



October 28, 2016

Debra Myles  
Review Panel Manager, Roberts Bank Terminal 2 Project  
c/o Canadian Environmental Assessment Agency  
160 Elgin Street, 22nd Floor, Ottawa ON K1A 0H3

Dear Ms. Myles,

**Re: Roberts Bank Terminal 2 Assessment – Sufficiency and Technical Merit Review**

The Raincoast Conservation Foundation is concerned about the impacts of the proposed project on the marine environment and in particular on endangered marine species such as the Southern Resident Killer Whale. We have retained David Scott, a fisheries biologist with particular expertise in salmon to review the sufficiency and technical merit of the assessment as it pertains to juvenile Chinook salmon. The potential for adverse effects on juvenile Chinook salmon marine survival is of direct significance due to their importance as prey items for endangered Southern Resident Killer Whales.

Please see attached for a review of the sufficiency and technical merit of the information in the Roberts Bank Terminal 2 Assessment as it pertains to juvenile Chinook salmon.

Sincerely,

A handwritten signature in black ink that reads "Chris Genovali". The signature is written in a cursive, flowing style.

Chris Genovali

Executive Director

Raincoast Conservation Foundation

**Participant:** David Scott

**Organization (if applicable):** Raincoast Conservation Foundation

**General Comments:**

I am David Scott a fisheries biologist, with particular expertise in salmon. I have been retained on behalf of the Raincoast Conservation Foundation to assist them in the Terminal 2 review, particularly as it pertains to effects on juvenile Chinook salmon.

1. Introduction

After reviewing the Environmental Impact Statement (EIS) and supporting technical reports, it is my conclusion that the information presented is not sufficient to allow for an adequate evaluation of the potential effects of the Project on juvenile Chinook salmon value component (VC). Consequently, I disagree with the conclusion that there will be negligible residual effects on juvenile Chinook. The conclusion that the Project will result in a minor negative effect on juvenile Chinook is based only on a qualitative assessment of various Project-related activities including construction, lighting and noise, all of which are predicted in the EIS to have a minor negative effect. The effects of the causeway and terminal on juvenile Chinook migration, behaviour and orientation represent a major knowledge gap; however it is also qualitatively assessed and predicted to have a minor negative effect. The lack of quantitative information should not equate to a lack of risk and the conclusion that the potential effects will be minor is not scientifically defensible. The application of the Roberts Bank ecosystem model is also flawed and should not be used as a line of evidence. Although mitigation measures are proposed, they are unlikely to adequately compensate for these effects. Overall, the Project has the potential to cause major adverse effects on juvenile Chinook, adding to cumulative effects currently experienced by this value component in the assessment area. In this document, I will describe the basis for this conclusion and provide comments on the technical merit of the information provided in the EIS, appendices, and technical reports and a number of information requests which could provide more information on potential effects of the project on juvenile Chinook.

2. Conclusion that the project will have a minor negative effect on juvenile Chinook based on insufficient qualitative evidence

The EIS states that the effects of the project on juvenile Chinook will be minor; however there is little quantitative evidence to support this conclusion. The balance of this conclusion appears to be based on the ecosystem productivity model and a qualitative assessment of other effects of the Project on juvenile Chinook, yet no explanation is provided regarding how these differing and opposing lines of evidence were weighed and incorporated into the final decision. It appears that in the absence of information, the effects are assumed to be minor; however there is no quantitative information provided regarding how these conclusions were made. In my opinion, the Project has the potential to result in substantial adverse effects to juvenile Chinook, and the information provided is insufficient to allow the panel and the public to evaluate these effects.

The ecosystem productivity model is inappropriate to accurately characterize the potential effects of the Project on juvenile Chinook, as it is unable to incorporate several factors which have the potential to cause adverse effects. The potential effects of the Project resulting from construction activities, noise, lighting and changes to migration pathways are only assessed qualitatively by the applicant, despite their potential to impact juvenile Chinook. EIS Section 13.6.3.6 p. 13-123 states:

*“Discrepancy between ecosystem model and other lines of evidence attributed to inability of model to incorporate construction, acoustic, lighting, and migration mechanisms.”*

The inability of the model to incorporate these factors cannot be interpreted as lack of risk to juvenile Chinook.

The proponent also states:

*“...the objective of the RB model was not to provide an assessment of Project impacts for each functional group at a fine temporal scale, but to estimate changes in productive potential, with and without the Project, at the ecosystem level”*

(From the Vancouver Fraser Port Authority to the Review Panel re: Answers to preliminary technical questions submitted during the completeness phase from Fisheries and Oceans Canada, Natural Resources Canada, and Environment and Climate Change Canada, concerning the ecosystem modelling to support the Roberts Bank Terminal 2 Project environmental review (CEAR doc. #547, p. 99, lines 1914-1917).

Based on that statement, it would follow that the ecosystem productivity model should not be used as a line of evidence to conclude potential effects. However, based on EIS Section Table 13-12, it would appear that the ecosystem model *is* considered equal to other lines of evidence in the final conclusion.

Furthermore, EIS Section 13 pp. 13-100-101 states:

*“Outstanding data gaps around:*

- (i) *the nature and quantification of biological effects from in-water infrastructure (Simenstad et al. 1999, Williams and Thom 2001, Tabor et al. 2004) and*
- (ii) *stock-specific juvenile salmon movement patterns and residency times in the LAA (Archipelago 2014e, Trudel 2014) reduce certainty in predictions. Certain Chinook salmon stocks, for example, are more likely to experience Project-related migration effects based on their life history requirements (i.e., ocean-type Chinook, which reside longer in estuarine waters) or their current downward population trajectories (i.e., spring 52, summer 52, and spring 42 Chinook) (see Appendix 13-A). **Given these uncertainties, minor decreases in juvenile salmon productivity may occur.**”*

It appears that in the absence of information, the effects of construction, acoustic disturbance, lighting and migration disruption are all assumed by the applicant to be minor. This is despite the fact that they were previously assumed to have an effect. Without quantitative evidence to analyze the potential effects there can be little confidence in the prediction that any effects will be minor.

### 3. Potential effects of the project on juvenile Chinook orientation and behaviour

The causeway and the terminal have the potential to impact juvenile Chinook migration, orientation and behaviour; however the magnitude of these effects is a question that has remained unresolved since the construction of the original terminal.

EIS Section 13.6.3.1 (p. 13-102) states:

*“terminal placement (expected to disrupt juvenile migration, especially given remaining uncertainties around juvenile salmon movement patterns and residency times in the LAA)”.*

The EIS Section 13.6.3.6 Summary of Marine Fish Productivity Changes Table 13-12 again states:

*“Long-term minor decreases [in juvenile Chinook productivity] during operation due to change in lighting and migration disruption...”* yet no information is provided on why these effects were concluded to be minor.

Small juvenile Chinook may avoid moving around the terminal, as this would push them into deeper more saline waters, potentially exposing them to a higher risk of predation. The proponent has failed to perform the necessary field studies to support the conclusion that the effects on migration will be minor. It is scientifically indefensible to conclude that juvenile Chinook will not be adversely affected when it is unknown how they rely on habitat that has the potential to be impacted. This conclusion cannot be supported.

EIS section 13.8.1 (p. 13-141) states:

*“quantification of this [disruption to juvenile salmon migration] effect is not available...”* with the footnote *“The Project would need to be in place in order to conduct studies evaluating potential changes in juvenile salmon migration”*.

However, a study of the existing effects from previous expansions could and should be undertaken. This issue has consistently been raised by panels that reviewed the previous expansions, and yet it still has failed to be quantified. In the Final Report of the Environmental Assessment Panel – Roberts Bank Expansion Project 1977 (80 pp.) states:

*“(10) The existing Roberts Bank Port and ferry terminal causeways **could represent a significant interruptive effect on the orientation of juvenile salmonids in their utilization of the intercauseway area, and this question warrants investigation.**”*

Furthermore, the RBT2 Juvenile Salmon Surveys (p. 39) found that:

*“juvenile Chinook salmon abundance was lower at locations in the Inter-causeway Area relative to other locations at Roberts Bank”*.

It seems very probable that the effect of the existing causeway and terminal is to inhibit juvenile Chinook movement at and around Roberts Bank. This represents a significant concern regarding potential effects to juvenile Chinook salmon. Despite this recommendation of the review panel nearly 40 years ago, the Port has not followed up with any research to answer this question. The overall size and orientation of the proposed expansion would further the movement barrier that was created by the initial causeway construction and no information exists on how this will impact juvenile Chinook and other salmon. Without further research into how the significantly increased barrier to movement affects juvenile salmon use of Roberts Bank, it is hard to understand how the EIS can conclude that there will not be significant adverse residual effects to the juvenile Chinook VC.

It is presumable that before the construction of the original causeway, juvenile salmon navigated along the marsh and eelgrass nearshore areas of Roberts Bank, and experienced a gradient of salinity as they moved further out into the estuary. However, with the current footprint of the Port, juvenile Chinook must move from the brackish eelgrass habitats on the north side of the causeway into deeper saline waters if they hope to move into the intercauseway habitat. Expanding the footprint would only further this issue. While the intercauseway area may be a productive ecological zone, the proponent has not provided any evidence that juvenile Chinook will move into this area. What is the potential increase in predation associated with having to move through these deeper and illuminated waters? What incentive do juvenile Chinook have to move south around the Port to reach the intercauseway eelgrass? What is the incentive for juvenile Chinook to move into deeper waters if they are still in an estuary rearing phase? These questions need be resolved before further impacts to juvenile Chinook migration and behaviour can be properly assessed.

#### 4. Lack of quantitative information on the potential effects of noise and light on juvenile Chinook

The EIS lacks of a full evaluation of the potential effects of Project related noise and lighting on juvenile Chinook salmon behaviour. Underwater noise has the potential to effect juvenile Chinook salmon use of the Roberts Bank ecosystem by causing behavioural changes including avoidance behaviour. Changes to light and shading have the potential to increase susceptibility to predation and lower foraging success. Together these effects have the potential to adversely affect juvenile salmon productivity, and no information has been provided which would allow an accurate quantification of the magnitude of these effects.

While little research has been conducted on juvenile salmon sound sensitivity, Pacific herring have been shown to avoid noise produced by vessels (Schwarz and Greer 1984). A recent review by Robertis and Handegard (2012) looked at a number of reasons that vessels may elicit a behavioural response in fish and concluded:

*“simple models of behaviour, for example those based on sound pressure level alone, cannot explain the observations of fish avoidance”.*

However the EIS relies on a simple sound threshold which may not accurately predict juvenile Chinook avoidance behaviour and is not based on peer reviewed literature.

The conclusion that noise associated with shipping will not have an effect on juvenile Chinook is based on the threshold:

*“sound levels generated by ship movements are not predicted to reach the behavioural threshold for salmon (i.e., 90 dBht) (Nedwell et al. 2007)” (EIS Section 13.6.1.2 Changes in the Acoustic Environment p. 13-75).*

Nedwell et al. (2007) states:

*“On this basis, a method which is relatively simple to calculate and apply is proposed for estimating areas around a pile driving operation within which the two key auditory effects of noise will occur”.*

This method may be summarised as:

*“Provided animals are free to flee the noise, those within the area bounded by the 90 dBht level contour will strongly avoid the noise.”*

This standard which the proponent has chosen to use is inappropriate as it is based on a consultant’s report which looked at the effect of pile driving noise (associated with the construction of wind farms) which creates very different types of noise than container ship operations. Pile driving creates short duration high intensity sounds as opposed to long duration low frequency noises produced by ships, which occur in the audible range for salmon (Schwarz and Greer 1984). The other significant problem with this standard is it provides no information on the minimum level of noise at which effects begin to occur, but instead is the level at which all individuals exhibit a strong response. Further justification for the use of this standard should be provided, and if possible it should be replaced. Overall, little information is presented to support the conclusion that project related noise will not have an effect on juvenile Chinook, and more information should be provided.

The role of artificial lights in facilitating excessive predation by seals on juvenile salmon has been documented in BC (Yurk and Trites 2000). Lighting and shading have the potential to negatively affect juvenile Chinook, but again the magnitude of this effect has not and cannot be quantified. EIS Section 13.6.3.1 (p. 13-97)

*“Changes in the light environment have the potential to influence Pacific salmon productivity in the LAA; however, since it was not possible to incorporate this mechanism into the ecosystem model, it is addressed qualitatively. Low light conditions, such as those brought about by structural shading, are not optimal for juvenile salmon, which depend upon light for prey capture and schooling (Nightingale and Simenstad 2001a). Increased predation on juvenile salmonids in low light (i.e., dawn or dusk) has been documented (Ginetz and Larkin 1976), and may be caused by a period of partial night blindness, since the process of dark adaptation takes as long as 50 minutes (Ali 1959), or by a loss of schooling ability (Ono et al. 2010).”*

Again, an effect on juvenile Chinook is predicted, and as there is no quantitative evidence provided on the potential magnitude of this affect, yet it is assumed in the EIS to be minor.

De Robertis, A., and Handegard, N. O. 2012. Fish avoidance of research vessels and the efficacy of noise-reduced vessels: a review. ICES Journal of Marine Science: Journal du Conseil, p. fss155.

Nedwell, J. R., Parvin, S. J., Edwards, B., Workman, R., Brooker, A. G., and Kynoch, J. E. 2007. Measurement and Interpretation of Underwater Noise during Construction and Operation of Offshore Windfarms in U.K. Waters. Subacoustic Report 544R0738, Prepared for COWRIE Ltd.

Schwarz, A. L. and Greer, G. L. 1984. Responses of Pacific herring (*Clupea harengus pallasii*) to some underwater sounds. Can. J. Fish. Aquat. Sci. 41(8): 1183-1192.

Yurk, H. and A. Trites. 2000. Experimental attempts to reduce predation by harbor seals on out-migrating juvenile salmonids. Trans. Am. Fish. Soc. 129:1360–1366.

#### 5. Flaws in the application of the ecosystem model to predict effects on juvenile Chinook

The output of the Roberts Bank ecosystem model was clearly used as a line of evidence to support the conclusions in the EIS for juvenile Chinook; however this application of the model is flawed for several reasons. The model fails to incorporate a number of factors which have the potential to impact juvenile Chinook, and the field data used to develop several key input parameters is insufficient. The ecosystem model is also inappropriate to predict effects on juvenile Chinook as they only spend a portion of the year in the assessment area. As noted previously, the proponent stated:

“...the objective of the RB model was not to provide an assessment of Project impacts for each functional group at a fine temporal scale, but to estimate changes in productive potential, with and without the Project, at the ecosystem level” (CEAR doc. #547, p. 99, lines 1914-1917).

Based on that statement and the deficiencies outlined below, it would follow that the ecosystem productivity model should not be used as a line of evidence upon which the final conclusions of potential effects are based.

The prediction of the model that juvenile Chinook will see an increase in productivity is based on the model's prediction that there will be a large increase in the productivity of macrofauna as a result of abiotic changes associated with the Project. However, the ecosystem model does not provide enough temporal clarity to accurately predict changes in juvenile Chinook productivity.

The ecosystem model predicts an increase in juvenile Chinook biomass of 16%:

*“based on an increase in productivity on the tidal flats northwest of the Roberts Bank causeway”* EIS Appendix 10-C Roberts Bank Ecosystem Model Development And Key Run Section 3.7.2 Chinook Salmon Juvenile (p. 74).

However it is not known if the predicted 27% increase in macrofauna biomass (EIS Appendix 10-C Roberts Bank Ecosystem Model Development and Key Run Section 3.7.2 Chinook Salmon Juvenile p. 75) which drives this trend occurs at a time of year when it is relevant to juvenile Chinook.

Juvenile Chinook peak in abundance at Roberts Bank in the spring and are completely absent from the area during the fall and winter, at least half of the year. The ecosystem model also describes several decreases in productivity associated with the project that have the potential to adversely impact juvenile Chinook at Roberts Bank. A decrease in Pacific herring productivity is predicted to occur (EIS Appendix 10-C Roberts Bank Ecosystem Model Development And Key Run Section 3.7.2 Chinook Salmon Juvenile P. 138).

Juvenile and immature Chinook are known to rely on larval and juvenile herring as prey. EIS Section 13.5.1.2 (p. 13-29) states:

*“At Roberts Bank, major food items (for juvenile Chinook) change from spring to summer (i.e., epibenthic crustaceans and other invertebrates are more prevalent in spring, whereas fish such as Pacific herring are prevalent in later months)”*

Does this decrease in herring productivity not have a negative effect on juvenile Chinook? Juvenile salmon rely on these two different types of prey items at different times during their estuarine residence, therefore an increase in macrofauna may not be suitable to compensate for the loss of herring and other prey items at different times of the year.

Further evidence that the ecosystem model may be inadequate to assess effects on juvenile Chinook come from EcoPath with Ecosim developers Christensen and Walters who, in a 2004 publication, discuss the potential pitfalls of its use and state:

*“Rather than pretending that Ecosim and single species methods are competitors, a useful assessment tactic may be to work back and forth between Ecosim and single-species assessment methods, using each to check and improve the other.”*

The ecosystem model and EIS also fail to incorporate the predicted effects of climate change on the Roberts Bank ecosystem, despite being directed to do so in the EIS guidelines, adding considerable uncertainty to the description of future conditions with the project. EIS guidelines Section 10.1.5 Effects of the Environment on the Project (p. 26):

*Longer-term environmental effects of potential future sea level rise and other changes to the climate on the project and surrounding ecosystems will also be assessed. This assessment will include a description of methodological approaches and climate data used as well as the scenarios and the assumptions made.”*

EIS Section 13.5 (p. 13-20) states:

*“Such variability is likely to be further amplified by climate change, where sea level rise is anticipated to cause a reduction in the intertidal mudflat area and an increase in marsh erosion in the foreseeable future.”*

However, the EIS fails to capture these potential effects, as EIS Section 13.5 (p. 13-20) states:

*“As such, in the absence of concrete predictions around changes in physical processes, for the purposes of this assessment, expected conditions are assumed to be the same as existing conditions”*

Sea level rise is predicted to result in decreases to freshwater and salt intertidal marsh and a decrease in the total area of tidal marshes (Craft et al. 2009). As the ecosystem model fails to incorporate sea-level rise, it fails to accurately characterize future conditions with the project. As tidal marshes are an extremely productive component of the Roberts Bank ecosystem, sea-level rise has the potential to result in adverse effect on the productivity of Roberts Bank. This has the potential to interact with the Project to decrease juvenile chinook productivity.

The ecosystem model also relies heavily on the assumption that the field data accurately depicts the Roberts Bank ecosystem; however as will be described in detail in the following section it fails to do so. The data collected during the field studies is insufficient to accurately depict juvenile Chinook biomass and habitat preferences, and as such adds significant uncertainty regarding these important parameters used by the model.

Overall there are many sources of uncertainty and significant assumptions in the ecosystem model which limit its ability to adequately predict the effects of the project on juvenile Chinook salmon. Due to these significant uncertainties it is my conclusion that the results

of the ecosystem model should not be used as a line of evidence when evaluating the potential adverse effects of the project on juvenile Chinook salmon.

Christensen, V., and Walters, C. J. 2004. Ecopath with Ecosim: methods, capabilities and limitations. *Ecological Modelling*, 172(2): 109-139.

Craft, C., Clough, J., Ehman, J., Joye, S., Park, R., Pennings, S., ... and Machmuller, M. 2009. Forecasting the effects of accelerated sea- level rise on tidal marsh ecosystem services. *Frontiers in Ecology and the Environment*, 7(2): 73-78.

#### 6. Field data insufficient to characterize current use of the assessment area by juvenile Chinook

The field studies carried out by the proponent form the basis for their effects assessment and the inputs for the ecosystem model; therefore, it is of the utmost importance that these data accurately represent use of Roberts Bank by juvenile Chinook salmon. In my professional opinion, for details discussed below, these studies fail to accurately characterize juvenile Chinook use of the Roberts Bank area. The proponent's field studies which relate to juvenile Chinook include the RBT2 Eelgrass Community Survey and the RBT2 Juvenile Salmon Surveys, which were conducted across 2012 and 2013. Due to their limited duration, lack of intensity, limited number of sites, and inefficient field methodology, the RBT2 Juvenile Salmon Surveys are wholly insufficient to accurately depict juvenile Chinook habitat preferences and abundance in the Roberts Bank ecosystem. Thus the parameters which have been used for the ecosystem model likely carry a high degree of uncertainty and are likely meaningless to make predictions about productivity.

The field studies conducted by the proponent had a very limited number of replicates, both spatially and temporally, that prevented them from detecting habitat preferences and likely lead to highly uncertain estimates of abundance for juvenile Chinook. The RBT2 Juvenile Salmon Survey (p. 40) states:

*“No consistent seasonal or annual trends were observed in juvenile chinook abundance at individual sites or habitats, as numbers were overall fairly low and extremely variable”.*

The assumption that juvenile Chinook do not exhibit habitat preferences between salt marsh, un-vegetated flats, and eelgrass is not supported by the literature, and instead seems to be an artifact of the limited field sampling conducted by the proponent. The RBT2 Eelgrass Fish Community Survey consisted of only 5 sites - 4 eelgrass sites and 1 reference site on the sandflat- and the RBT2 Juvenile

Salmon Survey consisted mostly of shore tied sites and again appears to have had only one reference sandflat site. The likely reason they were unable to detect any habitat preferences is that their study had very limited replication both in the number of sites of each habitat and in the number of sampling occasions.

The field studies also failed to make comparisons across years which could generate more accurate estimates of abundance and detect any changes in juvenile Chinook use of Roberts Bank over time. The Juvenile Salmon Surveys, although designed to complement the Eelgrass Community Survey, used a different methodology with a larger net and thus was not comparable across years. As juvenile chinook abundance varies significantly from year to year, how can the proponent be confident that a one-year study and the parameter estimates upon which it was based are an accurate representation of long term juvenile chinook use of the assessment area.

*Page 10: "While CPUE data were reported in studies occurring pre-1983 (Greer et al. 1980, Gordon and Levings 1984), CPUE data from studies completed after the year 2000 was not available for comparison"*

Research that has been conducted since 2000 (Triton 2004; Martel 2009; Thurninger 2013 a,b) has all been done on behalf of the proponent. Why then, has CPUE not ever been calculated? Based on the available information, it would appear that use of the Roberts Bank area by juvenile Chinook has decreased since the studies conducted in the 1980's; why was this not addressed in the Juvenile Salmon Survey or EIS Section 10?

*Page 10: "because studies conducted pre-1983 were carried out prior to the expansion of Roberts Bank Port facilities on Pods 3 and 4 (Hemmera 2004, Figure 3) and modifications to the BC Ferry Terminal, data from these studies are less relevant for inter-annual comparisons than data from more recent studies"*

By avoiding comparisons of recent studies with historical data, the proponent is excluding any examination of how previous Port expansions have impacted juvenile salmon use of the Roberts Bank area. A review of the potential impacts of the proposed expansion and investigation into juvenile salmonid use Roberts Bank would have been highly pertinent information. However, the proponent has conducted their studies in a way that precludes such analysis. The idea that studies conducted prior to the previous expansion are no longer valid creates a shifting baseline where conditions after each impact are taken as the new normal, while the cumulative impact of prior and proposed expansions is never truly evaluated.

Along with being unable to detect habitat preferences and make historical comparisons, the abundance estimates they have produced are unlikely to accurately represent juvenile Chinook use of Roberts Bank. Juvenile Chinook abundance in the Fraser estuary is known to have a sharp peak in the spring and then drop off rapidly (Levy and Northcote 1982), however only one round of sampling was

conducted during the spring season in each of the two sampling years. The results of their two years of spring sampling were highly variable:

*“Juvenile chinook salmon abundance in the survey area was significantly higher in 2012 ( $4.1 \pm 1.2$  SE) than 2013 ( $0.5 \pm 0.2$  SE)(RBT2 Juvenile Salmon Surveys p. 25).”*

Due to the limited replication of their sampling protocol, it is difficult to know whether this represents a true difference in abundance or in outmigration timing, or is an artifact of the sampling methods. Based on the lack of replication, there is little confidence in the abundance estimates generated, which represent a mere snapshot versus an accurate or relative representation of juvenile Chinook abundance at Roberts Bank across the spring outmigration period. As outmigration abundance is determined by the strength of the spawning class in the previous year, juvenile Chinook abundance in the Lower Fraser and estuary varies considerably from year to year. The limited repetition of their sampling protocol both within and across years is insufficient to represent the long term average of juvenile Chinook abundance at Roberts Bank.

Levy, D. A., and Northcote, T. G. 1982. Juvenile salmon residency in a marsh area of the Fraser River estuary. *Can. J. Fish. Aquat. Sci.* 39(2): 270-276.

Martel, G. 2009. T2 Environmental Baseline Monitoring Report, Section 7: Fish Communities. Prepared for Vancouver Port Authority, Vancouver, B.C.

Thuringer, P., H. Anderson, M. Morris, J. Tyler, and G. Williams. 2013a. Deltaport Third Berth Habitat Compensation Monitoring: East Causeway Year 1 Post-Construction Annual Report. Annual Report, Prepared by: Archipelago Marine Research Ltd., and GL Williams and Associated Ltd. Prepared for: Port Metro Vancouver, Vancouver, B.C.

Thuringer, P., J. Tyler, M. Morris, A. Park, S. Roais, and G. Williams. 2013b. Deltaport Third Berth Habitat Compensation Monitoring: East Causeway Year 2 Post-Construction Annual Report. Annual Report, Prepared by Archipelago Marine Research Ltd. and GL Williams and Associated Ltd., Prepared for Port Metro Vancouver, Vancouver, B.C.

Triton Environmental Consultants Ltd. (Triton) 2004. Deltaport Third Berth Project Marine Resources Impact Assessment. Prepared by Triton Environmental Consultants Ltd., Prepared for Vancouver Port Authority, Richmond, B.C.

#### 7. Failure of past mitigation measures

As the Port plans to offset habitat losses with tidal marsh creation, a detailed evaluation of the effectiveness of past compensation works should be presented. In Appendix 17-A:

*“Between 2010 and 2013, effectiveness monitoring was conducted for intertidal (salt) marsh habitat constructed along the south side of the causeway as compensation for the DP3 Project (Williams et al. 2014). Port Metro Vancouver constructed lagoon marshes at the shoreward end of the Roberts Bank causeway and open marsh benches in the mid-section of the causeway, and excavated upland and intertidal shoreline armouring to allow for natural colonisation of salt marsh plant species. Marsh vegetation has established on the open marsh benches, whereas the protected lagoon marshes and excavated mudflat have been less effective (G.L. Williams and Associates Ltd. 2013). The effectiveness monitoring concluded that “the habitat is not fully functional, and the biological and physical processes have not yet stabilised due to exposure to a higher wind and wave energy environment than the habitat had been designed for.”*

As recent compensation works have failed, what evidence can the Port provide that future works will meet with greater success?

Furthermore, ongoing research by Environment Canada at Sturgeon Bank has demonstrated a significant loss of marsh habitats at Sturgeon Bank, but has yet to determine the cause. As key factors controlling marsh distribution and growth have not been fully determined, is successful marsh creation certain?

#### 8. Need to assess Chinook at the appropriate management level including necessary field data

The Fraser River estuary is used by a diversity of Chinook salmon populations which spawn in locations throughout the watershed and vary in life history characteristics such as freshwater residence time, estuarine residence, outmigration timing, and return timing.

Chinook populations in the Fraser have been assigned into 21 Conservation Units (CUs) by Fisheries and Oceans Canada to preserve the locally adapted diversity of salmon populations, and are composed of one or more populations based on their unique ecology, life history and genetics (Holtby and Ciruna 2007; DFO 2013).

These Chinook CUs vary considerably in their life history including the extent of their reliance on the estuary as juveniles, and run timing as adults. The proponent should provide information at this level to be consistent with fisheries managers and ensure the panel can adequately assess the risk to the various CUs of Fraser River Chinook. For many years Fisheries and Oceans Canada have been using genetic stock id information to determine population origin of Chinook in order to further their conservation. Without genetic information to determine stock id of juvenile Chinook captured during the field studies, conclusions on potential effects cannot be justified.

DFO. 2013. Review and update of southern BC Chinook conservation unit assignments. DFO Can. Sci. Advis. Sec. Sci. Resp. 2013/022.

Holtby, L.B. & Ciruna, K.A. 2007. Conservation units for Pacific Salmon under the Wild Salmon Policy. Can. Sci. Advis. Sec. Res. Doc. 2007/070. viii + 350 pp.

#### 9. Need for a cumulative effects assessment for juvenile Chinook

As the project is likely to result in adverse effects on juvenile Chinook, an assessment of cumulative effects should be conducted. Even though the EIS fails to accurately describe existing conditions experienced by juvenile Chinook in the assessment area, and fails to conduct a cumulative effects assessment, the EIS assumes the potential effects on juvenile Chinook to be negligible after mitigation. However, the EIS guidelines Section 12.1.1 Residual Environmental Effects (p. 31) states that:

*“The residual effects, even if very small or deemed insignificant, will be described.”*

Without an adequate assessment of project or cumulative effects, the effect of the project nor the potential effectiveness of mitigation cannot be quantified and are thus functionally unknown. The lack of a cumulative effects assessment fails to provide the panel with sufficient information to properly evaluate the potential project effects in the context of the many other activities which adversely affect juvenile Chinook in the assessment area.

The proponent was directed to address cumulative effects on juvenile Chinook in the Regional Assessment Area, which is outlined as Hope to the estuary, with attention to be paid to the Cohen Commission Final Report (EIS Guidelines 12.2.1 Cumulative Effects Assessment p. 32). EISG 12.2.1 Cumulative Effects Assessment states that:

- i) *This narrative discussion should include historical data, where available and applicable, to assist interested parties to understand the potential effects of the project and how they may be addressed.*
- ii) *The EIS will describe the analysis of the total cumulative effect on a VC over the life of the project, including the incremental contribution of all current and proposed physical activities, in addition to that of the project. The EIS will include different forms of effects (e.g. synergistic, additive, induced, spatial or temporal) and identify impact pathways and trends.*

Despite this, the proponent has failed to describe previous cumulative effects on salmon and their habitats in the Lower Fraser. Cumulative effects to the Lower Fraser and estuary include, but are not limited to, the loss/alienation of at least 70% of floodplain and 70% of estuarine habitats which are now diked or armoured and converted to human uses, an array of pollutants discharged from sewage treatment plants and industrial activities, drastic recession of marsh across Sturgeon Bank, and trifurcation schemes with numerous jetties in the estuary, including the existing Roberts Bank Terminal causeway, which have altered the flow of water and sediment in the estuary, changing salinity gradients and the ability of juvenile salmon and other fishes to move throughout the estuary. These are only some of the cumulative changes to the Regional Assessment Area which the proponent failed to adequately represent. A full evaluation should be requested for the panel to be able to accurately understand the potential for significant cumulative effects on juvenile Chinook in the RAA.

10. Need for an assessment of Chinook population trends and status

Although Chinook were chosen as a VC for the EIS, very little information is presented to allow the panel to evaluate population status and trends for Fraser Chinook. Such information is critical for setting the context against which potential future effects should be evaluated. In the Fraser River, Chinook populations are typically grouped based on key life history characteristics. Juvenile Chinook

have two distinct life history strategies in the Fraser, “ocean type” juveniles that migrate to the ocean in their first year and “stream type” juveniles that remain in freshwaters for their first winter before outmigrating to the ocean the following spring (DFO 1999). Ocean type Chinook, particularly the Harrison River stock, are known to rely on habitats in the Lower Fraser and estuary (which is the Regional Assessment Area) as juveniles during the critical period before migrating to the open ocean. DFO (1999):

*“Within the Harrison River, all chinook spawn in a 16.5-km section stretch of river downstream from Harrison Lake. The fry emigrate downstream shortly after emergence and use side channels and sloughs of the lower Fraser River and its estuary as their primary rearing locations. The Harrison River is used for log transport and storage and the lower Fraser River and estuary is affected in numerous ways by the city of Vancouver. The wild population is clearly vulnerable to degradation of these important habitats.”*

As ocean-type Chinook are the most likely to rely on habitats in the LAA and RAA, they should be the focus of the effects assessment for the juvenile Chinook VC. Since 1999, escapements for the Harrison stock - while variable- have showed a steady decline as demonstrated by the most recent report by the Pacific Salmon Commissions Chinook Technical Committee (CTC)

The CTC 2015 report states:

*“A large and diverse group of Chinook salmon spawning in Canada occurs in the Fraser River watershed, with many local populations (CTC 2002b; Candy et al. 2002). Escapements to the three stock groups with yearling smolt life history (stream type) declined steeply from 2003 to 2009, and yearling smolts that entered the ocean in 2005 and 2007 had low survival. Recently, escapements have been low but with modest rebuilding over brood years. In contrast, escapements to the Fraser summer run 0.3 (ocean type) increased during the 1990s and remained abundant until 2012, which was very low compared to levels over the previous decade. Since 2012, escapements have increased from 2013 to 2015.*

*For the Fraser late stock group, the Harrison River had very low escapements from 2012 to 2014 with escapements more than 15% below the lower bound of the escapement goal. Escapement was estimated at 101,516 in 2015, which is higher than the 2014 escapement and just above the upper escapement goal. However, the escapement was only 82% of the 2011 parental brood of 123,478.*

*“2.2.3 Escapement Trends for Canadian Stocks - Long-term rates of change in escapement for Canadian stocks were based on 1999–2015 time series of escapement for 16 of 17 stocks evaluated. Escapement time series started for Lower Shuswap in 2000 due to changes in escapement estimation methodologies. Few Canadian stocks exhibited clearly positive or negative tendencies in long-term rates of change in escapement—generally due to large variability in annual rates of change (as indicated by the 80% CIs; Figure 2.4).*

*Seven stocks showed negative mean rates of change, but only Harrison, which has a CTC-agreed escapement goal, showed a clear negative trend.”*

The Harrison River stock has seen an escapement which in recent years has been both depressed and variable (See Figure 1 below). As this stock of ocean-type Chinook likely rely heavily on the local and regional assessment areas, they should be carefully considered, as they are representative of the juvenile Chinook VC upon which the effects are assessed. However, the proponent has failed to provide any information to allow the panel to evaluate the potential effects on juvenile Chinook within the appropriate management context, including information at the Conservation Unit level.

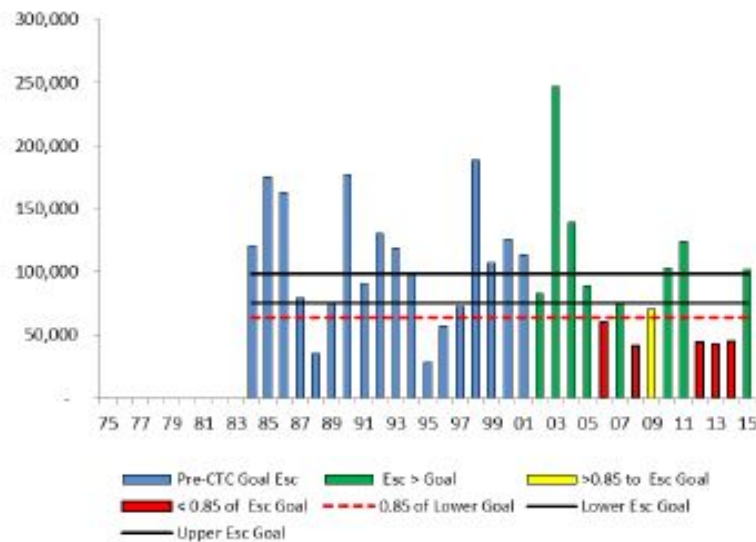


Figure 2.31.—Harrison River escapements of Chinook salmon, 1984–2015.

Figure 1. Taken from the 2015 CTC report demonstrates the escapement by year of the Harrison River Chinook stock.

CTC (Chinook Technical Committee). 2015. Annual report of catch and escapement for 2015. Pacific Salmon Commission, Report TCCHINOOK (16)–3. Vancouver, BC.

Department of Fisheries and Oceans. (DFO) 1999. Fraser River Chinook Salmon. DFO Science Stock Status Report D6-11 (1999).

11. Relevant conclusions from panels which reviewed previous expansion projects at Roberts Bank

Previous expansion projects at Roberts Bank have also undergone an environmental assessment process, and each time there have been conclusions by the panel and commitments by the proponent related to potential effects on juvenile Chinook which are relevant for the current assessment. Below I describe some of the key information provided by previous panel reports.

**Final Report of the Environmental Assessment Panel – Roberts Bank Expansion Project 1977 (80 pp.)**

As the panel should be aware, the facilities at Roberts Bank have undergone multiple previous expansions that have resulted in its current footprint of 85 hectares. The initial construction of the coal port was completed in 1970 with a footprint of only 20 hectares, and no review of environmental effects was conducted. When an expansion to the terminal was then proposed a full environmental review was conducted in 1979. I would like to draw your attention to the summary of their findings:

*“The proposal by the National Harbours Board is to increase the size of bulk loading facilities at Roberts Bank **from 20 hectares to as much as 130 hectares** to facilitate the export of commodities such as coal, sulphur, potash, grain and bulk liquids. The Panel has considered in depth the environmental implications of the proposal and has **concluded that significant environmental damage and risk would result from the proposal**. The Panel recommends that the expansion as proposed not be permitted to proceed. However, the Panel notes that there is an area where reduced expansion could be tolerated with minimal environmental impact.*

*The Roberts Bank Port is in the estuary of the Fraser River which is one of the most ecologically important estuaries in North America. The Panel considers that the area merits special attention and stringent conservation measures. The Panel supports current government initiatives in these directions and believes that a decision on the port expansion proposal should reflect the spirit of these initiatives.”*

The current facility at Roberts Bank now occupies a greater area than the previous review panel deemed to be at an acceptable risk to the environment at Roberts Bank. Since the previous review, cumulative effects on salmon habitats in the Regional Assessment Area of the project have also increased dramatically.

The panel also stated:

*“The Panel has concluded that the ecological damage would be minimal and other adverse impacts could be reasonably mitigated if port expansion were limited. If it is decided that a reduced expansion is feasible, the Panel recommends that it be limited to the area of the proposed Terminals 2 and 3 and that the ship channel not be enlarged significantly beyond the existing channel.”*

The importance of the ecological values at Roberts Bank has not changed since the 1979 review panel reached this conclusion, and the Port has already grown to 137 hectares to date. Since then the port has expanded beyond the proposed Terminals 2 and 3, and despite their specific recommendation against it, the ship channel was significantly enlarged. The proposed expansion is to add another 108 hectares, bringing the total to a 245 hectare footprint at Roberts Bank, significantly larger than the 130 hectare footprint that the 1979 review panel concluded would place too large a risk to the ecological system at Roberts Bank.

I would also like to draw your attention to some of the relevant points from the summary of major conclusions on page 39 of said document:

*“(7) Although no study has been conducted to verify the degree of eelgrass importance ecologically, the health and extent of eelgrass beds on Roberts Bank are considered good indices of overall habitat quality”*

To date, very little research has been done to further demonstrate the importance of the eelgrass at Roberts Bank relative to other areas in the Fraser River estuary.

*“(8) There is insufficient evidence to directly relate the deletion or addition of a given amount of eelgrass to a decrease or increase in the salmon fisheries resource”*

To date, the Port nor other researchers, have yet to empirically demonstrate that the eelgrass at Roberts Bank is related to the productivity of the salmon fisheries in the area, however it is implicitly assumed in their ecosystem productivity model run and thus in their conclusions related to the potential for adverse residual negative impacts on juvenile Chinook salmon and other salmon.

*“(10) The existing Roberts Bank Port and ferry terminal causeways could represent a significant interruptive effect on the orientation of juvenile salmonids in their utilization of the intercauseway area, and this question warrants investigation.”*

Despite this recommendation of the review panel the Port has not followed up with any research to answer this question. The overall size and orientation of the proposed expansion would further the movement barrier that was created by the initial causeway construction and no information exists on how this will impact juvenile Chinook and other salmon.

*“(11) There is no evidence to conclude that there is any Fraser River estuary area surplus to the needs of juvenile salmonids for nursery grounds and, therefore, any further loss of salmonid rearing grounds should be kept to an absolute minimum.”*

Since the time of this report there has been a cumulative loss of salmonid rearing habitats in the Fraser estuary, including but not limited to dramatic recession of the marsh habitats on Sturgeon Bank. As there is no evidence to indicate that the proposed expansion will not all but cut off juvenile salmon access to the intercauseway area, it seems reasonably foreseeable that the project may indeed lead to significant negative effects on juvenile Chinook, adding to cumulative effects already incurred.

#### **Final Report of the Roberts Bank Environmental Review Committee 1996 (36 pp.)**

The Roberts Bank Environmental Review Committee was established in 1980 to follow up on the recommendations of the Final Report of the Environmental Assessment Panel from 1979. As the panel had recommended that the project not go ahead, the Port then put forward a new proposal for limited expansion which was approved in 1981, and constructed from 1982 to 1984.

Important to note that the expansion which went ahead:

*“differed from the Panel's specifications in that:*

*1) the results of the hydraulic study, new information about habitat in the intercauseway area (between the port and the Tsawwassen Ferry Terminal causeways), and economic reality caused the number and location of the terminals to be altered; and 2) **the ship channel was significantly enlarged** for navigational safety.”*

The shipping channel was enlarged based on the recommendation of the Coast Guard on the basis of navigational safety. This goes directly against one of the strongest recommendations of the review panel, undoubtedly causing negative effects to the Roberts Bank ecosystem.

This review committee makes several recommendations in its report including:

*6 - Further investigate and quantify impacts of air and water pollution due to coal dust.:*

*At the time of the Panel's report, very little was known about the effects of coal dust on the environment. The only report available for the original impact assessment was a study by BC Research (1973) on coal dust toxicity to salmonids. Coal dust itself was not found to be toxic to fish, although various resinous binders used to suppress coal dust were found to exhibit varying degrees of toxicity.*

*Subsequent studies by DFO have shown that the impacts of coal dust on water quality and selected biota at Roberts Bank are negligible (Pearce and McBride 1977, Hillaby 1981). The Waste Management Branch also identified that there have been no demonstrable effects in the study area (Gough 1981).*

Research which has been conducted since this report has demonstrated that coal dust concentrations in the sediments surrounding the terminal significantly increased in the period from 1977 to 1999 (Johnson and Bustin 2006). As the coal dust concentrations have continued to increase in the area around the terminal, what research has the Port conducted on the potential for toxic effects on fish such as juvenile salmonids?

*“General Recommendation 9 - Appropriate government agencies undertake additional studies on the following: a) Utilization by salmonids, herring and crabs of the intercauseway and other adjacent zones of Roberts Bank, including food chains and habitats on which these species depend. **Possible interruptive effects of the existing Roberts Bank and ferry terminal causeways on the orientation of juvenile salmonids in their utilization of Roberts Bank and the intercauseway area.**”*

Here again, in 1996 we see the review panel call for research into the effects of the causeway on juvenile salmonid movement and orientation at Roberts Bank, as did the panel in 1979, some 17 years earlier.

The little research done that is referred to in this report includes the study by Levings et al. 1985 which concluded that:

*“Juvenile salmonids used disrupted and manmade habitats at a coal port on Roberts Bank, Fraser River estuary. Chinook (*Oncorhynchus tshawytscha*) and chum (*O. keta*) resided between the port causeways. Chinook fry fed on invertebrates, especially harpacticoids, produced in eelgrass (*Zostera marina*) and sandflat habitats.*

*Recent construction for expansion of the coal port has resulted in obliteration of shallow water habitats by filling and dredging. Further studies are required to examine feeding habits of salmon in the recently disrupted area.*

*Some invertebrate and algal habitat has been created by placement of rip-rap along the port shorelines and at an erosion control structure. Data on fish use of these habitats are required, as are investigations into the influence of causeways on fish migration.”*

Deltaport Third Berth Expansion Project – Comprehensive Study Report 2006 (241 pp.)

After the expansion in 1984, which added 60 ha for the three new berths and 25 ha for the expanded causeway, a new proposal to expand the facilities at Roberts Bank did not occur for an extended period. In 2004 the Port then proposed the Deltaport Third Berth

Expansion project, which expanded the 115 hectare footprint of the Port by another 22 hectares, and to further dredge and deepen the shipping channel.

Mitigation for this expansion included

*“Reduction of the project footprint from the original proposed 32 hectares to approximately 22 hectares”*

Throughout the previous expansion projects it has been recognized that limiting the overall footprint of the Port at Roberts Bank is critical to protecting ecological values. If reducing the footprint of the previous expansion by 10 hectares was part of mitigation for the previous expansion, how is that affected by a new 108 hectare expansion project?

The current environmental assessment is the fourth time that a panel is asked to review the potential effects of port expansion on the Roberts Bank ecosystem. Many ecological questions posed by the first review panel remain unanswered, providing considerable uncertainty in the proponent’s effects assessment. Most notably, the question of how the causeway and terminal affects juvenile salmon orientation and behaviour remains wholly unresolved. There is also no information provided on changes in fish use of the Roberts Bank area over time in relation to previous expansion projects. Therefore, the proponent’s assertion that the project will not have an adverse effect on juvenile Chinook is based on insufficient information, when in fact, the potential effects on juvenile Chinook remain highly uncertain.

Johnson, R., and Bustin, R. M. 2006. Coal dust dispersal around a marine coal terminal (1977–1999), British Columbia: The fate of coal dust in the marine environment. *International journal of coal geology*, 68(1): 57-69.

Levings, C.D. 1985. Juvenile salmonids use of habitats altered by a coal port in the Fraser River Estuary, British Columbia. *Marine Pollution Bulletin* 16 (6): 248-254.

This report by Levings (1985) was not followed up by any further research from the Port or Fisheries and Oceans Canada, therefore little information exists which adequately describes juvenile salmonid use of Roberts Bank.

12. Conclusions on potential adverse effects of the project on juvenile Chinook

- **The information presented is not sufficient to allow for an adequate evaluation of the potential effects of the Project on juvenile Chinook salmon.**
- **The conclusion in the EIS that the Project will result in a minor negative effect on juvenile Chinook is based only on a qualitative assessment of various Project related activities. This lack of knowledge should not equate to a lack of risk.**
- **The application of the Roberts Bank ecosystem model is inadequate and based on insufficient data, and therefore should not be used as a line of evidence to assess potential effects for juvenile Chinook.**
- **Field studies conducted by the proponent were insufficient to adequately describe baseline conditions for juvenile Chinook including abundance and habitat preferences.**
- **Based on the available information it is my opinion that there is significant potential for adverse effects on juvenile Chinook, which will contribute to incremental cumulative effects currently affecting juvenile Chinook productivity in the assessment area.**
- **Overall, the EIS lacks quantitative information necessary to evaluate the potential for adverse effects on juvenile Chinook salmon and fails to describe cumulative effects currently experienced by this value component in the assessment area.**

13. Proposed Information Requests on the Sufficiency and Technical Merit of the Environmental Assessment

Along with my review of potential effects I have a number of information requests which could provide more information on potential effects of the project on juvenile Chinook.

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
<i>EIS Section 13.4.1 Desktop and Field Studies            Technical Data Report            RBT2 Eelgrass Community Survey, Technical Data Report RBT2 Juvenile Salmon Surveys</i>	<p>A report which examines long term trends in juvenile salmon abundance in the Local and Regional Assessment Areas.</p>	<p>Several studies commissioned by the proponent (Triton 2004; Martel 2009; Thuringer 2013a,b) have captured juvenile salmon at Roberts Bank yet no historical comparisons are presented in the EIS as they inexplicably failed to calculate CPUE's for their studies. Information on long terms trends in juvenile salmon abundance at Roberts Bank is important for understanding how changes to the area have affected juvenile salmon use of the area over time as the Port has expanded.</p>
<i>EIS Section 13 Table 13-12; From the Vancouver Fraser Port Authority to the Review Panel re: Answers to preliminary technical questions submitted during the completeness phase from Fisheries and Oceans Canada, Natural Resources Canada, and Environment and Climate Change Canada, concerning the ecosystem modelling to support the Roberts Bank Terminal 2 Project environmental review</i>	<p>Explanation of the rationale for the conclusion that significant adverse effects on juvenile Chinook will not occur. A thorough explanation of how multiple lines of evidence were considered and incorporated should be included.</p>	<p>Little information is provided by the proponent regarding how they came to the conclusion that the project will result in a minor decrease to juvenile Chinook productivity. "The RB model was one of several tools used by PMV to inform the marine biophysical valued components effects assessments. Effects assessment conclusions were based on numerous lines of evidence and did not rely solely on RB model results;" (CEAR doc. #547, p.1, lines 23-25)." If the ecosystem model is not the primary line of evidence used than what was the decision based on?</p>

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
<i>(CEAR doc. #547)</i>		
<i>EIS Section 13.0            Appendix 10-C Roberts Bank Ecosystem Model Development and Key Run</i>	Further field studies to increase baseline data on juvenile Chinook, including abundances and habitat preferences to provide greater certainty in the Roberts Bank ecosystem model predictions.	<p>A major assumption in the ecosystem model is that juvenile Chinook do not show a habitat preference at Roberts Bank, based on the results of their limited field studies. This would not be expected based on previous research which has widely shown juvenile Chinook and other salmon to exhibit habitat preferences based on their life history, timing and other factors. Recent research from the Columbia River found that “spatiotemporal distributions and juvenile rearing behaviors in nearshore estuary habitats vary among genetic stock groups of Columbia River Chinook Salmon. Moreover, patterns of habitat use appear linked to the differing freshwater sources and sites of estuary entry of the genetic stocks”.</p> <p>Teel, D. J., Bottom, D. L., Hinton, S. A., Kuligowski, D. R., McCabe, G. T., McNatt, R., ... and Simenstad, C. A. 2014. Genetic identification of Chinook salmon in the Columbia River estuary: stock-specific distributions of juveniles in shallow tidal freshwater habitats. <i>North American Journal of Fisheries Management</i>, 34(3): 621-641.</p> <p>As previously described in this review the field studies conducted by the proponent did not feature sufficient replication during the spring and summer outmigration period in order to describe juvenile Chinook abundance at Roberts Bank with adequate certainty. Further field studies with increased replication of sites and sampling occasions during the spring and summer outmigration should be conducted to improve estimates of current baseline</p>

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
		<p>conditions for juvenile Chinook.</p>
<p><i>EIS Section 13.6 Future conditions with the project</i></p>	<p>Explanation of the potential effect of activities related to the intermediate transfer pit on juvenile Chinook movement at Roberts Bank</p>	<p>The proponent states that <i>“Placement of sand in the ITP has the potential to decrease productivity through: direct mortality (burial); acoustic disturbance from continuous noise from transport vessels; changes in water quality (increases in TSS); changes in sediment (contaminant re-suspension); and changes in habitat availability (i.e., shift from mud to sand).</i></p> <p><i>Limited interaction with VC because effect will be temporary and localised, and highly mobile species are expected to relocate.</i> “(EIS Table 13-8) What effect does this forced relocation have on juvenile Chinook productivity and there susceptibility to predation?</p>
<p><i>EIS Section 13.9.1 Significance determination</i></p>	<p>Rationale for choice of significance levels for effects on juvenile Chinook.</p>	<p>The assessment uses pre-determined significance levels which are separate from a cumulative effects assessment, and all populations are assumed to have the same level of susceptibility to effects from the project. However those species which are currently facing cumulative effects related to other activities in the Regional Assessment Area which have occurred over time are likely much more susceptible to project related effects. Therefore the choice of significance levels should be done on a VC by VC basis, depending on their susceptibility to project related effects given the cumulative effects they currently face.</p>

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
<p><i>EIS Section 13.2.2 Indicators</i></p>	<p>Rationale for use of biomass as an indicator for juvenile Chinook VC.</p>	<p>Juvenile Chinook use the Roberts Bank ecosystem in the crucial life history period before ocean entry, and size at ocean entry is an important determinant of marine survival for Chinook as noted in EIS Section 13 p. 13-31 <i>“As well, physiologically based mortality may occur during fall and winter if salmon fail to reach a critical size by the end of their first marine summer”</i>. The period of time juvenile Chinook spend at Roberts Bank is critical and any negative effects will have a proportionally greater effect on marine survival as opposed to other life stages. Therefore simply using biomass as an indicator may not appropriately characterize potential effects on juvenile Chinook.</p>
<p><i>EIS Section 13.0 Biophysical Effects Assessment - Technical Data Report Roberts Bank Terminal 2 Project Marine Fish Eelgrass Fish Community Survey</i></p>	<p>Justification of duration, intensity and sampling methods used in eelgrass community survey and juvenile salmon surveys.</p>	<p>Studies have been conducted throughout the years at Roberts Bank which have demonstrated its use by juvenile Chinook salmon, using a variety of methods. Various researchers have adapted their beach seine methods to the environment at Roberts Bank as it is very difficult to sample due to extremely low gradients. However the research conducted by the consultants used a beach seine set in shallow but functionally pelagic from a boat, a method which is known to be limited in its effectiveness. Why was a purse seine not used for this sampling?          As juvenile Chinook abundance varies over the out-migration period why was a more intensive sampling program not conducted over this period? How were the number and timing of sampling occasions determined?          It is also known that certain populations of “ocean-type” Chinook are most likely to utilize habitats in the Fraser estuary but previous research was unable to identify which individual Fraser River populations most rely on these</p>

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
		<p>habitats. As genetic stock identification technology is now commonly used in the Fraser why did the proponent not collect this information? Without this information it is impossible to predict if the project may have an effect on a particularly sensitive Conservation Unit or population of Fraser Chinook.</p>
<p><i>EIS Guidelines Section 9.1.5  EIS Section 13.5.1.2  Chinook Salmon – Status and limiting factors</i></p>	<p><i>Characterization of contaminant loads in the Local and Regional Assessment Area.</i></p>	<p>The EIS guidelines (pp. 19-20) state: <i>“As a minimum, the EIS will include: ...a characterisation of the contaminant loading in fish species and aquatic species at risk and the pathways of bioaccumulation, for those species whose contaminant loadings may be affected by the project. The results of baseline surveys will be included, as appropriate.”</i></p> <p>The EIS notes that <i>“Contaminants are a potentially limiting factor for Pacific salmon species”</i> however fails to describe current contaminant loads in the Assessment Area, and refers to Appendix 14-D. Appendix 14-D notes that <i>“marine sediments in this region provide a record of historical contamination, including: trace elements such as lead and mercury; industrial by-products such as dioxins and furans; PCBs, and the flame retardant polybrominated diphenyl ethers (PBDEs); polycyclic aromatic hydrocarbons; and industrial detergents.”</i> however the potential for direct effects of these contaminants on juvenile chinook is not discussed.</p> <p>EIS Section 13 p. 13-37 states <i>“There is concern that these activities may also disturb historical deposits of sediment-bound contaminants (particularly those associated with the release of coal particulates); when re-suspended, contaminants may be ingested or indirectly consumed through the food chain, thereby affecting marine fish</i></p>

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
		<i>productivity.”</i>
<i>EIS Section 10.3.1 Model Approach and Selection</i>	<i>Provide a single-species model to evaluate the effects of the project on juvenile Chinook salmon in the Fraser estuary.</i>	<p>As the proponent states “there are few precedents for the assessment of productivity in such an environment at an ecosystem scale. Few productivity assessments have been conducted in the context of environmental assessments” (EIS section 10.3.1 – p. 10-9) how can they be confident in their conclusions that there will not be significant effects on important VC’s such as juvenile Chinook without consulting further lines of evidence. EcoPath with Ecosim developers Christensen and Walters (2004) discuss the potential pitfalls of its use and state “Rather than pretending that Ecosim and single species methods are competitors, a useful assessment tactic may be to work back and forth between Ecosim and single-species assessment methods, using each to check and improve the other.”</p> <p>(Christensen, V., and Walters, C. J. 2004. Ecopath with Ecosim: methods, capabilities and limitations. Ecological modelling, 172(2): 109-139.),          Further quantitative analysis is necessary to adequately predict effects of the project on juvenile Chinook.</p>
<i>Appendix 17 – A- Concept 1: Intertidal (Salt) Marsh</i>	<i>Detailed report on the effectiveness of past fish habitat compensation works throughout the RAA.</i>	<p>As the Port plans to offset habitat losses with compensation works a detailed evaluation of the effectiveness of past compensation works should be presented. In particular the plan to create new saltmarsh habitat in the intercauseway area should be further evaluated.</p> <p>As recent compensation works have failed what evidence can the Port provide that future works will meet with greater success?</p>

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
		<p>Furthermore ongoing research by Environment Canada at Sturgeon Bank has demonstrated a significant loss of marsh habitats at Sturgeon Bank but has yet to determine the cause. As key factors controlling marsh distribution and growth have not been fully determined for this area is successful marsh creation probable?</p>
<p><i>EIS Appendix 17 – A- Onsite Concept 5: Eelgrass Transplanting</i></p>	<p><i>Detailed report on potential effectiveness of eelgrass transplanting activities. Further evidence that the Roberts Bank eelgrass provides important habitat for juvenile Chinook.</i></p>	<p>Previous Port expansion projects included the transplanting of eelgrass however these efforts were unsuccessful however the eelgrass beds expanded naturally so no further effort was put in (“Eelgrass habitat creation was unsuccessful due to a poor choice of site and was later rendered unnecessary by the natural expansion of eelgrass beds.” – Roberts Bank Environmental Review Committee 1996). The current compensation plan includes “Following terminal construction, there is an opportunity to transplant up to 3 ha of native eelgrass within the Roberts Bank study area.”</p>
<p><i>EIS 13.3.1 - Table 13-3</i></p>	<p><i>Explanation of why ecosystem model area is defined on the south by the Canada – US border.</i></p>	<p>The ecosystem at Roberts Bank includes continuous habitats which cross Canadian and American waters, therefore it is likely inappropriate to choose the boundaries of the ecosystem model area based on a border which is irrelevant to ecosystem processes. The EIS states “Project-related effects on marine fish are not expected to extend into U.S. waters; as such, the LAA does not extend across the U.S. border;”. Based on the configuration of the LAA it seems incredibly unlikely that this statement has any ecological foundation. To accurately represent the ecosystem at Roberts Bank the ecosystem model area should be determined based solely on ecological considerations.</p>

<b>Information Source</b> <i>(section or page# of EIS, Marine Shipping Addendum, Responses to Information Requirements, etc.)</i>	<b>Proposed Information Request</b>	<b>Rationale</b>
<i>Technical Data Report RBT2 Eelgrass Community Survey, Technical Data Report RBT2 Juvenile Salmon Surveys</i>	Martel, G. 2009. Section 7. Fish communities. In Hemmera Envirochem (Editors), T2 environmental baseline monitoring report – Final report. Prepared for Vancouver Fraser Port Authority, Vancouver, B.C.	This document is referenced in the EIS and apparently forms some of the basis for their field studies and conclusions however it has not been made available to the public. Based on the data they report in the Juvenile Salmon Surveys the study by Martel (2009) captured very few fish relative to their effort. Furthermore the RBT2 Juvenile Salmon Survey states: The most detailed work on juvenile salmon relevant to the proposed RBT2 project area was conducted for the Deltaport Third Berth (DP3) Environmental Assessment (Triton 2004) and previous baseline studies (Martel 2009). Can this document be added to the Registry?
<i>Technical Data Report RBT2 Eelgrass Community Survey, Technical Data Report RBT2 Juvenile Salmon Surveys</i>	Triton Environmental Consultants. 2004. Technical Volume 5: Deltaport Third Berth Project Marine Resources Impact Assessment. Deltaport Third Berth EA application	Like Martel 2009 this document is referenced in the EIS and apparently forms some of the basis for their field studies and conclusions however it is very difficult to acquire. Based on the data they report in the Juvenile Salmon Surveys the study by Triton (2004) captured very few salmon relative to their effort, including no Chinook over 128 beach seine sets. Can this document be added to the Registry?
<i>Please use as many pages as necessary.</i>		

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