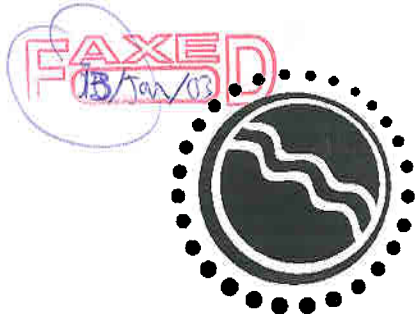


~~1/13/03~~  
1/13/03



# Mackenzie Valley Environmental Impact Review Board

Box 938, 5102-50th Avenue, Yellowknife, NT X1A 2N7

**Date:** Mon., Jan. 13<sup>th</sup>, 2003  
**From:** Alan Ehrlich, A/ Manager of Environmental Impact Assessment  
**Pages:** 12 (including these 3 cover pages)  
**File:** EA02-002 WesternGeco Mackenzie River 2D Seismic Program  
**Subject:** Comments on Draft Terms of Reference + Workplan

*The following letters (from DIAND and DFO) contain comments on the draft Terms of Reference and Workplan for this environmental assessment. Also included in this fax are DFO's comments on draft research results by WesternGeco. All of this will be placed on the Public Registry.*

*Sincerely,*

*Alan Ehrlich  
A/ Manager of Environmental Impact Assessment  
Mackenzie Valley Environmental Impact Review Board  
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**Mackenzie Valley**

Chris Paci, Dene Nation	920-2254
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81

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Gordon Yakeleya, Tulita Land and Financial Corporation (867) 588-4025  
Rocky Norwegian, Hamlet of Tulita (867) 588-4908  
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Indian and Northern Affairs Canada  
Affaires indiennes et du Nord Canada

Environment & Conservation  
P.O. Box 1500  
Yellowknife, NT X1A 2R3

January 9, 2003

Mr. Alan Ehrlich  
Environmental Assessment Officer  
Mackenzie Valley Environmental Impact Review Board  
P.O. Box 938  
Yellowknife, NT X1A 2N7

Your file: *Valley references*

Our file: *Noting references*

YEL-N 7392-7-A2-15

**Re: Western Geco Draft Terms of Reference**

Dear Mr. Ehrlich,

The Department of Indian Affairs and Northern Development (DIAND) has reviewed the draft terms of reference and provides the following comments.

Spill contingency plans should be provided as part of the environmental assessment documentation. The developer should also provide a full accounting of its fuel handling and waste disposal procedures.

In Section 3: Scope of the Assessment, details regarding the decommissioning of the operation should be included (e.g. barges taken back to Hay River, etc.).

Under section 4.7, the developer should also provide the dates and participants of each consultation meeting.

It is not clear why the Benefits Plan along with the schedule for its completion is being requested in the draft terms of reference. The benefits plan is not a contractual document and is not intended to require that mitigation and follow-up monitoring be implemented. It is more appropriate to focus on the actual Geological Operation Authorization that may be granted by the National Energy Board should the proposal be allowed to proceed. It is our understanding that it is this legal instrument that can dictate mitigation measures and follow-up requirements.

Should you have any questions, please contact me at (867) 669-2591.

Sincerely,

Elaine Blais  
Environmental Scientist  
Environment & Conservation

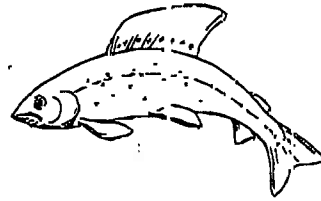
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Fisheries  
and Oceans

Pêches  
et Océans



Fish Habitat Management  
P.O. Box 1871  
Inuvik, Northwest Territories  
XOE 0T0

January 7<sup>th</sup> 2003

TO/A:  
Alan Ehrlich  
Mackenzie Valley Environmental Impact  
Review Board

Copy:  
Laura Van Ham - NEB

DFO File No. SC02019

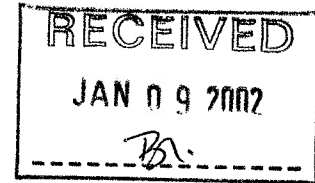
MESSAGE

FAX

(867) 766-7074

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page 1 of 3



**RE: WesternGeco, Mackenzie River 2D Seismic Program 2003 (Re-Activation) -DFO  
Comments on Draft Terms of Reference.**

FROM/DE:

Pete Cott  
Area Habitat Biologist  
Western Arctic Area

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Canada



Fisheries  
and Oceans

Pêches  
et Océans

Fish Habitat Management  
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X0E 0T0

Your file *Voire référence*

Our file *Notre référence*  
SC02019

January 9, 2003

Alan Ehrlich  
Mackenzie Valley Environmental Impact Review Board  
Sent by Fax (867) 766-7074

**RE: WesternGeco, Mackenzie River 2D Seismic Program 2003 (Re-Activation)  
DFO Comments on Draft Terms of Reference.**

Dear Alan,

The Department of Fisheries and Oceans, Western Arctic Area (DFO) has reviewed the Draft Terms of Reference for the above mentioned project proposal. The following are suggested additions:

- 1) **Page 7, Section 4.5 Alternatives:** A clear rationale should also be given for why WesternGeco is proposing to use the 1500 cubic inch airgun arrays over the 1000 and 1250 cubic inch arrays that were tested along with the 1500 cubic inch during the summer of 2002.
- 2) **Page 7, Section 4.8 Noise:** Additional bullets for this section should be:
  - noise thresholds for fish species likely to be encountered (all life stages)
  - pressure as it relates to noise and the possible effects on fish likely to be encountered (all life stages)
- 3) **Page 8, Section 4.9 Aquatic Resources:** The third bullet should be changed to read: "potential impacts of airguns on all life stages of fish species that are likely to be present in the Liard and Mackenzie rivers at the time of the seismic survey, including physical and behavioural effects;"
- 4) **Page 8, Section 4.9 Aquatic Resources:** The fourth bullet should be changed to read: "details of mitigation measures to prevent mortality, injury or adverse behavioural changes to fish (all life stages), including, but not limited to, ramping up procedures;"
- 5) **Page 8, Section 4.9 Aquatic Resources:** Additional bullets for this section should be:
  - potential impacts of airguns on invertebrates
  - effects on subsistence and recreational fisheries in the project area
  - shutdown protocol in the event that fish mortality or stress is detected

If you have any questions feel free to contact me at (867) 777-7520 or Bruce Hanna at (867) 669-4931.



Pete Cott  
Area Habitat Biologist  
Fish Habitat Management  
Department of Fisheries and Oceans- Western Arctic Area

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Bruce Hanna, Habitat Biologist - DFO  
Kathleen Simms, Habitat Biologist - DFO  
Laura Van Ham - NEB

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and OceansPêches  
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X0E 0T0Your file *Votre référence*Our file *Notre référence*

SC02052

January 7, 2003

Keith Rosindell  
WesternGeco  
Suite 2300, 645-7<sup>th</sup> Ave SW  
Calgary, Alberta  
T2P 4G8**RE: Draft Report "Behaviour and Physical Response of Riverine Fish to Airguns" prepared by IMG-Golder for WesternGeco in support of the Mackenzie River/ Delta 2D Seismic Programs 2002: DFO Comments**

Dear Keith,

As we've discussed, below is a written summary supporting the views of DFO presented by Eric Gyselman, Regional Hydro-Acoustics Specialist, during the workshop in Calgary on December 5, 2002, that he participated in via telephone link. These comments are being provided to assist in the further development and refinement of the Draft Report "Behaviour and Physical Response of Riverine Fish to Airguns" prepared by IMG-Golder for WesternGeco. Many of the comments/ concerns can be addressed through revising the draft report, providing more supporting documentation or outlining project and study design limitations clearly. As I indicated at the December 5 meeting, if there are outstanding issues that cannot be addressed through report revisions, there may be opportunity for them to be addressed in the field during the seismic program if it proceeds.

From DFO's perspective the contents of the finished report will be one of the main considerations when assessing the WesternGeco Mackenzie River/ Delta 2D Seismic Programs 2003.

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Start of comments by Eric Gyselman

I think all parties agree that little high quality information is available on the effects of seismic airguns on fish and other aquatic biota in riverine environments. Some information is available for marine waters but this cannot be directly applied to rivers because of the drastically different physical structure in rivers. From a biological perspective, I have two critical concerns: 1) does the sound spectrum and intensities of the seismic airguns adversely affect biota in river and 2) can the biota successfully avoid the potentially harmful sound source. We discussed these issues in the spring and subsequently made recommendations to

**Canada**

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SC02052



WesternGeco and IMG-Golder that we felt would begin to attempt to answer these questions.

IMG-Golder's biological program had three components:

- 1) an experiment to measure the potential lethal and sublethal effects of the seismic sound source on fish,
- 2) an experiment to measure the swimming reaction of fish to the seismic sound source
- 3) an experiment to measure fish avoidance of the seismic sound source, specifically 'herding' upstream in front of the seismic ship

In my view, the experimental design of the three experiments was reasonable especially considering the operational constraints that IMG-Golder was expected to carry out this research with. Time was limited and experimental fish of the size and species required were difficult to catch. Given these constraints, I believe IMG-Golder did a reasonable job in achieving their objectives. However, their results are by no means conclusive and I do not believe that the definitive conclusions presented in the draft report can be substantiated by the data presented. The following are my principal concerns:

#### 1) Potential Lethal and Sub-lethal Effects

The species and range of sizes in each species used in Experiment #1 was limited. In fact, no coregonids, the species that make up almost the entire subsistence fishery in the lower Mackenzie River and Delta, were used. The species that were used are considered 'hardy' relative to the whitefishes. Therefore, the potential impact of the seismic airguns on the subsistence fishery is still unclear. Of particular concern is the impact on the large number of young-of-the-year that are carried out of their natal streams and into the Mackenzie River in the spring. In my opinion, this is a critical issue. We do not fully understand how this migration takes place and these small fish do not have the swimming capability to avoid the seismic survey ship. I am also concerned that some of the fish in the cage closest to the airguns were apparently 'stunned' but that no one from IMG-Golder could explain the physiological effect that resulted in the 'stunning'. The fact that the necropsies showed no gross physiological abnormalities seems to result in the conclusion that the fish were unharmed. I would argue that 'stunning' is a consequence of exposure to the sound. The physiological cause is still unknown and since the observation time after exposure was short (48-hours), the long-term effects of the sound are not known. I do not believe from this work that we can conclude that the seismic airguns will have no effect on biota in the Mackenzie River and, of particular concern, that the seismic survey will not impact the subsistence fishery in the three land claim areas.

#### 2) Swimming Reaction

The experiment to measure the reaction of fish to the seismic airgun by aiming the beam of the scientific sounder horizontally along the airgun array was a valid design to achieve the objective. However, the results presented are minimal. In the draft report, no explanation of the methodology used to actually calculate the

swimming vectors was presented nor were any data presented other than one table that stated that only one fish moved away from the array. Furthermore, the sample size of tracked fish was small (<40), all of the targets were small, and the experiment was only carried out at one location. IMG-Golder also seems to assume that the only possible swimming vector that would demonstrate a reaction to the airgun is a horizontal one away from the airgun. Other vectors are possible and, in fact, the fish may react in a chaotic manner if they are stunned or partially stunned as was demonstrated in the cage experiment. Perhaps a change in vector or velocity would be a better measure of effect than simply looking for a preconceived behaviour. I was also concerned with lack of a clear understanding of the difficulties of acoustically tracking fish movement. Obviously, my concern is based on the limited discussion with the IMG-Golder staff during the workshop and the material presented in the draft report. However, I have spent a considerable amount of time working with colleagues in Alaska and with DFO Pacific on fish tracking in rivers and I am not convinced (although my mind could be changed) that these results are valid. For example, when I asked IMG-Golder whether they had used target strength as a parameter for determining a fish track, they responded that they had. In fact, target strength is a very poor parameter to use because it is so highly variable depending on the aspect of the fish that is presented to the beam. Apparently, no validated software was used to track targets. It seems to have been done by simply looking at target locations in subsequent pings and assuming they were the same fish. Finally, no information was collected on the species of fish being insonified. Therefore, the use of the generalized term 'fish' in the report and particularly the conclusions is not supported. The fish could have all been of one species, for example. Certainly the fish insonified are not representative of the all of the fish in the Mackenzie River because the targets were all quite small acoustically which, by inference, are small physically.

### 3) Fish Avoidance

In an attempt to measure avoidance behaviour of fish with the passing of the seismic ship, IMG-Golder ran a series of transects across the river well before, immediately before, immediately after, and well after the seismic ship passed a particular location. Four transects were run in each of the three test areas in an effort to look at a number of different bottom contour shapes. The hypothesis was that the fish would be 'herded' upstream as the vessel approached. Consequently, this was the only avoidance behaviour considered to be significant. In my opinion, the survey design was reasonable but the way the experiment was conducted was flawed. My primary concern is that a number of assumptions are made that were not validated resulting in results that must be considered suspect. I can think of three that may have a significant impact on the interpretation of the results. First, each series of transects was carried out over a 6 to 8-hour period. IMG-Golder assumes that the distribution and density of fish did not change naturally over this time period. Second, IMG-Golder assumes that each transect is run over exactly the same track and therefore they are measuring exactly the same cross-section of river on each transect. In a dynamic river such as the Mackenzie this is nearly impossible. Finally, IMG-Golder assumes that the acoustic survey launch has no

impact on the density and distribution of fish in the river, that is, the fish demonstrate no vessel-avoidance behaviour towards their launch. The degree to which these assumptions affect the results is not addressed in the draft report. However, in my opinion, a violation of any of these assumptions could result in a bias in the measurement of the distribution and density of fish that could mask the true behaviour of the fish to the seismic survey ship. I believe a number of other problems exist with the data collected. Almost all of the targets are very small. IMG-Golder predicted that the mean length of the targets calculated from Love's conversion of target strength to body length was about 15-cm. From modelling work we have done in my lab, I believe the mean is closer to 10-cm. However, the point is that almost all of the targets are small. Very few large fish were seen acoustically. I can think of three possible reasons for this: 1) they were not in the river, 2) they were not in the part of the river being surveyed, or 3) they exhibited avoidance behaviour towards the acoustic survey launch. Reason #1 seems unlikely given the high density of migratory species in the river. Reason #2 is possible considering that in some cases half the river was too shallow to survey acoustically. In other large rivers (ex. Fraser), migrating fish stay very close to the bottom and near the shore because that is where the current is lowest and consequently they expend the least amount of energy to swim. If this is the case in the Mackenzie, then many fish would be missed. Vessel avoidance (Reason #3) has been well documented for many species including coregonids. The narrow beam used in this study (7 dg) has a very small footprint (1.2-m in 10-m of water depth). Fish in the water column below the survey vessel need only move a very short distance to the side to be out of the beam. The result of this under-representation of large fish is that no conclusion about their behaviour relative to the seismic survey ship can be made irrespective of violations of the other assumptions discussed above. A final concern that I have with this part of the study was that no attempt was made to identify which species were being insonified. Consequently, we do not know whether the results apply to all fish species in the Mackenzie or whether only one or two species that were actually measured acoustically. All of my comments in this section lead me to question the certainty of the conclusions reached in the draft report. We do not know whether the measured changes in density and distribution were caused by the influence of the seismic survey ship, we do not know whether the density and distribution fish observed acoustically was representative of all sizes of fish in the river, and, finally, we do not know whether the density and distribution observed was representative of all fish species in the river.

All of the criticisms above must be taken within the context of the conclusions presented in the report. Useful information was collected during this study. However, it was not definitive. The conclusions imply that we now have a very clear understanding of the behaviour of fish (apparently all sizes and species!) in the river with respect to the seismic survey and that the seismic survey will have no impact on the fish. Regardless of whether this proves to be ultimately true or not, the evidence from this study does not clearly support this conclusion.

I also have a few minor points that I would like to see cleaned up in the final report for the sake of clarity and to prevent misunderstanding and confusion.

1. In the text of the report, the authors call the scientific sounder both a split-beam system (which it is) and a dual-beam system (which it is not) (ex. Page 7). These are two quite different acoustic systems. Three-dimensional target location cannot be done with a dual-beam system.
2. On page 10 and other locations, the authors give a ping rate of 1 ping every 4 seconds. I believe they mean 4 pings per second.
3. The authors give not indication of the duration of each of the transect series which apparently was about 6 to 8 hours. I only found out by asking during the workshop. A table of transect start and stop times should appear in the text or appendix.
4. The beam width and pulse length are not given in the text. This is important information. I only discovered what they were by looking at the header file for the sample data output in the Appendices.
5. No methodology, analytical procedure, nor vector map is given for the target tracking experiment. A rudimentary table is supplied but this is insufficient.

End of comments by Eric Gyselman

---

If you have any questions feel free to contact me at (867) 777-7520 or Bruce Hanna at (867) 669-4931.



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Area Habitat Biologist  
Fish Habitat Management  
Department of Fisheries and Oceans - Western Arctic Area

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Eric Gyselman - DFO Science  
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Allen Ehrlich - MVEIRB