Northern Gateway Pipelines Limited Partnership ("Northern Gateway") Section 52 of the *National Energy Board Act* Application for Enbridge Northern Gateway Project NEB File No.: OF-Fac-Oil-N304-2010-01 01

Raincoast Conservation Foundation Response to Northern Gateway Information Request No. 1

1.1 Composition

Reference:

Written Evidence of Raincoast Conservation Foundation (A37896).

Preamble:

Northern Gateway requires additional background information on the Raincoast Conservation Foundation

Request:

(a) Please provide a description of the Raincoast Conservation Foundation.

(b) Does the Raincoast Conservation Foundation prepare Annual Reports? If so, please provide the most recently published Annual report available.

(c) If the Raincoast Conservation Foundation is a collection of like-minded individuals, please list its members.

(d) Did the Raincoast Conservation Foundation apply for and receive participant funding in this proceeding? If so, how much was received?

Response:

(a) A description of the Raincoast Conservation Foundation ("Raincoast") can be found online at <http://www.raincoast.org/about-raincoast/>.

(b) This question is not relevant to any of the issues before the Panel. However, Raincoast is willing to provide the information nonetheless. The Annual Report is a publicly available document which can be found online at <http://www.raincoast.org/wp-content/uploads/TrackingRaincoast_2012-low.pdf>.

(c) This information is publicly available online at <http://raincoast.org/about-raincoast/our-staff/>.

(d) This question is not relevant to any issue before the Panel. However, Raincoast is willing to provide the information. Raincoast received participant funding in the amount of $83,790. This information is publicly available online at <http://www.ceaa-acee.gc.ca/050/document-eng.cfm?document=41642>.

1.2 Risk Report

Reference:

Evaluating external risk to protected areas; the proposed Northern Gateway oil pipeline in British Columbia, by Chris T. Darimont et al (A2K3H2).

Preamble:

The Reference acknowledges that the proposed pipeline route directly avoids all protected areas in BC (adobe page 5).

The Reference concludes that "identifying areas where risk might be greatest, for example, provides managers the opportunity to plan how resources for spill responses might be distributed over space."

Request:

(a) Please advise as to whether the term "managers" includes Northern Gateway, or simply park managers and policy makers.

(b) The highest risk rankings assigned to a protected area include Monkman Park and Guillim Lake Park, which are 45.73 km and 205.43 km from the proposed pipeline, respectively. Please describe in detail how managers of these two parks, or others, should distribute spill response resources in light of these findings.

(c) Please advise as to whether these two parks are downstream from the location of the Year 2000 rupture on the Pembina Plateau pipeline which entered the Pine River.

(d) Please advise as to whether the Pembina rupture had any noticeable effect on either the Monkman Park or the Guillim Lake Park. If so, provide specific evidence of such effect.

(e) Among the second-ranked parks listed is the Edge Hills Park, in the Fraser River watershed, which is 503.81 km from the proposed right of way. Given the mitigation measures proposed by Northern Gateway, please describe the specific steps that managers of the Edge Hills Park should take if the Project is approved.

(f) Please describe the specific measures currently employed by managers of the Edge Hills Park to respond to potential spill events from pipelines, trains, or other liquids transporters within 500km upstream of the park.

(g) Do these include measures to protect earthworms in the Edge Hills Park, as per the discussion of potential effects of spills at page 15 of the Report?

(h) The Acknowledgements portion of the study thanks Patagonia, Wilburforce Foundation and Morisla Foundation and acknowledges support from NSERC USRA, and NSERC IRDF awards. Please explain who each of these organizations are, and where they are based.

Response:

(a) The term “managers” is used broadly to include park managers and policy makers at all levels of government, including First Nations, and Enbridge managers.

(b) The purpose of the reference was to provide a risk assessment procedure. It is not within Raincoast’s expertise to provide detailed guidelines for emergency planning and readiness related to oil spill response and management in these parks. Northern Gateway should refer to park managers for this information. If Provincial and Federal emergency response plans are not already in place, Raincoast considers this a critical deficiency in preparedness to respond to pipeline leaks and spills.

(c) This is not within Raincoast’s knowledge.

(d) This is not within Raincoast’s knowledge. “Noticeable effects” require that appropriate and satisfactory pre- and post-spill monitoring occurred. Accordingly, an absence of evidence might relate more to a lack of effort than an absence of an effect. An axiom in science is, “absence of evidence is not evidence of absence”.

(e) It is not within Raincoast’s expertise to provide detailed guidelines for emergency planning and readiness related to oil spill response and management in these parks. Raincoast refers Northern Gateway to park managers for this information.

(f) This is not within Raincoast’s knowledge. Raincoast refers Northern Gateway to park managers for this information.

(g) This is not within Raincoast’s knowledge. Raincoast refers Northern Gateway to park managers for this information.

(h) This information is not relevant to any of the issues before the Panel.

1.3

Reference:

What's at Stake? The Cost of Oil on British Columbia's Priceless Coast (A2K3H9).

Preamble:

(a) Please confirm that the "What's at Stake? study" was prepared for use as a public relations tool, to advocate against approval of the Northern Gateway.

(b) Please confirm that nowhere in the report is there any mention of safety or environmental mitigation measures proposed by Northern Gateway. If not confirmed, provide specific examples of where such measures are described.

(c) Please confirm that chronic oiling is most often associated with small recreational vessels.

(d) Please provide specific evidence to support the insinuation, at adobe page 43 of the report, that chronic oiling off the coast of Newfoundland and Labrador is associated with oil tanker operations rather than commercial fishing and other small vessels.

(e) Please confirm that there is no active exploration for oil and gas offshore of Vancouver Island.

Response:

(a) Page 3 of *What's at Stake: The Cost of Oil on British Columbia's Priceless Coast* provides a description of the purpose of the report.

(b) Enbridge filed its ESA with the NEB on May 27, 2010. *What's at Stake* was released in March 2010. Therefore, Raincoast could not comment on Northern Gateway's mitigation measures because they were unknown.

(c) Raincoast does not agree that chronic oiling is most often associated with small recreational vessels. Raincoast does agree, however, that small recreational vessels contribute to the problem. In the context of these hearings, Raincoast's concern relates to the potential chronic oiling problems associated with proposed marine transportation activities of the Enbridge Northern Gateway project. Environment Canada has the same concerns, as indicated in an email dated November 15, 2010, attached at Schedule A.

In addition, an email dated November 1, 2010, attached at Schedule B, outlines the Canadian Wildlife Service and Environment Canada's, "comments and advice to Transport Canada on the TERMPOL submission on areas under our mandate and areas of expertise; namely, species at risk, migratory birds (including birds oiled at sea) and wetlands". Among the list of concerns, the email notes, "CWS/EC is concerned that effects from smaller illegal, but [sic] discharges of oil via bilge, etc. have not been considered. We recognize that stricter standards and increased monitoring efforts have decreased these impacts over the past several decades; however, based on knowledge and experience from our scientists we are of the opinion that the risks are not negligible."

These concerns are repeated in an Environment Canada email dated January 5, 2011, attached as Schedule C, under the sub-title, "Risks associated with chronic discharge from Terminal Operations and Marine Transportation". The email notes that, "The EA does not currently address impacts associated with chronic discharges & related cumulative effects in a meaningful way. What additional information do we require/recommend? Given the pushback that we have already received on this, what information sources can we use to substantiate our concerns?"

As the proponent is aware, the issue of chronic oiling formed part of an information request from Environment Canada to Northern Gateway (Question 115, A2C4I8 - Government of Canada-Letter and Information Request No 1 to Northern Gateway, 08/25/2011), which stated, "[a]s part of the Follow-up and Monitoring Program, details are requested on provisions for monitoring migratory bird and habitat

impacts that could result from any chronic minor spills and leaks from routine operations associated with Marine Transportation and the Kitimat Terminal operations". An earlier draft of the rationale for this request is attached at Schedule C which states, "[t]here is considerable potential for cumulative effects on migratory birds and their habitats as a result of small, chronic spills. These types of spills could occur from time to time during routine operations, for example in the process offloading and transfer from ship to shore. Such 'minor' incidents in a series pose scientifically credible environmental threats equivalent to larger single incidents. The program should explicitly include, in addition to the comprehensive baseline assessment of current biotic and abiotic (including chemical) conditions, a comprehensive and long-term monitoring program to assess the potential effects of minor, chronic spills on migratory birds and habitats (local project area, up channel and down channel aquatic environment)."

(d) Other studies (see *Effects of Sheens Associated with Offshore Oil and Gas Development on the Feather Microstructure of Pelagic Seabirds*, O'Hara and Morandin, 2010, attached at Schedule D) outline the link between operational discharges of hydrocarbons and increased seabird mortality on the east coast. In terms of the role of vessels in chronic pollution in eastern Canada, Environment Canada states that most oil on the feathers of dead east coast seabirds was "heavy fuel oil mixed with lubricants, typical of the mixture found in the engine room bilges of large vessels."

(e) This information is within the knowledge of the proponent.

1.4

Reference:

What's at Stake? The Cost of Oil on British Columbia's Priceless Coast, adobe page 44- 46 (A2K3H9).

Preamble:

At adobe page 44, ship strikes are discussed. More detail is required.

Request:

(a) Please describe the typical speed of cruise ship vessels transiting the Inner and Outer Passage of British Columbia.

(b) Please describe the measures taken by cruise ships and other commercial vessels to avoid marine mammal strikes.

(c) Please provide statistics of the number of marine mammal strikes within the study area of the report, for the years 2009-2011.

(d) Please provide specific evidence to support the contention that the EVOS event had measureable effects on bear and wolf populations, as insinuated at adobe pages 45 and 46 of the study.

(e) Please comment on the opportunity for use of the data collected by the Raincoast Conservation Foundation in informing future environmental effects monitoring and operational spill response planning, should the Project be approved.

(f) Please confirm that the "bottom line" of the study is that "the 35 year-old 'now-you-see-it-now-you-don't' moratorium" on oil tanker traffic must be legislated and codified into law.

(g) Please provide the specific wording used in conducting the public opinion poll reference at page 36 of the report (i.e. the Synovate July 2008 poll commissioned by the Dogwood Initiative with funding assistance from Raincoast and other ENGO's). Please include any information provided to the interviewee prior to the survey questions being asked.

(h) Please list the other ENGO's referred to in Endnote 100 of the report.

Response:

(a) This is not within Raincoast's knowledge.

(b) This is not within Raincoast's knowledge.

(c) This is not within Raincoast's knowledge.

(d) For effects to be "measureable" they need to have been measured. To Raincoast's knowledge, no studies have addressed the potential impacts of EVOS on bears and wolves. As noted above, however, the absence of evidence is not evidence of absence. Ignoring this truism and discounting potential risks signals a low degree of precaution in any environmental assessment process. On ecological first principles, if important food supplies of a consumer are adversely affected (e.g. contaminated by oil), then consumers can realistically be affected. This is a clear inference, supported by overwhelming evidence. As noted in Raincost's original submission, there is abundant evidence that marine resources on which bears and wolves feed were adversely affected by EVOS. Accordingly, the potential risks posed by the Northern Gateway pipeline and associated tanker traffic to these consumers should be addressed seriously.

(e) Raincoast data is available.

(f) Yes, the tanker moratorium should be codified in law.

(g) The polling question and results are attached at Schedule E.

(h) This information is not relevant to any issue before the Panel.

1.5 Marine Mammals – Underwater Noise

Reference:

Written Evidence of Raincoast Conservation Foundation, Part 2: Marine Impacts – Marine Mammals Attachment E: *Submission of the Natural Resources Defense Council to the Enbridge Northern Gateway*

Project Joint Review Panel: Regarding Underwater Noise Impacts from Northern Gateway Tanker Traffic
Section I: Introduction to Underwater Noise, adobe page 2 (A2K3I0).

Preamble:

The Reference states: "Impacts from shipping include habitat avoidance and abandonment..."

Request:

Please provide references to scientific studies that have demonstrated that underwater noise *associated with shipping* has led to habitat abandonment.

Response:

Underwater noise, including noise from shipping, is associated with a wide variety of behavioral and other impacts with serious implications for marine wildlife. With respect to habitat abandonment, for example, gray whales were documented to abandon their breeding lagoon at Laguna Guerra Negro from 1957 through at least the early 1970s, during disturbance by commercial shipping and associated dredging activities (1957-1967), and only began to reoccupy the lagoon several years after the activities had ceased (Bryant et al. 1984; see also Dahlheim 1988, Jones et al. 1994). Similarly, a decrease in humpback whale use of Glacier Bay, Alaska, was correlated with relatively high levels of cruise ship noise within the bay compared to noise levels in other locations (Malme et al. 1981). Among other species, it has been shown that manatees strongly prefer habitat associated with high propagation loss in the low frequencies (where boat and coastal development noise predominates), and that they alter their habitat on a regular diurnal basis in negative correlation with high noise levels, including from vessel activity (Miksis-Olds et al. 2006, 2007). The correlation of manatee habitat use with high propagation loss was found stronger than any other factor in habitat selection, including the quality of foraging opportunities (Miksis-Olds et al. 2007).

These results are consistent with habitat abandonment documented in response to a range of other noise sources, including airguns used in oil and gas exploration (MacLeod et al. 2006, Parente et al. 2007, Weller et al. 2006), whale-watching vessels (Lusseau 2005, Lusseau et al. 2006), and acoustic harassment devices used to reduce marine mammal predation on fisheries (Morton and Symonds 2002). This last study is of particular interest in the present case, as it demonstrates, within the narrow channels of coastal British Columbia, that even discrete noise sources can exclude marine mammals from large areas of habitat by creating acoustic barriers that species will not cross (Morton and Symonds 2002).

The above literature indicates that marine mammals will sometimes abandon even highly important habitat, such as breeding grounds, in response to anthropogenic noise. But marine mammals that remain in ensonified habitat can also suffer significant adverse impacts, including chronic stress (see, *e.g.*, Rolland et al. 2012, Wright and Highfill eds. 2007) and other harms. A recent, 93-page "scientific synthesis" from the Convention on Biological Diversity (CBD 2012; see also Weilgart 2007) summarizes and assesses the noise literature, concluding *inter alia*:

> 4. Sound is extremely important to many marine animals and plays a key role in communication, navigation, orientation, feeding and the detection of predators….

> 5. A variety of marine animals are known to be affected by anthropogenic noise. Negative impacts for least 55 marine species (cetaceans, teleost fish, marine turtles and invertebrates) have been reported in scientific studies to date.
>
> 6. A wide range of effects of increased levels of sound on marine fauna have been documented both in laboratory and field conditions….
>
> 7. There are increasing concerns about the long-term and cumulative effects of noise on marine biodiversity….

Raincoast submitted new evidence on the distribution and abundance of marine mammals in its written submission and highlighted the numerous inadequacies in the Enbridge marine mammal studies. These included a paucity of empirical data and inadequate methodology, both of which resulted in unsupported conclusions.

Any assessment of impacts associated with noise on marine mammals would require a more detailed assessment of the distribution and abundance of marine mammals within the affected areas.

References:

Ayres, K. L., Rebecca K. Booth, Jennifer A. Hempelmann, Kari L. Koski, C. K. Emmons, R.W. Baird, Kelley Balcomb-Bartok, Bradley Hanson, Michael J. Ford, Samuel K. Wasser. 2012. Distinguishing the Impacts of Inadequate Prey and Vessel Traffic on an Endangered Killer Whale (*Orcinus orca)* Population. PLoS ONE Vol 7-6 [Attached at Schedule F].

Bryant, P.J., Lafferty, C.M., and Lafferty, S.K. (1984). Reoccupation of Laguna Guerrero Negro Baja California, Mexico, by gray whales. Pp. 375-386 in M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.). The Gray Whale *Eschrictius robustus*. Orlando: Academic Press.

Convention on Biological Diversity (CBD). (2012). Scientific synthesis on the impacts of underwater noise on marine and coastal biodiversity and habitats. CBD Doc. no. UNEP/CBD/SBSTTA/16/INF/12.

Dahlheim, M.E. (1988). Bio-acoustics of the gray whale (*Eschrichtius robustus*). Ph.D. dissertation accepted by the University of British Columbia.

Michele B. Halvorsen, B. M. Casper, C.M. Woodley, T.J. Carlson, and A.N. Popper. 2012. Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive Pile Driving Sounds. PLoS ONE Vol 7 -6 [Attached at Schedule G].

Jones, M.L., Swartz, S.L., and Dahlheim, M.E. (1994). Census of Gray Whale Abundance in San Ignacio Lagoon: A Follow-Up Study in Response to Low Whale Counts Recorded During an Acoustic Playback Study of Noise Effects on Gray Whales.

Lusseau, D. (2005). Residency pattern of bottlenose dolphins Tursiops spp. in Milford Sound, New Zealand, is related to boat traffic. Mar. Ecol. Prog. Ser. 295: 265-272.

Lusseau, D., Slooten, L., and Currey, R.J.C. 2006. Unsustainable dolphin-watching tourism in Fiordland, New Zealand. Tourism Mar. Enviro. 3: 173-178.

Malme, C.I., Miles, P.R., and McElroy, P.T. (1981). The acoustic environment of humpback whales in Glacier Bay and Fredrick Sound, Alaska. J. Acoust. Soc. Am. 70: S85. Abstract of report, The acoustic environment of humpback whales in Glacier Bay and Fredrick Sound/ Stephens Passage, Alaska; Bolt, Beranek and Newman report no. 4848.

Miksis-Olds, J.L., Donaghay, P.L., Miller, J.H., Tyack, P.L., and Nystuen, J.A. (2007). Noise level correlates with manatee use of foraging habitats. J. Acoust. Soc. Am. 121: 3011-3020.

Miksis-Olds, J.L., and Miller, J.H. (2006). Transmission loss in manatee habitats. J. Acoust. Soc. Am. 120: 2320-2327.

Morton, A.B., and Symonds, H.K. (2001). Displacement of Orcinus orca (L.) by high amplitude sound in British Columbia. ICES J. Mar. Sci. 59: 71-80.

Parente, C.L., de Araújo, J.P., and de Araújo, M.E. (2007). Diversity of cetaceans as tool in monitoring environmental impacts of seismic surveys. Biota Neotropica 7.

Rolland, R.M., Parks, S.E., Hunt, K.E., Castellote, M., Corkeron, P.J., Nowacek, D.P., Wasser, S.K., and Kraus, S.D. (2012). Evidence that ship noise increases stress in right whales. Proc. Royal Soc. B: Biol. Sci. doi:10.1098/rspb.2011.2429.

Weilgart, L.S. (2007). The impacts of anthropogenic ocean noise on cetaceans and implications for management. Can. J. Zool. 85: 1091-1116.

Weller, D.W., Rickards, S.H., Bradford, A.L., Burdin, A.M., and Brownell, R.L., Jr. (2006). The influence of 1997 seismic surveys on the behavior of western gray whales off Sakhalin Island, Russia. Paper no. SC/58/E5, presented to the International Whaling Commission Scientific Committee, Cambridge, UK.

Wright, A.J., and Highfill, L. eds. (2007). Considerations of the effects of noise on marine mammals and other animals. Int'l J. of Comp. Psychol. 20: 89-316.

1.6 Marine Birds

Reference:

Written Evidence of Raincoast Conservation Foundation, Part 3: Marine Impacts – Marine Birds, paragraph 44, adobe pages 20-21 (A2K3I1).

Preamble:

The Reference indicates that the Raincoast Conservation Foundation conducted systematic surveys of marine birds from 2005 to 2008. The reference given for on-line supporting materials (www.raincoast.org) does not include a report, the survey design/methods, or other information with regard to baseline data collection, apart from observation maps. It appears that from the materials available online that the observations were incidental or designed to align with structured marine mammal surveys. It is important, in evaluating the information provided within the evidence submission, to have a good understanding of how marine bird data was collected, under what conditions and if there are any potential biases, especially when the data is used to build and present oil spill / risk assessment models.

Request:

(a) Please provide a detailed summary of the methods used by Raincoast Conservation Foundation to conduct the systematic marine bird surveys, criteria for survey design, level of scientific rigor, methods used to analyze data to develop abundance and distribution, assumptions and limitations of the data, survey dates, weather conditions, and robustness of resulting reported baseline.

(b) Please indicate whether Key Indicator species have been considered to assess environmental effects or risk to marine birds and, if so, what are those species and why?

Response:

(a) A detailed summary of marine bird line transect survey methods and analytical approach is condensed here (Kawai et al., below).The methods we used are appropriate for use with marine birds. Raincoast's marine bird information represents the largest systematic survey of marine birds in the Queen Charlotte Basin.

Marine Bird Survey Methods:

Line transect surveys

The line transect method has much in common with the strip transect method but allows detection probability to decrease with distance from a survey line, and uses the detection function to estimate

densities. All individuals "at" the line still need to be observed, or alternatively, estimated as the proportion missed at the line for a correction.

Assumptions for line transects are (Buckland et al. 2001)

1. Line transects are randomly allocated in the study area independently of the distribution of the survey population
2. All individuals on the line are detected with certainty ($g(0)=1$)
3. Animal movement is slow compared with observer movement
4. Distances are measured without error

For more details on the line transect methods, see online <http://www.ruwpa.st-and.ac.uk/distance/>.

Line transect surveys using Distance Sampling are an effective approach for estimating the density and/or size of wildlife populations (Buckland et al. 2001). Using Distance software (Thomas et al. 2010), Raincoast applied a systematically planned line transect survey for seabirds. Line transects were placed against the coastline with a random starting point. An equally spaced zigzag design was adopted, which compensates for excess travel time between transect lines without sacrificing good spatial coverage. Details of our survey design are described in Thomas et al. (2007).

Marine bird surveys were conducted five times during 2005 – 2008, in conjunction with cruises originally designed and conducted for marine mammals (Williams and Thomas 2007). Our 2,976 km^2 study area included Dixon Entrance, Hecate Strait, Queen Charlotte Sound, and Queen Charlotte Strait in British Columbia, Canada.

Raincoast used two research vessels for our surveys. In 2005, the survey was conducted aboard the *Gwaii Haanas*, a 20-metre long powerboat. During 2006 - 2008, surveys were conducted aboard the *Achiever*, a 22-metre long powered sailboat. The average running speed during surveys was approximately 15 km/h. Ship routes were tracked by a Global Positioning System (GPS), with position and speed recorded automatically every 10 seconds by computer. The software Logger 2000 (International Fund for Animal Welfare, available at http://www.ifaw.org/ifaw_european_union/) was used to collect GPS data.

Observers conducted surveys with an average eye height of 2.5 – 3.5 m above sea level. In most cases, observations were conducted by one-person using naked eyes and binoculars (8×42) to scan 180° of the vessel's course. Occasionally, two observers collected seabird sighting data, contributing to less than 5% of the overall survey effort. These observer conditions were recorded but no adjustment for $g(x)$ was applied in this study.

Marine bird sighting data collected were detection time, distance between observer and the detected group of birds, angle of the object from the track line, species, group size, and object position (object in flight, on water, or on land). Observers estimated distance and angle. To improve accuracy, observers were trained and calibrated on distance and angle estimates within cruises. Species were identified with 95% observer confidence; otherwise, higher taxa or group specifications were applied. Collected data were immediately recorded in field notes and later transcribed into an Excel spreadsheet.

Although observations of flying birds were collected, only stationary birds observed on the water's surface were used for modeling and predictions. We did not include flying birds because of unresolved

problems concerning detection (Tasker et al. 1984). Survey efforts slower than 9 km/hr were also removed from the analyses in order to maintain a relatively consistent survey condition.

Detection function model

Raincoast modeled $g(x)$ using the software Distance 6.0 release 2 (Thomas et al. 2010). Raincoast assumed that $g(0)$ was 1 and that $g(x)$ was reduced with increasing distance x. Using $g(x)$, we can estimate the density of animals in the observed area. The R library package mrds in Distance 6.0 performs modeling $g(x)$ on the mark-recapture distance-sampling engine. This library allows us to estimate the probability of detection for each segmented effort line directly from R console. Log-normalized group size was used for $g(x)$ as a covariate (Marques and Buckland 2004) because data indicate the effect of size bias against distance x. For each target, a key function was selected from a half normal and hazard rate model. Right truncation was applied to find the best-fitted model. The $\chi 2$ test, Kolmogorov-Smirnov (K-S) test, and the Cramér-von Mises (C-vM) test were used to assess model fit. The $\chi 2$ test examines the fit of a model using arbitrary grouped distance data, whereas the other two tests assess the difference between the cumulative distribution function and the empirical distribution function. Akaike's information criterion (AIC) was used for the model selection.

Surveyed transects were segmented by a 1 km interval. Variables were spatially joined into segments at the center of a segment. Segment data were then merged into the Distance dataset.

Predictors and response variables used for spatial models

Sixteen predictor variables were prepared for spatial prediction models. Most were derived from open-access web sources and had been previously tested (e.g. Yen et al. 2004). Derived data were manipulated in ArcGIS 9.2 (ESRI) to fit the format for modeling. The raster bathymetry layer was transformed from the original contour shape file by interpolation, with a spatial resolution set to 350 m. From the raster bathymetry, the slope of the ocean floor was generated in ArcGIS as an additional predictor.

Euclidean distance was calculated in ArcGIS from the nearest object of interest for several static variables. Spatial resolution for all predictors representing Euclidean distance was set to 50 m. The following spatial data manipulations were conducted before Euclidean distance calculations were carried out. Shelf edge is located from north to south near the west coast of Haida Gwaii and Vancouver Island. Our shelf edge data were originally composed of polygons with categorical benthic information. We determined the 'shelf edge' by selecting categories of depth 200 - 1,000 m and slope of 20 - 50 degrees in the shelf edge location. From the web search results, towns with populations of more than 1,000 inhabitants were included in the 'distance from human community' data.

Climatologic data were derived from long-term seasonal averages provided by National Oceanographic Data Center, available online <http://www.nodc.noaa.gov/>. Dynamic variables are available at Ocean Watch, online <http://las.pfeg.noaa.gov/oceanWatch/> as either raster or vector data formats. Inverse Distance Weight in ArcGIS was applied to cover the entire study area.

The prepared modeling data layer consisted of effort segments containing target abundance or density as a response variable. All predictor variables were spatially joined at the center of each segment.

Random Forests

RF is an ensemble of trees, which combines the concept of 'bagging' and random selection of predictors (Breiman 2001b). For regression trees, a number of non-pruning independent trees is grown in parallel and averaged at the end. RF differs from bagging by using a randomly sampled subset of predictors that let RF handle a large number of predictors. The algorithm is based largely on three steps: (1) prepare *B* number of bootstrap samples from the given dataset, (2) create *B* number of regression trees using each bootstrap sample data; the number of predictors used to find the best split at each node is a randomly chosen subset of the total number of predictors, (3) generate a prediction result by averaging all tree results with a good set of generalizing rules (stored in the grove file). The last step is a crucial feature that allows RF to produce robust prediction results. RF was run in the R statistical software using package randomForest version 4.5 (Liaw and Wiener 2002). The best number of the sampled predictors was adjusted in each prediction for maximizing predictive accuracy.

(b) Raincoast conducted a comprehensive survey of all marine birds and therefore did not consider Key Indicator species. However, the information Raincoast collected can be used to determine reliably which species are appropriate Key Indicators.

References:

Breiman, L. 2001. Random forests. Machine Learning. 45: 5-32.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to Distance Sampling. Oxford University Press, Oxford, United Kingdom.

Kawai, D., C. H. Fox, P. C., Paquet, F., Huettmann. Submitted. Machine Learning with Distance Sampling; an effective approach for modeling density surfaces.

Liaw, A. and M. Wiener. 2002. Classification and regression by random forest. R News. 2(3): 18-22.

Marques, F. F. C., and S. T. Buckland. 2004. Covariate models for the detection function. *In* Advanced Distance Sampling (S. T. Buckland, D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas, Eds.). Oxford University Press, Oxford, United Kingdom. pp 31-47.

Tasker, M. L., P. H. Jones, T. Dixon, and B. F. Blake. 1984. Counting seabirds at sea from ships: a review of methods employed and a suggestion for a standardized approach. The Auk. 101: 567-577.

Thomas, L., R. Williams, and D. Sandilands. 2007. Designing line transect surveys for complex survey regions. Journal of Cetacean Research and Management. 9: 1-13.

Thomas, L., S. T. Buckland, E. A. Rexstad, J. L. Laake, S. Strindberg, S. L. Hedley, J. R. B. Bishop, T. A. Marques, and K. P. Burnham. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology. 47: 5-14.

Williams, R. and L. Thomas. 2007. Distribution and abundance of marine mammals in the coastal waters of British Columbia, Canada. Journal of Cetacean Research Management. 9:15-28.

Yen, P., F. Huettmann, and F. Cooke. 2004. Modelling abundance and distribution of Marbled Murrelets (*Brachyramphus marmoratus*) using GIS, marine data and advanced multivariate statistics. Ecological Modelling. 171: 395-413.

1.7 Marine Fish and Fish Habitat - Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0, paragraph 20, adobe pages 13-14 (A2K3I3).

Preamble:

The Reference suggests that nomadic coho salmon would be a more suitable indicator species than chum salmon for assessing potential effects of the Northern Gateway Project on Pacific salmon.

The following information on nomadic coho is provided: "Nomadic coho fry rely on the stream estuary ecotone for more than a year. As fry, nomadic coho acclimate to brackish water, survive, and grown in the stream-estuary ecotone. Instead of migrating farther to the ocean, they return upstream into freshwater to overwinter before migrating to sea as smolts the following year. This unique use of overwintering and estuarine habitats has enabled coho to develop a life history strategy that promotes their resilience. The loss or decline of these nomads affects adversely the diversity and abundance of coho populations. Healthy estuarine habitats are essential for the persistence and recovery of depressed coho populations, such as those found in the Kitimat River and in other watersheds in Kitimat Arm."

Request:

Please provide a justification as to why the unique nomadic coho life history is more representative of Pacific salmon than chum salmon. Please also provide references that document the presence of nomadic coho in the Kitimat River and/or Kitimat Arm watershed.

Response:

The diverse life history strategies of salmon using marine, estuarine, and freshwater habitats exemplify the difficulty in using a single species to capture all strategies. Varied and disparate strategies allow different species to reproduce and sustain their populations under a range of conditions with which they have co-evolved. Consequently, a single species is an unsuitable indicator of the behavior and ecology of other species. Chum, for example, cannot capture the more extensive usage of lower reaches and estuarine habitats of ocean type coho, sockeye, and Chinook. Conversely, coho and Chinook cannot capture the vulnerability of pink and chum embryos during the fall, winter and spring, as they spawn much higher in the watershed. The bottom line is that information from multiple species is needed to adequately represent the behavior and ecology of salmon in British Columbia.

As with other aspects of ecology, new understandings of species and ecosystem complexity are constantly emerging. The presence of nomadic coho is no exception. Studies that thoroughly examined and documented the behavior and biology of nomadic coho were not completed until the last decade (see Koski, 2009, available online at <http://www.ecologyandsociety.org/vol14/iss1/art4/>), and were

undertaken primarily in Alaska and Oregon. Thus, the presence of nomads must be verified by watershed specific studies. Their presence, however, should be presumed in estuarine ecotone habitats that are characterized by low gradient, long stream channels, and tidal sloughs connected to estuary basins with salt marsh vegetation and diluted salinities. The Kitimat estuary and the estuaries of several other larger watersheds draining into Kitimat Arm meet this description and likely host populations of nomadic coho.

According to Koski (2009) the nomad strategy for rearing in estuarine habitats is essential to the sustainability of some coho populations. Maintaining this life-history strategy for coho resilience requires protection and restoration of habitats in the lower reaches of rivers, ecotones, and estuaries. Further, the recovery of coho populations will require breaching dikes and restoring tidal inundation and linkages between estuarine habitats and natal and non-natal stream habitats. The importance of coho in the Kitimat region requires that the species habitat needs are specifically addressed.

1.8 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0, paragraph 27, adobe page 15 (A2K3I3).

Preamble:

The Reference states that the "sediment and circulation model is mostly data deficient, based on simple and often broad assumptions, and was designed to give a very general picture of sediment dispersal at a time when dredging and disposal might not actually occur'. The Reference further states that the 'oversimplification or neglect of often key considerations, data inputs, and assumptions is embedded in a narrative that gives extensive model detail. Although implying technical merit, the fundamental flaws of the report are evident."

Request:

(a) Please describe which key considerations, data inputs and assumptions have been oversimplified or neglected.

(b) Please indicate what type of sediment transport/circulation model would be considered more appropriate.

Response:

(a) Examples of oversimplified or neglected considerations include:

- The modelling shows a time consideration of 80 hours and one week after dredging completion. However, the combined activities of dredging and blasting will occur over a period of 18 weeks. The modeling does not consider the continuous loading and re-suspension that covers the full duration of the activity.

- The modeling only considers TSS plume and not PAH contamination.

- The TDR states that if the dredging occurs in the spring, the increase in TSS will be negligible compared with background values at this time. However, impacts at other times of year would likely be higher and are not modeled. In the event of delays, dredging would likely occur whenever possible.

- At other times of year the re-suspended sediment may move differently or represent a greater contribution to the TSS in Kitimat Arm. It appears Enbridge made no measurements of their own in the PDA or PEAA. The reference for TSS of 18mg/L average in winter is from the Kitimat LNG EA application, in Bish Cove, by Jacques-Whitford in 2005. TSS in Kitimat Arm could differ significantly depending on currents and the localized contribution of Bish Creek to TSS in Bish Cove.

- It is unlikely that sediments from glacial scour etc., will have as high levels of contamination as marine benthic sediments resuspended by construction activities. Thus, the contribution to TSS does not reflect the contribution to bioavailable or resuspended PAHs.

- The ESA states that dredging will not release new contaminants. However, dredging changes the physical and chemical properties of sediments (e.g. the redox potential). Thus, chemical speciation changes, new chemical compounds can form, and the mobility and potential for uptake in food chains can change significantly.

(b) A more appropriate model would address the deficiencies listed in response (a).

1.9 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0, paragraph 29, adobe pages 16-17 (A2K3I3).

Preamble:

The Reference states that the 'consultant's findings of existing PAH concentrations are inconsistent with previously collected data.'

The following discussion is provided: 'Table D1-5 of the Marine Risk Assessment TDR shows polycyclic aromatic hydrocarbon (PAH) concentrations of less than 1.0 mg/kg (Enbridge 2010). However, previous work in this area (Simpson et al. 1998) found concentrations of individual PAHs up to 450 mg/kg and 350 mg/kg dry weight.'

Request:

(a) Please confirm that the samples collected by Simpson et al. (1998) were in the same locations as those collected by Northern Gateway (2010).

(b) Please provide a rationale as to why it is appropriate to compare samples that were collected >10 years apart.

Response:

(a) Simpson et al. 1998 reported on 7 sampled locations in the vicinity of Kitimat Arm. Simpson's 1998 site, KA 14, was closest to Enbridge's reference sites. KA 13 and 15, reported on by Simpson et al. 1996, were closer to Enbridge's terminal sites. Importantly, these 1996 sites appear to be deeper (100 m vs. 30 -100 m), where sediments would be less disturbed. Currents and bottom topography are extremely important in selecting appropriate sample sites.

(b) Because of the persistent, toxic nature of PAHs, their documentation in Kitimat Arm, and the concern for re-suspension of these sediments, the tracking and assessing the state of these compounds over time is extremely important.

Studies in Port Valdez, Alaska showed relatively high levels of weathered PAHs and saturated hydrocarbons. The source of these hydrocarbons was determined to be Alaska North Slope crude, which began to accumulate following the construction of the oil terminal. The highest levels exceeded NOAA's Effect Range – Low (ERL) level in three samples. Hydrocarbon profiles at Port Valdez over time showed very low level concentrations before the oil terminal /port startup, followed by a steady increase that corresponded with increased oil flow through the pipeline.

KA14 had total PAHs of about 3.3 -3.5 mg/kg. Enbridge's reference samples 9 and 10 from the Marine Fish and Fish Habitat TDR (adobe pg 253) show only 0.06 and 0.21 mg/kg of total PAH. This does not necessarily indicate a change since 1996. The samples KA11-14 are across the channel from the proposed terminal locations. The total PAHs range from 14-20 mg/kg in these samples. This illustrates that the 'baseline' levels for modelling are dependent on the locations of the samples. Even Simpson's core sample from Gillioytes Inlet shows higher contaminations than Enbridge's reference sites, and it is a long way from the Kitimat Smelter, linking the fact that the fluvial and aeolian transport of PAHs from the smelter will determine where the contaminants end up.

References:

C.D. Simpson, A.A. Mosi, and W. R. Cullen. K. J. Reimerb. 1996. Composition and distribution of polycyclic aromatic hydrocarbon contamination in surficial marine sediments from Kitimat Harbor, Canada. Sci. Tot. Env. 181 265-278.

C. D. Simpson, C.F. Harrington, W.R. Cullen, D.A. Bright and K.J. Reimer 1998. Polycyclic Aromatic Hydrocarbon Contamination in Marine Sediments near Kitimat, British Columbia. Env. Sci. Tech. 32, 3266-3272.

M. A. Savoie, J. M. Savoie, J.H. Trefry, C.M. Semmler, D.W. Woodall, R.P. Trocine, J. M. Brooks and T.McDonald. 2006. Port Valdez Sediment Coring Program Final 2004 Monitoring Report. Prepared for Prince William Sound Regional Citizens' Advisory Council.

1.10 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0, paragraph 31, adobe page 18 (A2K3I3).

Preamble:

Raincoast suggests that using only two marine invertebrates for sediment toxicity tests was insufficient to characterize potential effects of sediment re-suspension on marine organisms. The Reference states: "Without proper surveys to determine the presence, distribution, and use of the area by juvenile salmonids, and the use of only two marine invertebrates for toxicity tests, this exercise is of little utility, raising more concerns than it actually addresses."

Request:

Please indicate the number of and type of species that would be considered appropriate for toxicity tests.

Response:

Raincoast has two concerns with the testing. Firstly, the selected invertebrates might not capture toxicity and biomagnification concerns for vertebrates, i.e. fish. Secondly, the limitations of the selected species to adequately represent invertebrate groups across different trophic levels.

When selecting test species as surrogates for other organisms, Munns et al. (2002) recommend that three species representing different phyla be tested for water column effects, and that three different ''life history strategies'' or more appropriately, three ecological life styles (filter feeding, deposit feeding, burrowing) be used to assess sediment effects (US EPA and US ACE, 1991, 1998 in Munns et al. 2002).

Rial and Beiras (2012) found that a wide variability of responses can occur with different bioassays (exposed to moderate sediment contamination) and the difference in sensitivity between species highlights the importance of using a suite of species from different trophic levels to evaluate the sediment toxicity.

Consumers of benthic organisms can also bioaccumulate or biomagnify chemicals. Therefore, in addition to sediment toxicity, examining the uptake of chemicals by aquatic organisms from contaminated sediments is important. The literature identifies several species that biomagnification can be examined through including oligochaetes, bivalves and molluscs, amphiopds, and fish. Further, the literature identifies criteria for selecting organisms and testing (see examples in references below).

References:

W. R. Munns Jr., W.J. Berry, T. H. Dewitt. 2002. Toxicity testing, risk assessment, and options for dredged material management. Marine Pollution Bulletin 44 (2002) 294–302.

Rial, Diego and Ricardo Beiras*. in press.* Prospective ecological risk assessment of sediment resuspension in an estuary. J. of Env. Mon. Cite this: DOI: 10.1039/c0xx00000x.

EPA. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates Second Edition. EPA 600/R-99/064.

1.11 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0; Figure # 9, 10, 11, 12, 13 and 14, pages 32-35 (adobe pages 1-4) (A2K3I4).

Preamble:

Raincoast presents data on historical trends in catch and escapement for Pacific salmon in the PEAA and CCAA.

Request:

Please provide references for the data presented in Figure # 9, 10, 11, 12, 13 and 14.

Response:

DFO catch and escapement data can be accessed online at:

Commercial catch: http://www.pac.dfo-mpo.gc.ca/stats/comm/ann/index-eng.htm.

Escapement: http://www.pac.dfo-mpo.gc.ca/gis-sig/maps-cartes-eng.htm.

1.12 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0, paragraph 55, page 39 (adobe page 8) (A2K3I4).

Preamble:

Raincoast suggests that tanker wake poses a threat to juvenile salmon. The Reference states: "Wakes and subsequent beach run-up from large ships in confined channels have also been shown to strand (i.e. kill) juvenile salmon in the near shore environment…"

Request:

Please discuss how applicable the results of the Pearson and Skalski (2011) study are to the potential effects of vessel wake on juvenile salmonids in the PEAA and CCAA.

Response:

Using information from one area to infer the potential for similar problems in another area is informative and precautionary. The results of the Pearson and Skalski (2011) study and literature cited therein are applicable because they suggest a problem might exist that has not been satisfactorily addressed by Enbridge's EA. For example, we can use the coastal mapping data TDRs to show that sheltered areas such as the estuary at Quaal River would likely receive wakes from large tankers moving nearby. As a holding area, juvenile salmon in the Quaai estuary might be susceptible to wake induced stranding.

Clearly, the stranding of juvenile salmon owing to tanker caused wakes and subsequent beach run-ups is site and time specific. Whether physiographic and ecological conditions conducive to stranding are present in the narrow and varied channels of the BC coast is unknown, but given the potential for environmental harm the potential problem should be assessed by careful study.

1.13 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts Salmonids; Section 3.0, paragraph 57, page 39 (adobe page 8) (A2K3I4).

Preamble:

Raincoast suggests that tanker wake poses a threat to eelgrass habitats. The Reference states: "Because eelgrass grows in low energy (i.e. low wave) shore zones."

Request:

Please provide a map showing the locations of eelgrass beds that may be damaged by tanker wake.

Response:

In 2010, the Raincoast and its partners (Gitga'at Lands and Resources Stewardship Society and SeaChange Marine Conservation Society) began mapping sensitive nearshore habitats of eelgrass (*Zostera marina)* within Gitga'at Territory. These habitats host vital substrates and conditions for

adult and/or juvenile stages of many pelagic, forage and shellfish, as well assist in nutrient cycling, climate stability, and healthy land-sea connections.

Identifying and mapping sensitive nearshore habitats was identified as important in light of the numerous proposals for hydrocarbon transport through this region. Such projects greatly increase the likelihood of oil spills in a part of BC's coast that includes some of world's most ecologically valuable and unique ecosystems. Eelgrass habitats are also susceptible to impacts from land use and marine activities. For example, the wakes of large ships have been shown to adversely affect these habitats as they move through confined channels.

The priority for nearshore eel grass inventories in 2010 was Wright Sound. Preliminary fine scale mapping of the spatial extent of eelgrass beds was initiated in August and September 2010 using surface boats, SCUBA divers, and underwater still photo and video documentation, and included identification of habitat features and species use. GIS maps identifying the locations of some eel grass habitats in Wright Sound were developed from the field surveys. These maps are an incomplete inventory and simply serve to identify the existence of these habitats.

Importantly, much of the eelgrass mapped in the 2010 field season occurred in areas where there are no eelgrass bed data in the SHOREZONE database, highlighting the limitations of using existing data without on-the-ground confirmation. Using only the SHOREZONE data, few or no eelgrass beds appear to be exposed to disturbances such as tanker wakes. However, the direct observations of eelgrass from our fieldwork indicate that there are many eelgrass beds near proposed tanker routes. These eelgrass beds would be susceptible to injury from hydrocarbon exposure in the event of spills or chronic oil contamination, and potentially from the wakes of tankers.

In addition, when the oil-residency time is mapped with the eelgrass beds, most eelgrass beds are close to shorelines that will have medium to long-term oil residency. This again highlights the importance of comprehensively mapping critical habitats such as eelgrass beds, from both spill response and resource impact perspectives.

It is critical that important and sensitive habitats throughout coastal regions that are subject to impacts from shipping, land use, and marine use proposals be properly identified, mapped and action plans for their protection developed.

See Schedule H: Eelgrass beds mapped in the 2010 field survey along with existing shorezone eelgrass and in 2010 with oil residency time.

1.14 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0, paragraph 61, page 41 (adobe page 10) (A2K3I4).

Preamble:

Raincoast states that returning adult spawners are at risk of physical injury (gills) "from increased suspended sediment in holding areas of the PEAA."

Request:

(a) Please provide a figure showing the holding areas that are being referred to.

(b) Please provide empirical data that clearly demonstrate the use of these areas by adult salmon.

Response:

(a) Schedule I shows the estuary of Kitimat Arm, which salmon will use as a holding area before entering the watersheds of Big Tilhorn Creek, Bish Creek, Cordella Cree, Dala River, Eagle Bay Creek, Emsley Creek, Falls River, Fosh River, Hugh Creek, Kildalla River, Kihess Creek, Kitimat River, Minette Bay Creek, Pike Creek, Wathl Creek and Wathlsto Creek. The Kitimat Arm estuary extends from the tidal limit near the hatchery in the Kitimat River to the salt intrusion limit near Coste Island. Salmon can hold for several weeks in estuaries before moving into the river proper. This is a critical period where they adjust their osmoregulatory systems, as they must remain in osmotic and ionic balance at all times.

(b) Due to unsuitable and inadequate surveys methods, Enbridge was unable to capture a single salmonid in their biological assessments. However, it is well documented that between 100,000 to 1,000,000 adult salmon (primarily chum, pink, coho, and Chinook) can return annually to the watersheds of Kitimat Arm, all of which pass through and hold in the estuarine waters of Kitimat Arm. See Schedule J, which shows salmon escapements in counted streams returning in the watersheds of Kitimat Arm between 1950 and 2009 (Data Source: DFO NuSEDS database Area 6-1 Kitimat Arm). These statistics represent a minimum number of salmon present in Kitimat Arm, as this is escapement to counted streams only, and does not include catch. In addition, these figures do not represent trends in abundance, as counting effort varies dramatically over this period. A quarter million to more than a million adult salmon can easily hold and pass through Kitimat Arm on their way to spawning rivers. Historically, these salmon would have been present in much higher numbers. Larger watersheds that drain into this area include the Kitimat, Dala, Bish, Kildala, Fosh and 11 other smaller salmon bearing watersheds that were identified in Raincoast's original written submission (Part Four - salmonids).

1.15 Marine Fish and Fish Habitat – Salmon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 4: Marine Impacts – Salmonids; Section 3.0, paragraphs 71-82, pages 45-52 (adobe pages 14-21) (A2K3I4).

Preamble:
Raincoast's quantitative risk assessment for salmon generalizes the effects of oil on different salmonids species across a wide geographic area.

Request:
Please provide a detailed discussion on the inherent uncertainties and weaknesses of this approach.

Response:

Broader consideration of consequence and spill probability

Raincoast's written submission highlights which additional areas could be covered in order to provide a more comprehensive assessment of the risk posed to salmon. In part 4, paragraph 82 of Raincoast's written submission, Raincoast states: "Raincoast's risk assessment used only two indices of impacts/consequence to salmon at a large scale (watershed). A comprehensive assessment of risk would address other components of consequence (e.g. salmon diversity, conservation units, terrestrial animals, cultural and economic values, seasonality etc.) and other components of spill probability (i.e. seasonality of weather conditions and marine traffic etc.)". Specifically, concerning salmonids, Raincoast has not assessed the potential influence on genetic diversity, individual conservation units, related cultural and economic value or seasonality. Raincoast recognizes that such assessments would provide a more precise picture of the risk to salmonids and recognizes that risk assessments at a closer scale would provide a more informed basis for decision-making.

Unreliable data on spill probabilities

The principle areas of weakness in Raincoast's quantitative risk assessment for salmon concerns the probabilities of a tanker incident provided by Enbridge. These are outlined in Raincoast's written submission in part 7, paragraph 11:

> In the QRA, the probability of a spill associated with project tanker traffic was quantified by using incident statistics from the Lloyds Register Fairplay (LRFP) database over the period 1990-2006. However, this database is proprietary, not available without a significant purchase cost, and carries disclosure limitations. Consequently, independent analysis by interveners is effectively precluded. No other databases were referenced to assess the extent, sources, or completeness of the data used for the analysis. All the calculations and assumptions in the QRA are based on information in this database. Therefore, even if the methods used for the analysis were acceptable, analyzing the conclusions would not be possible.

Although Raincoast used the Enbridge probabilities in the absence of other information, Raincoast does not accept these as accurate or reliable. Questionable assumptions and shortcomings in the QRA include:

-assumption that calculation of a return period is the most appropriate method to assess 'risk'

-inclusion of statistics from dissimilar voyages, terminals, and exclusion of local and regional non-tanker incidents

-inclusion of statistics for ships not likely to be used for transport of oil or condensate

-treatment of all project ship classes (i.e. Suezmax, Afromax and VLCCs) as equal

-Probability Per Voyage Methodology versus Per Volume of Oil Transported

[Raincoast submission – Part 7 – paragraph 14].

Raincoast also notes that major incidents of high relevance were not included in the data set of spill incidents. This includes the *Exxon Valdez* oil spill in 1989, because the dataset chosen for analysis in the

QRA covered the period from 1990-2006. This represents a major oil spill in a region geographically and climatologically similar to the area potentially affected by the proposed project. Exclusions such as these in Enbridge's analysis selectively limit a comprehensive assessment of local events.

Cumulative impacts
Raincoast's quantitative risk assessments for salmon, reproduced at Schedule K, only considers the risk posed by an oil spill associated with the Enbridge Northern Gateway project.

Raincoast's written submission at part 7, paragraph 68 states:

> The environmental risks introduced by tankers are first associated with the transportation of petroleum products such as bitumen, condensate, light fuel, bunker oil and crude. The spill of these substances from catastrophic or chronic releases threatens the presence of countless species, food webs and ecosystems that are relied upon for subsistence, cultural, social, economic, physical and spiritual well being by an untold number of individuals and communities. In many cases, hydrocarbon impacts to species and habitats are additive in terms of the cumulative impacts and stressors that coastal ecosystems are under.

Raincoast's quantitative risk assessment did not include the many other contributors to environmental risk to salmon such as garbage disposal, sewage discharge, water ballast, noise, ship wake and anti-fouling substances that are again cumulative to existing disturbances. The focus of Raincoast's risk assessment was limited only to accidental spills of persistent oil and condensate (not chronic oiling). These cumulative impacts have not been included in Raincoast's assessment. In addition, Raincoast has not included the impacts associated with climate change. We recognize that a quantitative risk assessment for salmonids that included these factors would provide a stronger base for decision-making and Raincoast is willing to support such an undertaking with the information we currently possess.

1.16 Marine Fish and Fish Habitat - Herring

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 5: Marine Impacts – Herring; Section 3.0, paragraph 20, adobe pages 9-10 (A2K3I5).

Preamble:

Raincoast suggests that juvenile and adult Pacific herring as well as herring eggs may be stranded by tanker wake in the CCAA. The Reference states:

"Disturbance and stranding of Pacific herring juveniles and eggs as well as adults by tankers and associated vessels transiting confined inlet waters are also concerns. In the Columbia River, wakes and beach run-up generated from passing vessels have been shown to strand juvenile salmon and other fish."

The cited reference (Pearson and Skalski 2011) describes the effects of vessel wake in the Lower Columbia River on juvenile salmonids. Juvenile salmonids and herring have different life histories and exhibit different behaviours. In addition, the physical and environmental characteristics of the Lower

Columbia River (e.g., shoreline slope, shoreline substrate, water depth, average natural wave height, average natural wave period) are very different from marine habitats in the PEAA and CCAA.

Request:

Please justify the use of Pearson and Skalski 2011.

Response:

The use of Pearson and Skalski (2011) is justified. Raincoast refers to the study and references therein - and are clear about the study area - to highlight that wakes and beach run-up generated from vessels can strand fish. Regardless of any physical or environmental differences, the use of this study to highlight the concern over pacific herring stranding is done in a precautionary manner.

References:

Pearson, W. H. and J. R. Skalski. 2011. Factors affecting stranding of juvenile salmonids by wakes from ship passage in the Lower Columbia River. River Research and Applications Vol. 27(7):926–936.

1.17 Marine Fish and Fish Habitat - Herring

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 5: Marine Impacts – Herring; Section 3.0, paragraph 20, adobe pages 9-10 (A2K3I5).

Preamble:

Raincoast suggests that tanker traffic may disturb adult herring during spawning.

Request:

Please provide a reference for the above statement.

Response:

From observations of multiple Pacific herring spawn events in British Columbia, Raincoast has noted that Fisheries and Oceans Canada closes boat ramps in proximity to spawn events, log barges transiting near spawn-on-kelp operations have been delayed and local spawn-on-kelp fishermen minimize the use of their own outboard engines in proximity to spawning herring and routinely ask other boats to avoid their operations area; these measures are mainly put in place due to concern and/or direct observation of disturbance of spawning herring attributable to underwater noise, in addition to other possible mechanisms for disturbance, including hydrocarbon pollution. These observations highlight a reliance on traditional ecological knowledge for pacific herring that guides both a federal organization operating at the local level and experienced, small-scale fishermen.

Disturbance of pacific herring by tanker traffic is also supported in the scientific literature. For pacific herring, "avoidance responses were elicited by the sounds of large vessels approaching at constant speed [and] by smaller vessels but only when on accelerated approach..." (Schwarz and Greer 1984). Closely related and morphologically similar to pacific herring, Atlantic herring (*Clupea harangues*) also display significant vessel avoidance responses in their Norweigan wintering grounds (Vabø et al. 2002).

References:

Schwarz, A. L., and G. L. Greer. 1984. Responses of Pacific herring, *Clupea harengus pallasi*, to some underwater sounds. Canadian Journal of Fisheries and Aquatic Sciences. 41:1183-1192.

Vabø, R., Olsen, K., Huse, I. 2002. The effect of vessel avoidance of wintering Norwegian spring spawning herring. Fisheries Research. 58:59-77.

1.18 Fish and Fish Habitat - Eulachon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 6: Marine Impacts – Eulachon; Section 3.0, paragraph 11, adobe page 6 (A2K3I6).

Preamble:

Raincoast states that "the current condition of Kitimat Arm, Kitimat River, and estuary is not an accurate assessment of the baseline state. Productivity, species diversity, and abundance of fish species in Kitimat River have been greatly reduced below the historical baseline."

The ESA defines 'baseline condition' as the existing state of the environment, prior to Project construction.

Request:

Please indicate when Kitimat Arm, Kitimat River and estuary were at their "historical baseline".

Response:

Although the Enbridge ESA defines 'baseline condition' as the existing state of the environment before project construction, we note that the biophysical nature of BC has been changing for the last two centuries. Most of the change is attributable to human caused disturbance. Inferring the ecological status of the environment from current conditions without reference to the past ignores the temporal aspects of adverse cumulative effects and is a dangerously misleading lowering of environmental assessment standards. The concept of *shifting baselines,* first described by marine scientist Dr. Daniel Pauly (Pauley, D. 1995. Anecdotes and shifting baselines. Trends in Ecology and Evolution 10:430), refers to the incremental lowering of standards in which each new generation assesses environmental degradation only in the context of their own lifetimes. More broadly, this idea explains our inability to recognize ailing ecosystems, as our only reference is what preceding generations left behind. For this

reason, an historical baseline is important and would represent the earliest time from when reliable sources of evidence, including traditional environmental knowledge, can be established.

Raincoast's written submission notes that the Kitimat River was formerly the most valuable eulachon-bearing river in the province. Unlike the Nass, which also had a large run, the Kitimat was easier to fish. Historically, the Haisla harvested a minimum of 100 to 240 tons of eulachon annually. Run sizes in the 1990s were measured showing the magnitude of their decline in the 20th century. This change in run size was described in important studies carried out by Kitamaat Village Council, which document the value of the Kitimat estuary and other local eulachon runs.

Raincoast's written evidence also highlighted the value of the traditional harvest of eulachon, as understood through interviews and reports describing traditional environmental knowledge. These interviews and reports explain indigenous understanding of eulachon ecology, management of the fishery, role of eulachon in economy, and how catch is/was processed. See attached Schedules L, M, N and O.

Based on traditional ecological knowledge interviews conducted by John Kelson in 2002, historical abundance before the decline in eulachon run size caused by habitat destruction (basically the 1960s and prior) was on average 240 tons/year caught by the Haisla. This likely represents less than half the actual run size. Using these data, we can estimate the historical eulachon run size in the Kitimat River was approximately 500 tons/year.

In 1997, the Kitimat River eulachon run was estimated at less than 20 tons. Since then, runs have been irregularly monitored but have been significantly smaller and are now close to extirpation.

Lastly, COSEWIC provides additional information concerning the historical baseline of eulachon. COSEWIC, available online <http://www.cosewic.gc.ca/eng/sct1/searchdetail_e.cfm?id=1163&StartRow=1&boxStatus= >.

Combined, these sources of data help present a historic baseline for eulachon dating back to a period before the 1950s when industrial development began to degrade spawning habitat.

The Kitimat River functioned at its baseline condition before construction of the industries and town of Kitimat in the Kitimat River floodplain and estuary. Together with these estuary impacts, aggressive logging occurred in the Kitimat watershed peaking in the 1980s. Since the early 1950s, a gradual and complex series of alterations in the hydrology, sediment loads, and water chemistry has occurred. Among these alterations are:

1. Weirs that prevent much of the floodplain from flooding during high water events concentrating flood waters;

2. A weir to maintain water supply to DFO fish hatchery that creates a barrier to upstream migration;

3. Extensive rip rapping to protect infrastructure (municipal water intake, Alcan intake, DFO fish hatchery, Eurocan intake, sewage outfall, etc.) entraining the river bank causing downward scouring of fine sediments and probably the most significant factor in destruction of spawning habitat;

4. Pollution from primary treatment sewage outfall, pulp mill effluent, municipal runoff, and deleterious contaminants from methanol production, (although the pulp mill is closed at present); and

5. Alteration in hydrology and sediment loads from logging effects but especially higher peak flows from rain on snow events during spring freshet and during eulachon egg incubation.

1.19 Fish and Fish Habitat - Eulachon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 6: Marine Impacts – Eulachon; Section 3.0, paragraph 16, adobe page 8 (A2K3I6).

Preamble:

Raincoast asserts that important studies done by the Kitamaat Village Council on the value of the Kitimat estuary and local eulachon runs [prior to its collapse] were omitted from the Marine Fish and Fish Habitat TDR and the ESA. These studies are not publicly available.

Request:

Please provide copies of the following documents:

(a) Kelson, John. Kitamaat River Oolichan (*Thaleicthys pacificus*) Study: 1994, 1995, 1996 and 1997. Unpublished reports to Science Council of BC.

(b) Kelson, John. Kawesas River Oolichan (*Thaleicthys pacificus*) Study: 2000. Consultant's report to Na na kila Institute.

(c) Kelson, John. 2002. Unpublished traditional knowledge interviews of the Haisla and Nisgaa. Prepared for Adam Lewis, Ecofish.

Response:

(a) The 1996 and 1997 reports, (Kelson, John. Kitamaat River Oolichan (*Thaleicthys pacificus*) Study), are attached at Schedules P and Q. The Science Council of BC has been contacted for additional reports of the same title for 1994 and 1995 and will be provided when available.

(b) A copy of the consultant's report to Na na kila Institute *Kawesas River Oolichan (Thaleicthys pacificus) Study: 2000* could not be obtained from the author. A request has been made to the Nanakila Institute and will be provided when available.

(c) The references to unpublished Haisla TEK interviews with T. Robinson, Bea Wilson and JR Wilson are attached at Schedule R.

1.20 Fish and Fish Habitat - Eulachon

Reference:

Written Evidence of Raincoast Conservation Foundation; Part 6: Marine Impacts – Eulachon; Section 3.0, paragraph 17, adobe page 8 (A2K3I6).

Preamble:

Raincoast states that "the Marine Fish and Fish Habitat TDR considers eulachon only as a cultural fish, with no mention of the commercial harvest. Although they are not harvested at present because of their collapsed status, before 1972 eulachon were much more important than any other commercial or FSC harvested species."

Request:

(a) Please describe why it is important to consider the historical commercial eulachon fishery when assessing potential effects of the Project on eulachon.

(b) Aside from opposing the Project, does the Raincoast Conservation Foundation have any suggestions regarding mechanisms or programs that would assist in promoting recovery of the eulachon fishery?

Response:

(a) Considering the historical eulachon fishery is important because it helps explain the cultural and economic significance of the eulachon to the Haisla. It is also the only feasible way of estimating the size of past runs, which is essential information for recovering depleted populations and restoring the fishery. It is also a means of determining the cumulative effects of past industrial development on eulachon. As a forage fish that supports many other species important for sports and commercial fisheries, eulachon are a key component of the marine and freshwater ecosystems that the local economy depends upon.

(b) The onus is in the proponent to provide mitigation measures as part of the application. If the impacts cannot be mitigated, the Project should not proceed.