



EMBROIDERED: VOLUME 1

Salmon, Tankers and the Enbridge
Northern Gateway Proposal



RAINCOAST
CONSERVATION FOUNDATION





www.raincoast.org

Acknowledgements

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Embroided: Volume 2

will address salmon, tankers and the Kinder Morgan Trans Mountain Expansion.

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About Raincoast Conservation Foundation:

Raincoast is a team of conservationists and scientists empowered by our research to protect the lands, waters and wildlife of coastal British Columbia. We use peer-reviewed science and grassroots activism to further our conservation objectives.

Our vision for coastal British Columbia is to protect the habitats and resources of umbrella species. We believe this approach will help ensure the survival of all species and ecological processes that exist at different scales.

Our mandate: Investigate. Inform. Inspire.

We Investigate to understand coastal species and processes.

We Inform by bringing science to decision makers and communities.

We Inspire action to protect wildlife and their wilderness habitats.

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Executive Summary

PHOTO: M. CARWARDINE



This report was written in response to public concern regarding the threat posed to salmon by the marine component of Enbridge's proposed Northern Gateway project. Our aim with this report is to inform decision makers and communities, in BC and elsewhere, by presenting the science of what we know, and the uncertainty around what we do not know. We believe both show that implementing an oil corridor through Canada's most important wild salmon habitat is not a risk worth taking. We hope to inspire readers to protect wild salmon and the ecosystems they sustain.

PHOTO: J. RHODES



Our entanglement with oil

We live in a complicated world. Easy access to cheap, abundant, oil has created a high standard of living for many cultures and societies. At the same time, the extraction, refining, distribution, and use of this oil – as energy and in products – is increasingly undermining many of our planet's life forms and the fragile balance of conditions that support climate stability and human prosperity. These effects are occurring on local, regional, and global scales.

Canada's northwest coast stands alone as one of our planet's last unspoiled coastlines. Its assemblage of wild rivers, First Nations cultures, animals, and landscapes makes it qualitatively different from any other place in the world. British Columbians have increasingly come to cherish this maritime commons of waters, islands, and forests. And wild salmon – the foundation species on which this coastal bounty is built – are as important to British Columbians as the French language is to Quebec.

Recently, there has been an aggressive push to convert British Columbia's (BC) coast into an energy corridor for the export of tar sands oil. This initiative, proposed by the Enbridge pipeline company and backed by the Canadian federal government, would see the world's largest oil tankers routinely traverse the rare, natural labyrinth of islands and inlets to deliver diluted bitumen to global markets. Such a project would transform a place that has largely withstood the march of industrialization. It would inescapably subject its waterways to the chronic contamination and likelihood of spills that has accompanied the oil industry the world over.

This report is about the proposed transport of Canadian tar sands oil through the BC coast, and the implications such a project would have for wild salmon. We reviewed elements of risk and potential impacts to wild Pacific salmon in BC's Queen



Stretching from Dixon Entrance in the north, to Queen Charlotte Strait in the south, and west to the edge of the continental shelf, the region contains hundreds of coastal islands and inlets that form an archipelago with 27,000 km of shoreline in less than 1,000 km distance. IMAGE: GOOGLE EARTH



PHOTO: CHEADLE/
ALLCANADAPHOTOS.COM

On average, 25 million adult salmon return each year to watersheds of the Queen Charlotte Basin; however annual fluctuations in returns are large.⁴ The commercial value of salmon returning to the Skeena River catchment alone has been estimated at \$110 million annually.⁵ In total, salmon from the Queen Charlotte Basin represent 58% of all salmon populations on Canada's west coast.⁶ The Queen Charlotte Basin also supports populations of salmon from Washington, Oregon, and California.⁷

Charlotte Basin from the tanker and terminal components of Enbridge's proposed Northern Gateway Project. These risks stem from the presence of oil tankers loading and transporting tar sands oil (diluted bitumen), the toxicity of diluted bitumen from chronic and episodic oil exposure, and other effects to BC's wild salmon habitat from tanker and terminal operations.

The Queen Charlotte Basin

The Queen Charlotte Basin is a vital marine rearing and staging area, and migration corridor for wild salmon. An incredible diversity of habitat and environmental conditions occurs within this region.

There are more than 5,000 populations of spawning salmon within the 1,200 plus primary watersheds that drain to the Queen Charlotte Basin. The salmon runs from these watersheds are grouped into 267 units of irreplaceable salmon diversity called Conservation Units.

The basin hosts approximately 383 major runs of the five commercially managed salmon species¹, and another 3,000 smaller runs² that together form the foundation for the remarkable genetic diversity and biological complexity of salmon populations within this region. Wild salmon also play key roles in coastal ecosystems, nourishing a complex web of interconnected species.³

The archipelago nature of the Queen Charlotte Basin has created extensive, essential nearshore habitat for hundreds of millions of young salmon. Estuaries form a critical component of this essential habitat. Use of coastal estuaries is considered a cornerstone phase in a salmon's life history when adaptation to salt water, feeding, and refuge from predators is critical.⁸

The threat to salmon

Salmon naturally have poor odds for survival. At best, only one salmon for every thousand eggs that a female lays will return to spawn. Threats from predators, limited food supply, and environmental conditions challenge salmon at every life stage. Development activities in salmon watersheds and in the ocean drive survival rates even lower.



The severity of an oil spill on the BC coast would be exacerbated by the persistence of crude oil in cold water habitats, and the potential for strong winds, currents and freshwater to disperse oil over large distances.

PHOTO: McALLISTER/RAINCOAST



Chum and pink salmon are the most vulnerable salmon to marine oil spills because of their tendency to spawn in the lower reaches of freshwater streams, where oil residue can accumulate.

PHOTO: M. CARWARDINE

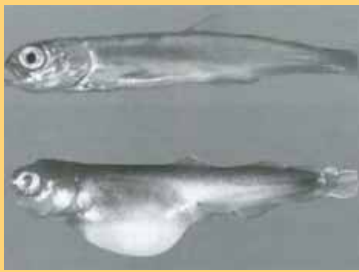
Oil tankers and spills in our coastal waters present a new, added threat to salmon survival. Adverse effects come from acute, chronic, and indirect exposure to oil products.⁹ The most vulnerable period for salmon from an oil spill is during their embryonic-to-larval stage of incubation in the spawning gravels. Salmon embryos and larvae are highly sensitive to oil exposure (up to ten times that of adults), because their high lipid content attracts oil.¹⁰ In the embryonic stage, chum and pink salmon are the most vulnerable species to marine oil spills because of their tendency to spawn in the lower reaches of freshwater streams, where oil residue could accumulate.

The early life phase of marine feeding, rearing, and migration is the next most vulnerable period for salmon from an oil spill. When young salmon first migrate to sea, all species are vulnerable because of a reliance on estuaries and nearshore waters for food, protection, and safe migration. However, chum, pink, and the ocean-rearing types of Chinook, coho, and sockeye salmon are the most vulnerable due to longer residency times.¹¹ Although acute exposure to crude oil will cause immediate death (largely through heart failure), the indirect exposures from contaminated food, loss of food resources, and degradation of nearshore habitat may be of greater risk to wild salmon.

The component most associated with the toxic and persistent properties of petroleum products are the polycyclic aromatic hydrocarbons (PAHs).¹² Low levels of exposure to PAHs (at parts per billion, ppb), are known to have lethal and sub-lethal consequences for salmon.¹³

In addition, indirect effects to salmon habitat from oil contamination operate at multiple levels of the food web, which can adversely affect salmon.¹⁴

There are also threats to salmon without a marine oil spill. Oil tankers in confined channels have the potential to degrade and destroy sensitive habitats (such as eelgrass meadows) from the impacts of wake action.¹⁵ Wakes can also strand juvenile salmon.¹⁶ Less known are the potential impacts from acoustic disturbance on salmon by tankers.



The component most associated with the toxic and persistent properties of petroleum products are the polycyclic aromatic hydrocarbons or PAHs. Exposure to low levels of PAHs (in parts per billion) are known to have lethal and sub-lethal consequences for both juvenile salmon (above) and herring (below). PHOTOS: NOAA AUKBAY LAB



Salmon embryos and larvae are up to ten times more sensitive to oil than adult salmon. PHOTO: NOAA

Other potential problems relate to increased suspended sediments in Kitimat Arm and Kitimat estuary associated with terminal construction, operations, and maintenance. These activities have the potential to harm salmon directly and indirectly. Gill damage and smothering, combined with reduced feeding from visual impairment, will compromise young salmon survival. Increased sediments will affect habitat (particularly eelgrass, previously far more abundant in Kitimat Arm) and food abundance for juvenile salmon.

Food web and ecosystem toxicity concerns also exist from the potential to disturb existing PAHs that lie in the previously contaminated bottom sediments of Kitimat Arm. Biochemical processes have the ability to further transform these PAHs into other toxic compounds and make them available to the salmon food web.¹⁷

Lastly, chronic oiling from routine operations and small spills at terminals (where most spills occur) can represent a significant input of oil into the marine ecosystem. Studies from the Port of Valdez in Alaska show a clear correlation between PAH levels in sediment and volumes of oil shipped.¹⁸ Other shipping activities associated with ports and terminals may deplete oxygen, degrade water quality, and negatively affect salmon habitat.

Misleading and flawed information

We also examine information that should have been considered by Enbridge, yet was either inadequately assessed, or ignored. We found that scientifically flawed studies and cursory reviews by Enbridge served to downplay the extent of, and impacts to, salmon presence within Kitimat Arm and the Queen Charlotte Basin.

The inadequate assessment of baseline conditions and project impacts is exacerbated by Enbridge's failure to adequately consider cumulative impacts, including climate change. Consequently, the conclusions arrived by Enbridge cannot be scientifically supported in many cases. The following are a summary of the primary inadequacies in Enbridge's impact assessment:



Eelgrass habitat is very important for young salmon and it grows in several locations near the proposed oil terminal and along the tanker route. Eelgrass is highly sensitive to poor water quality and has already suffered extensive loss from industrial activity in the upper Kitimat estuary. PHOTOS: (TOP) MARINEBIO.CA (BOTTOM) J.M. CARROLL

- Misleading, selective, and erroneous data used in Enbridge’s contaminant study, which served to downplay and dismiss contamination and toxicity issues around PAHs,
- No adequate baseline surveys were conducted to determine the extent of habitat use by juvenile salmon within the Kitimat estuary and throughout Kitimat Arm,
- No empirical data were collected on juvenile salmon use within Kitimat Arm (or elsewhere),
- A literature review with notable omissions of:
 - Recognition of at least 15 salmon-bearing streams in Kitimat Arm that contain seven salmon species in 63 spawning populations; all of which spawn, feed, and rear in Kitimat Arm,
 - Recognition of more than 400 spawning populations within the Confined Channel Areas of the tanker route that contain some the highest densities of spawning salmon on the BC coast,
 - The presence of two unique Conservation Units (each) of chum and coho salmon that encompass the Confined Channel Area of the tanker route,
 - The presence of more than 30 unique Conservations Units of sockeye salmon within, or on the border of, the tanker route’s Confined Channel Area.

In the absence of an adequate assessment of risk by Enbridge, (*risk* defined as the probability of an oil spill x the consequence of an oil spill), Raincoast performed a limited risk assessment to demonstrate the type of analysis that should have been undertaken.

Our assessment used salmon densities, vulnerability, and Enbridge’s own oil spill probabilities¹⁹ to determine consequence and risk. Highly valued salmon populations that may incur adverse consequences from an oil spill occur throughout the Skeena watershed, and the central and north coasts of BC (Figure 7.4). In the event of a large spill within Enbridge’s higher ranked risk areas, salmon populations within these regions could be severely affected for multiple generations, with concurrent impacts to human and non-human wild salmon dependants.

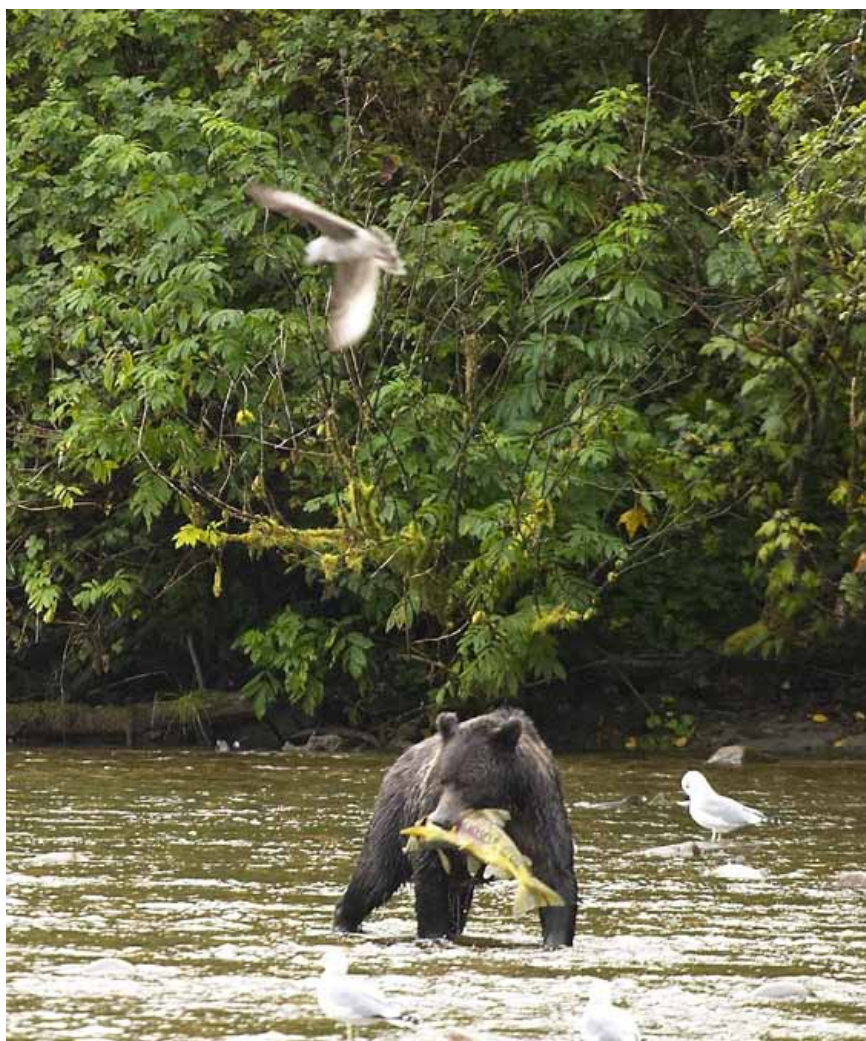


An example of vulnerable intertidal spawning grounds used by British Columbia's pink and chum salmon.

PHOTO: M. MACDUFFEE/RAINCOAST

Conclusion

Salmon, and the interconnected biota that they support, are the very soul of British Columbia. Although it is difficult for a nation to set aside short-term profits, the decision to build Northern Gateway may come with irreparable cost in the long term. The prospect of losing this natural identity, livelihoods, and connection to the land and waters that British Columbians love, compels us to think large and long term. Our aim is to provide the fact-based information necessary for society to make the sound decision wild salmon and their dependents deserve.



Enbridge did not attempt to identify intertidal spawning habitat, holding areas, or important wildlife streams where key species (i.e., grizzly bears) rely on salmon. PHOTO: T. IRVING