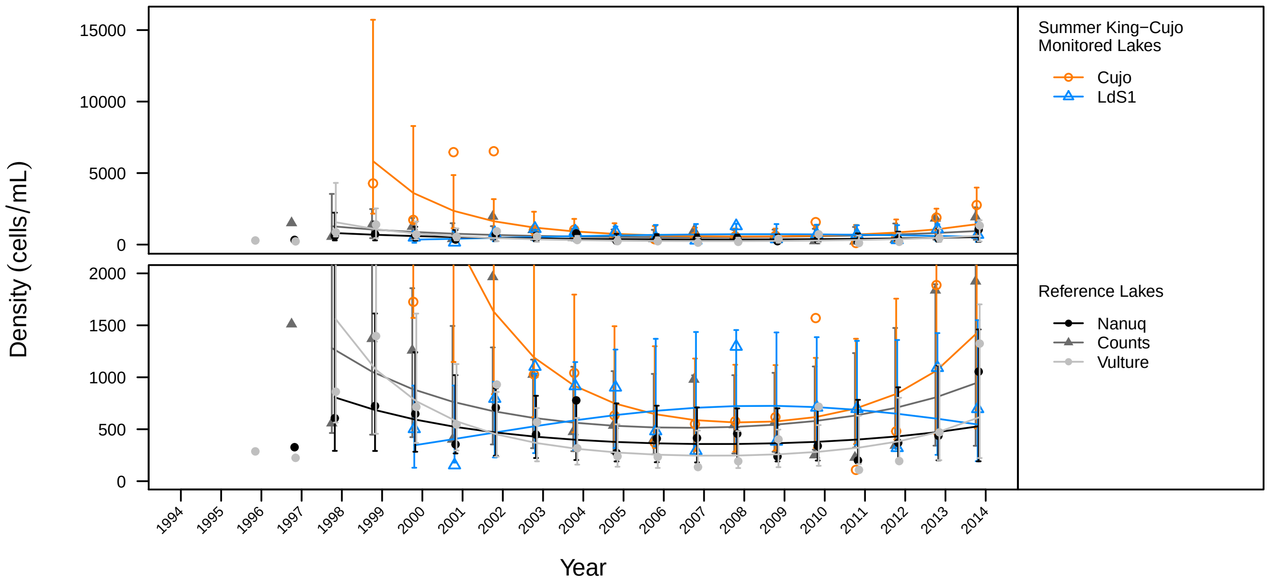
- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.2600
Monitored Lake	Cujo	0.4460
Monitored Lake	LdS1	0.1200

- Conclusions:

- Conclusions:
  Model fit for pooled reference lakes and Cujo Lake is weak. Model fit for site LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean phytoplankton density for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	2.77E+03	1.42E+03	7.48E+02	5.08E+02	3.99E+03	2.19E+03
LdS1	6.96E+02	5.46E+02	2.91E+02	1.92E+02	1.55E+03	8.50E+02
Nanuq	1.05E+03	5.28E+02	2.74E+02	1.91E+02	1.46E+03	
Counts	1.92E+03	9.42E+02	4.89E+02	3.41E+02	2.60E+03	
Vulture	1.32E+03	6.16E+02	3.19E+02	2.23E+02	1.70E+03	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Density	Summer	King-Cujo	Lake	Biology	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

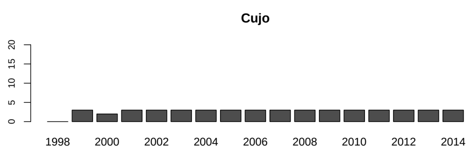
Analysis of August Zooplankton Biomass in Lakes of the King-Cujo Watershed and Lac du Sauvage

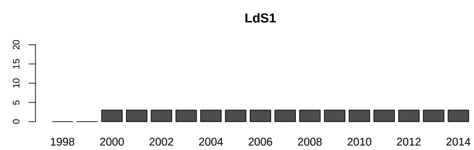
February 11, 2015

1 Censored Values:

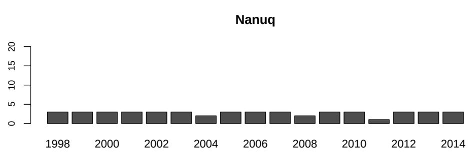
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

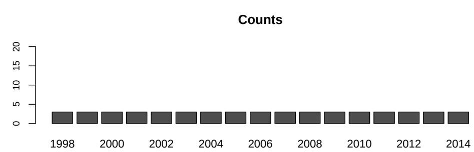
1.1 Monitored

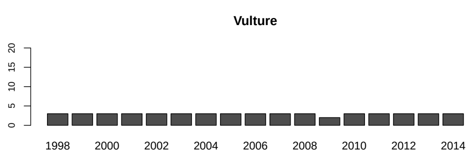




1.2 Reference

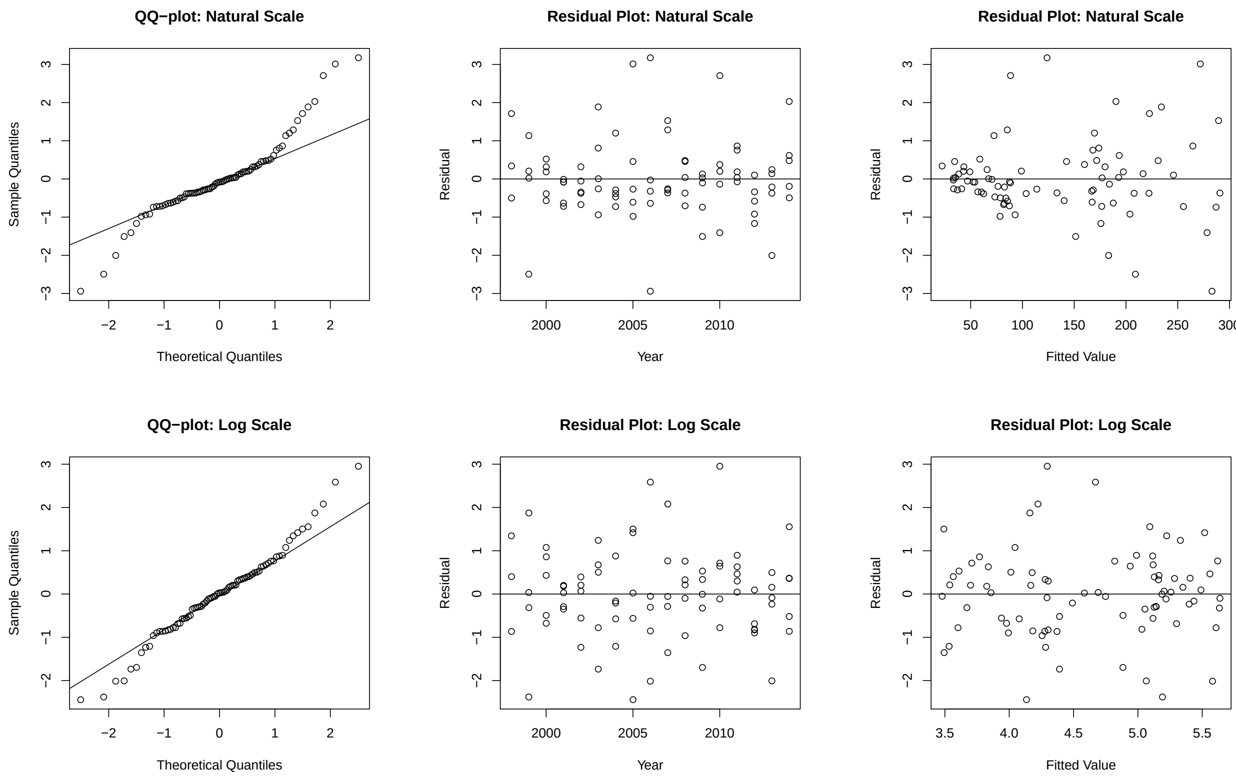






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	441.21	271.87	3.01
76	LdS1	2006	302.21	123.83	3.17

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
33.87	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
10.39	4.00	0.03

- Conclusions:
  The slopes differ significantly among reference lakes. Reference lakes do not fit reference model 2.

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference mode testing and reveal that the reference lakes are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1.

4 Test Results for Monitored Lakes

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored lake compared to a slope of zero (reference model 1a).

- Results:

	Chi-square	DF	P-value
Cujo	4.6307	2	0.0987
LdS1	6.0354	2	0.0489

- Conclusions:
  LdS1 shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to slope of each reference lake (reference model 1b).

- Results:

	Chi-squared	DF	P-value
LdS1-vs-Nanuq	5.2032	3	0.1575
LdS1-vs-Counts	38.4098	3	0.0000
LdS1-vs-Vulture	14.5338	3	0.0023

- Conclusions:
  LdS1 shows significant deviation from the slopes of individual reference lakes.

5 Overall Assessment of Model Fit for Each Lake

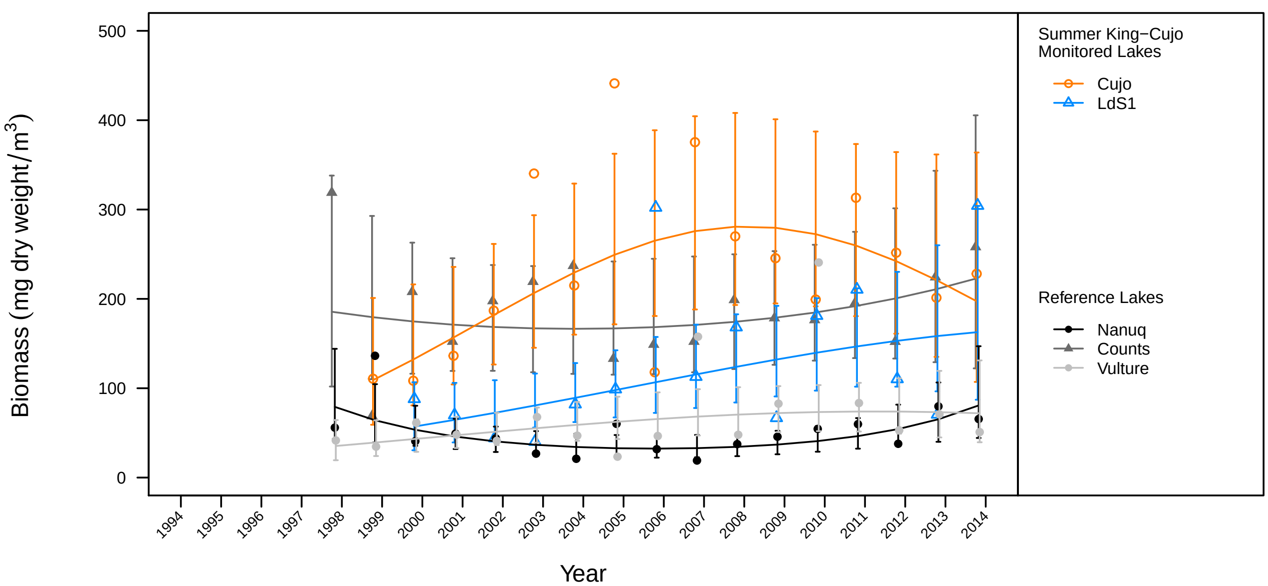
- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Reference Lake	Counts	0.0670
Reference Lake	Nanuq	0.4130
Reference Lake	Vulture	0.1930
Monitored Lake	Cujo	0.4360
Monitored Lake	LdS1	0.2920

- Conclusions:

- Conclusions:
  Model fit for Nanuq, Cujo, and LdS1 is weak. Model fit for Counts and Vulture is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean zooplankton biomass for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	2.28E+02	1.97E+02	6.16E+01	1.07E+02	3.64E+02	1.80E+02
LdS1	3.04E+02	1.63E+02	5.19E+01	8.71E+01	3.04E+02	1.52E+02
Nanuq	6.55E+01	8.07E+01	2.47E+01	4.43E+01	1.47E+02	
Counts	2.58E+02	2.23E+02	6.81E+01	1.22E+02	4.05E+02	
Vulture	5.09E+01	7.20E+01	2.20E+01	3.95E+01	1.31E+02	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Biomass	Summer	King-Cujo	Lake	Biology	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	NA	LdS1

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

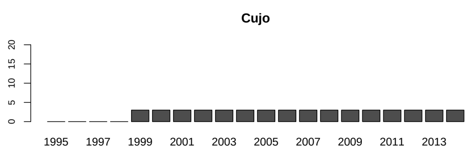
Analysis of August Zooplankton Density in Lakes of the King-Cujo Watershed and Lac du Sauvage

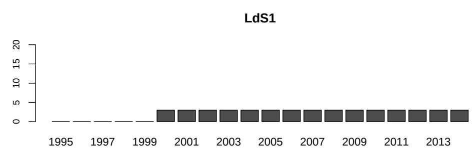
February 11, 2015

1 Censored Values:

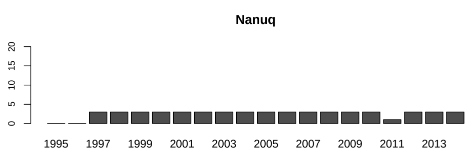
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

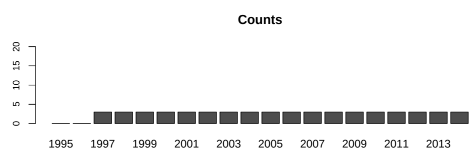
1.1 Monitored

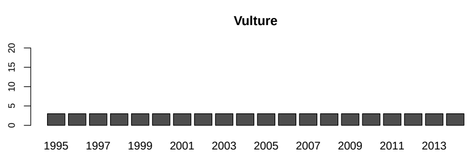




1.2 Reference

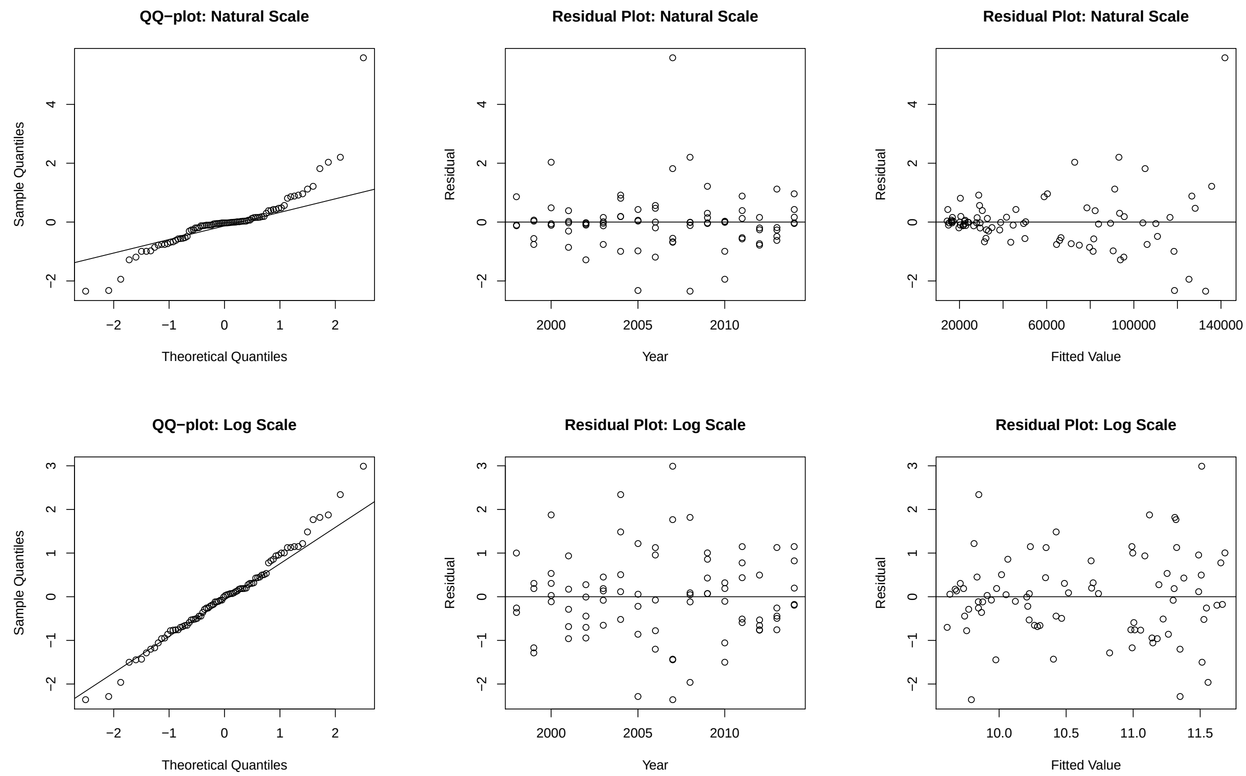






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
56	Cujo	2007	348239.66	141815.71	5.58

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
9.17	6.00	0.16

- Conclusions:
  The slopes and intercepts do not differ significantly among reference lakes.

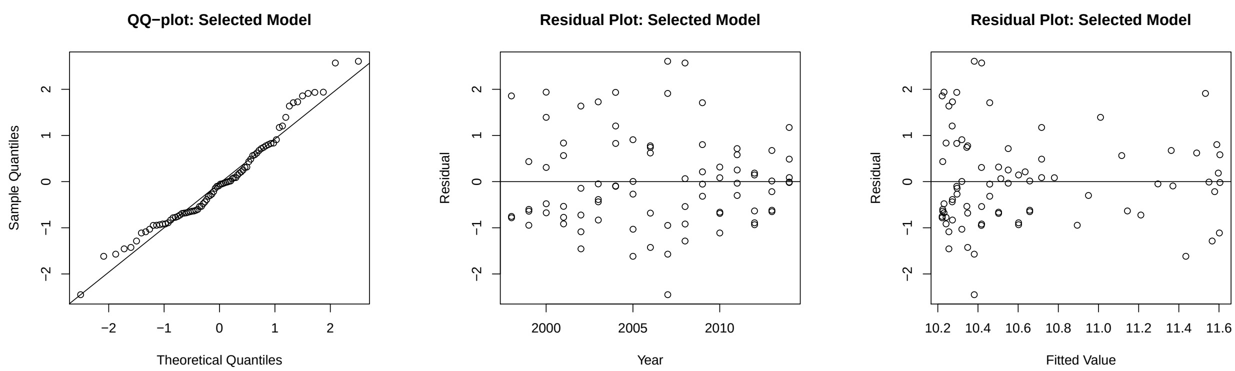
3.2 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope and intercept. Proceeding with monitored contrasts using reference model 3 (fitting a common slope and intercept for reference lakes) to avoid defaulting to comparing trends in monitored lakes against a slope of zero.

3.3 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
No extreme deviations from normality and equal variance found after fitting the reduced model using a common reference lake slope and intercept (reference model 3). Proceeding with remaining analyses using reference model 3.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the slope and intercept of each monitored lake compared to a common slope and intercept fitted for all reference lakes together (reference model 3).

- Results:

	Chi-square	DF	P-value
Cujo	2.1446	3	0.5430
LdS1	1.9044	3	0.5925

- Conclusions:
  No significant deviations were found when comparing monitored lakes to reference lakes.

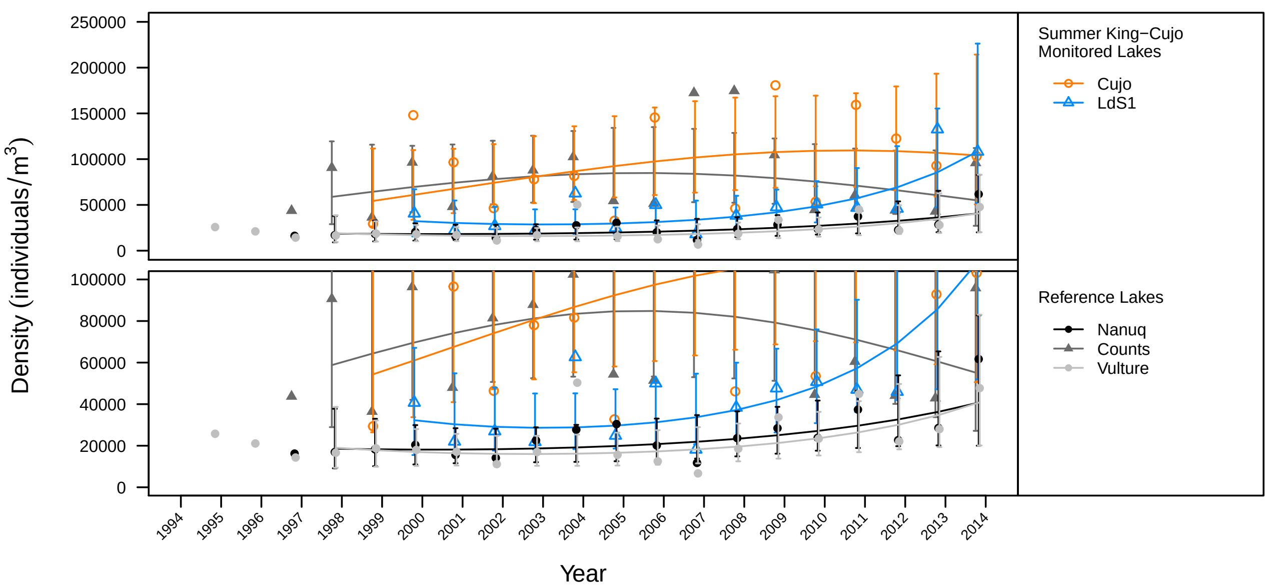
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0460
Monitored Lake	Cujo	0.1200
Monitored Lake	LdS1	0.5810

- Conclusions:
  Model fit for pooled reference lakes and Cujo Lake is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean zooplankton density for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	1.03E+05	1.04E+05	3.83E+04	5.06E+04	2.14E+05	1.12E+05
LdS1	1.08E+05	1.08E+05	4.07E+04	5.19E+04	2.26E+05	1.19E+05
Nanuq	6.17E+04	4.07E+04	1.47E+04	2.00E+04	8.27E+04	
Counts	9.59E+04	5.52E+04	2.00E+04	2.72E+04	1.12E+05	
Vulture	4.77E+04	4.09E+04	1.48E+04	2.01E+04	8.30E+04	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Density	Summer	King-Cujo	Lake	Biology	none	log e	linear mixed effects regression	#3 shared intercept & slope	NA	none

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

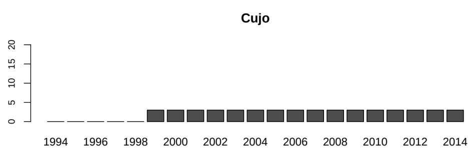
Analysis of August Benthos Density in Lakes of the King-Cujo Watershed and Lac du Sauvage

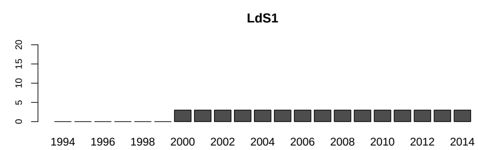
February 11, 2015

1 Censored Values:

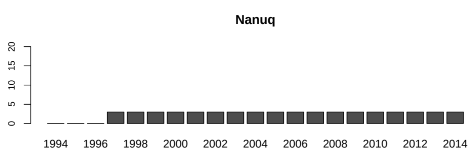
The following charts indicate the number of measurements taken in each year from each lake that were less than the detection limit (grey) or greater than the detection limit (black).

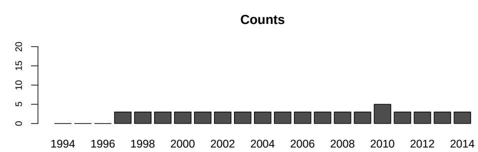
1.1 Monitored

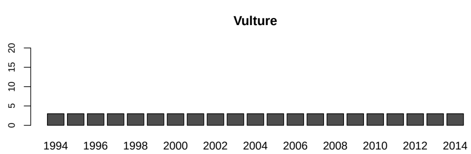




1.2 Reference

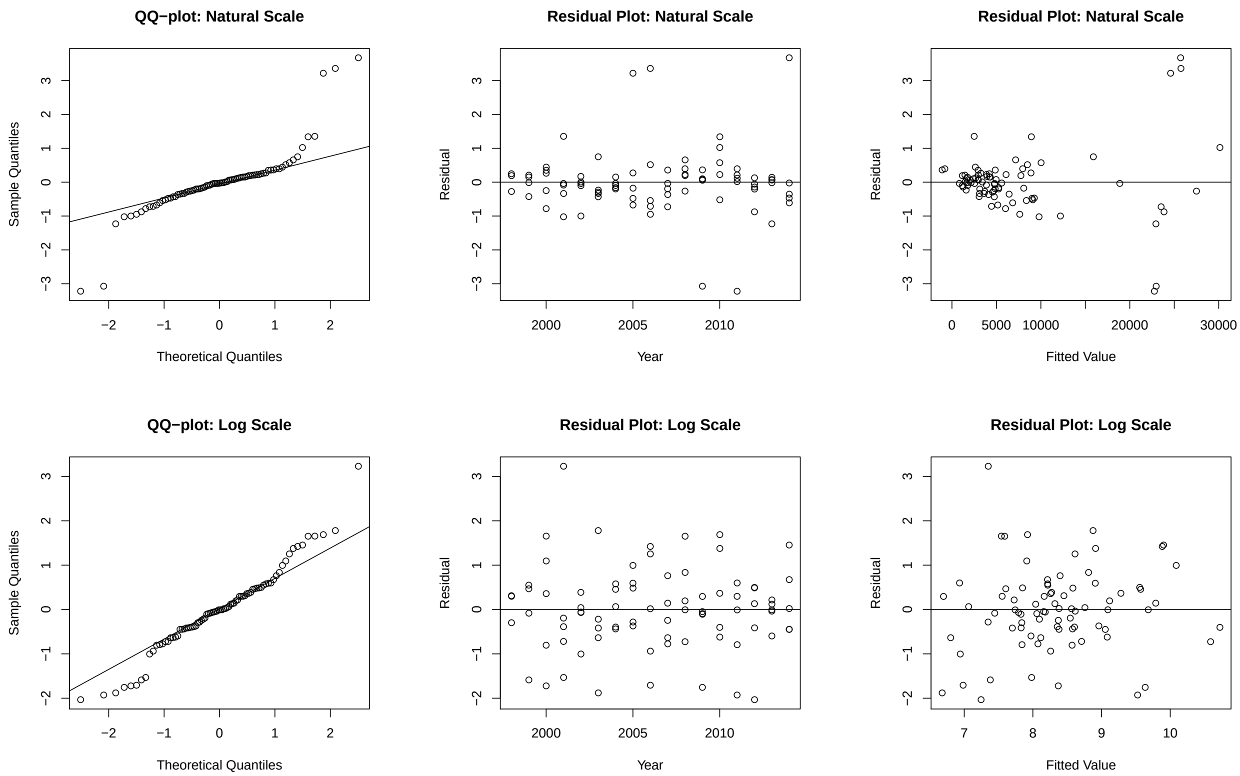






Comment:
None of the lakes exhibited greater than 10% of data less than the detection limit. Proceeding with linear mixed model regression for the remainder of the analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
54	Cujo	2005	42874.07	24590.93	3.22
55	Cujo	2006	44844.44	25754.30	3.36
58	Cujo	2009	5511.11	22970.66	-3.07
60	Cujo	2011	4464.19	22765.24	-3.22
63	Cujo	2014	46594.14	25714.85	3.67

Outliers on log scale:

	Lake	Year	Impute	Fitted	Std. Resid.
113	Nanuq	2001	10192.59	7.35	3.23

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
No extreme deviations from normality and equal variance found after fitting the log-transformed model. AIC reveals that the data is modeled best after log transformation. Proceeding with analysis using log-transformed model.

3 Comparisons within Reference Lakes

3.1 Compare Fitted Curves for All Reference Lakes: reference model 3

- Results:

Chi-square	DF	p-value
21.15	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference lakes. Reference lakes do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Lakes: reference model 2

- Results:

Chi-square	DF	p-value
5.88	4.00	0.21

- Conclusions:
  The slopes do not differ significantly among reference lakes.

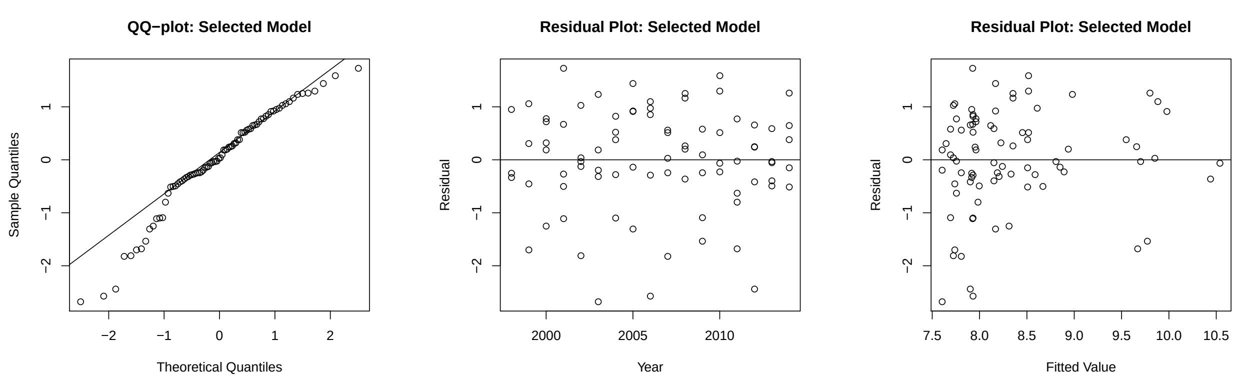
3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	1.000	0.000	0.000	Ref. Model 1

- Conclusions:
  Results of AIC do not agree with reference model testing. Although AIC suggests that reference lakes are best modeled using separate slopes and intercepts, contrasts suggest that reference lakes share a common slope. Proceeding with monitored contrasts using reference model 2 (fitting a common slope for reference lakes) to avoid defaulting to comparing trends in monitrored lakes against a slope of zero.

3.4 Assess Fit of Reduced Model



Outliers:

None

Conclusion:
Reduced model shows dependence on fitted value. Results should be interpreted with caution.

4 Test Results for Monitored Lakes

4.1 Comparisons Against Reference Lakes

Fitted model of the trend (slope) of each monitored lake compared to a common slope fitted to all reference lakes (reference model 2). This contrast does not test for differences in intercepts between reference and monitored lakes.

- Results:

	Chi-square	DF	P-value
Cujo	5.6960	2	0.0580
LdS1	1.0868	2	0.5808

- Conclusions:
  Cujo Lake shows significant deviation from the common slope of reference lakes.

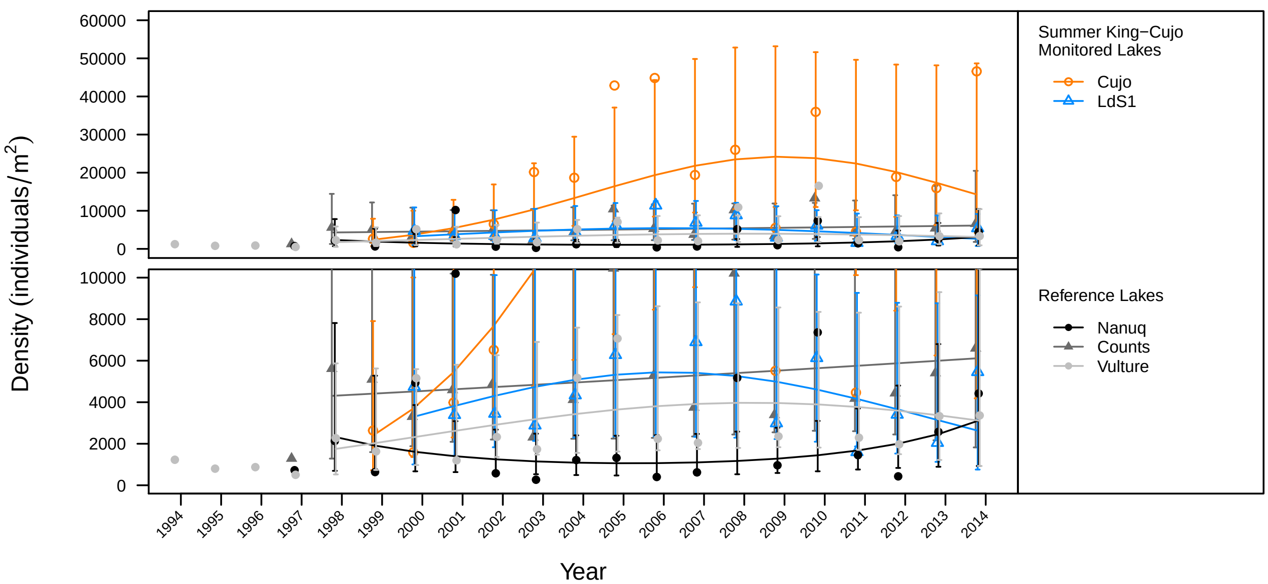
5 Overall Assessment of Model Fit for Each Lake

- R-squared values for model fit for each lake:

Lake Type	Lake Name	R-squared
Pooled Ref. Lakes	(more than one)	0.0200
Monitored Lake	Cujo	0.4540
Monitored Lake	LdS1	0.1720

- Conclusions:
  Model fit for Cujo Lake is weak. Model fit for pooled reference lakes and site LdS1 is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for lakes during baseline years are represented by symbols only. For lakes during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean benthos density for each monitored lake in 2014. Reference lakes are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo	4.66E+04	1.43E+04	8.94E+03	4.19E+03	4.87E+04	2.61E+04
LdS1	5.46E+03	2.63E+03	1.67E+03	7.58E+02	9.15E+03	4.90E+03
Nanuq	4.42E+03	3.12E+03	1.92E+03	9.30E+02	1.04E+04	
Counts	6.59E+03	6.11E+03	3.77E+03	1.82E+03	2.05E+04	
Vulture	3.36E+03	3.11E+03	1.92E+03	9.29E+02	1.04E+04	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transfor-mation	Model Type	Reference Model	Bench-mark	Significant Monitored Con-trasts*
Density	Summer	King-Cujo	Lake	Biology	none	log e	linear mixed effects regression	#2 shared slopes	NA	Cujo

* Monitored lakes are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference lake in model 1b, to the common slope of reference lakes in model 2, and to the common slope and intercept of reference lakes in model 3.

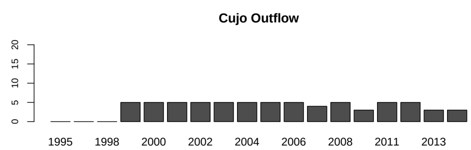
Analysis of Benthos Density in Streams of the King-Cujo Watershed and Lac du Sauvage

February 11, 2015

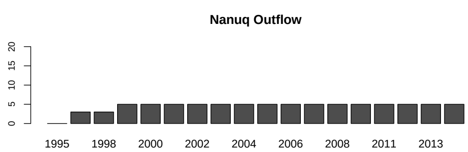
1 Censored Values:

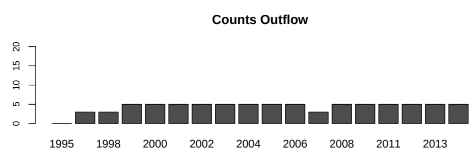
The following charts indicate the number of measurements taken in each year from each stream that were below the detection limit (grey) or above the detection limit (black).

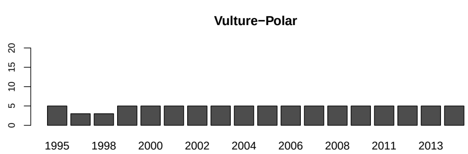
1.1 Monitored



1.2 Reference

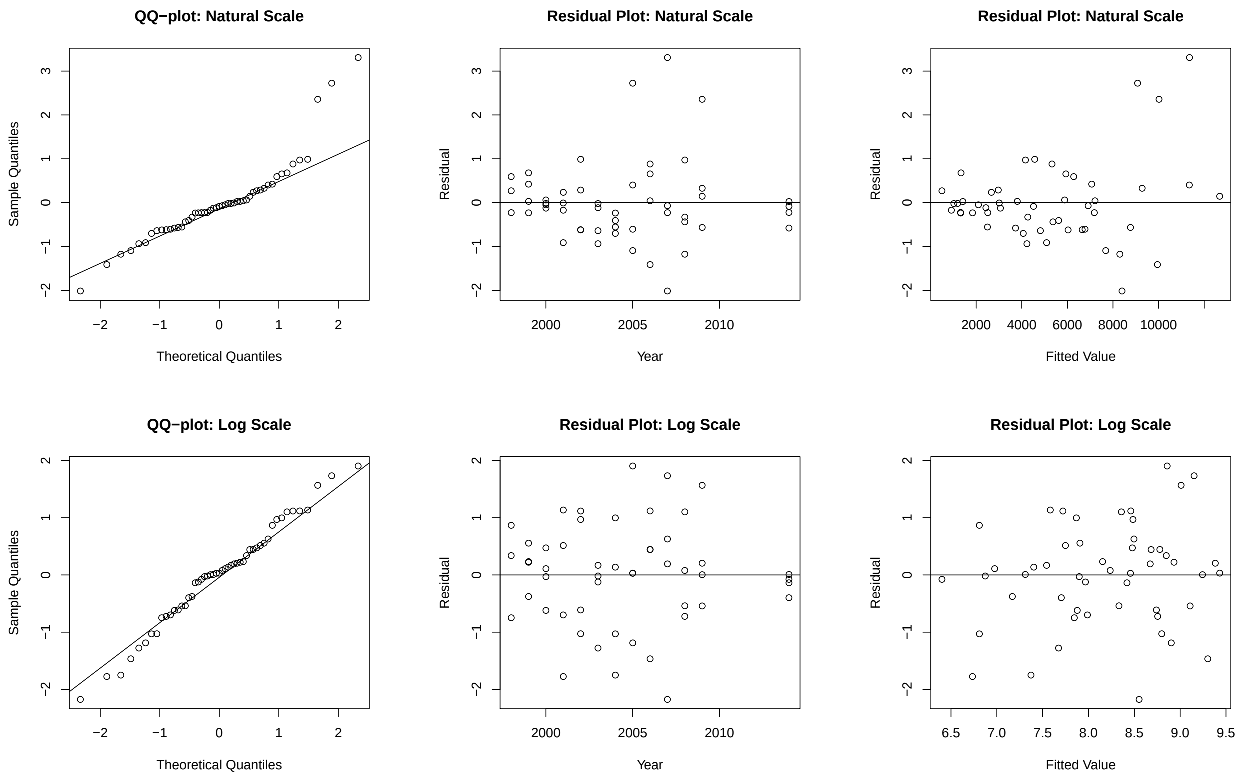






Comment:
None of the streams exhibited greater than 60% of data below the detection limit. We proceeded with linear mixed model regression for the remainder of the analyses. Note: Data from years 2011, 2012 and 2013 were excluded from statistical analyses.

2 Initial Model Fit



Outliers on natural scale:

	Lake	Year	Impute	Fitted	Std. Resid.
77	Cujo Outflow	2007	22252.75	11355.58	3.31

Outliers on log scale:

None

AIC weights and model comparison:

	Un-transformed Model	Log-transformed Model	Best Model
Akaike Weight	0.000	1.000	Log-transformed Model

Conclusion:
The natural and log-transformed models show dependence on year. The log-transformed model best meets the assumptions of normalty and equal variance. AIC also reveals that the data is best modeled after log transformation. Proceeding with anlaysis using log-transformed model. Results of statistical tests should be interpreted with caution.

3 Comparisons within Reference Streams

3.1 Compare Fitted Curves for All Reference Streams: reference model 3

- Results:

Chi-square	DF	p-value
26.35	6.00	0.00

- Conclusions:
  The slopes and intercepts differ significantly among reference streams. Reference streams do not fit reference model 3. Continuing with test of reference model 2 (fitting a common reference slope).

3.2 Compare Trend for All Reference Streams: reference model 2

- Results:

Chi-square	DF	p-value
11.34	4.00	0.02

- Conclusions:
  The slopes differ significantly among reference streams. Reference streams do not fit reference model 2. Continuing with monitored contrasts using reference model 1 (fitting separate slopes and intercepts for reference streams).

3.3 Compare Reference Models using AIC Weights

- Results:

	Ref. Model 1	Ref. Model 2	Ref. Model 3	Best Model
Akaike Weight	0.995	0.000	0.005	Ref. Model 1

- Conclusions:
  AIC results are in agreement with reference model testing and reveal that the reference streams are best modeled with separate slopes and intercepts. Proceeding with monitored contrasts using reference model 1b (fitting separate slopes and intercepts for reference streams).

4 Test Results for Monitored Streams

4.1 Comparisons Against a Slope of Zero

Fitted model of the trend (slope) of each monitored stream compared to a slope of zero (reference model 1a).

- Results:

	Chi-square	DF	P-value
Cujo Outflow	11.4216	2	0.0033

- Conclusions:
  Cujo Outflow shows significant deviation from a slope of zero.

4.2 Comparisons Against Reference Streams

Fitted model of the trend (slope) of each monitored stream compared to slope of each reference stream (reference model 1b).

- Results:

	Chi-squared	DF	P-value
Cujo Outflow-vs-Nanuq Outflow	4.2522	3	0.2355
Cujo Outflow-vs-Counts Outflow	13.5886	3	0.0035
Cujo Outflow-vs-Vulture-Polar	5.1346	3	0.1622

- Conclusions:
  No significant deviations were found when comparing monitored streams to reference streams.

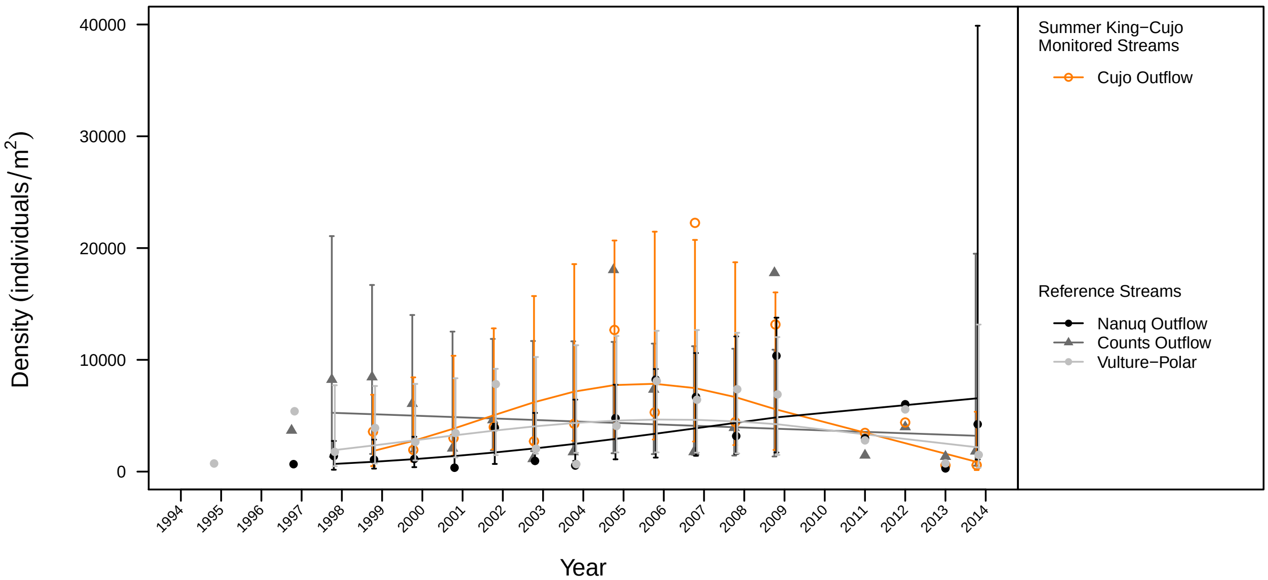
5 Overall Assessment of Model Fit for Each Stream

- R-squared values for model fit for each stream:

Stream Type	Stream Name	R-squared
Reference Stream	Counts Outflow	0.0230
Reference Stream	Nanuq Outflow	0.4140
Reference Stream	Vulture-Polar	0.1700
Monitored Stream	Cujo Outflow	0.5460

- Conclusions:
  Model fit for Nanuq Outflow is weak. Model fit for Counts Outflow and Vulture-Polar is poor. Results of statistical tests and MDD should be interpreted with caution.

6 Observed and Fitted Values



Note: The yearly observed mean for streams during baseline years are represented by symbols only. For streams during monitored years, the yearly observed mean is shown by symbols, and the mean and 95% confidence interval estimated by model fitting is represented by curved horizontal lines and vertical bars respectively. For years 2011 to 2013, only observed means are plotted. No confidence intervals are included as data from these years were not used in statistical analyses.

7 Minimum Detectable Differences

The estimated minimum detectable difference in mean benthos density for each monitored stream in 2014. Reference streams are shown for comparison.

	Observed	Fitted	SE Fit	Lower	Upper	Min. Det. Diff
Cujo Outflow	5.80E+02	8.72E+02	8.07E+02	1.42E+02	5.35E+03	2.36E+03
Nanuq Outflow	4.24E+03	6.56E+03	6.04E+03	1.08E+03	3.99E+04	
Counts Outflow	1.82E+03	3.21E+03	2.95E+03	5.27E+02	1.95E+04	
Vulture-Polar	1.50E+03	2.16E+03	1.99E+03	3.56E+02	1.32E+04	

8 Final Summary Table

Parameter	Month	Watershed	Water Body	Analysis	Lakes & Streams Removed	Data Transformation	Model Type	Reference Model	Benchmark	Significant Monitored Contrasts*
Density	Summer	King-Cujo	Stream	Biology	none	log e	linear mixed effects regression	#1b separate intercepts & slopes	NA	none

* Monitored streams are contrasted to a slope of 0 in reference model 1a, to the slope of each individual reference stream in model 1b, to the common slope of reference streams in model 2, and to the common slope and intercept of reference streams in model 3.