8. Petroleum and Shipping Threats to Marine and Terrestrial Animals on the BC Coast

Fin whale wedged on bow of cruise ship. Fisheries and Oceans Canada examine the carcass of a fin whale struck by a cruise ship and carried into the Port of Vancouver in the summer of 2009. Ship strikes are a growing concern for whales in BC coastal waters, as shipping traffic is expected to increase by 300% from 2007 levels. PHOTO: AP

A black bear crosses a channel on the BC coast. Increased shipping traffic can affect terrestrial wildlife. Even though these animals spend less time in the water, they cannot dive or swim quickly to avoid danger. As such, they may be more vulnerable to ship strikes than marine mammals. PHOTO C.T. DARIMONT

Ship strikes

Growing shipping traffic is escalating the risk of vessel strikes on whales and other marine mammals. The recent expansion of the Port of Prince Rupert, the potential for supertanker traffic in and out of Kitimat for oil and gas transport, plus high levels of cruise ship traffic, increase the potential for ship strikes. By 2020, container traffic travelling to Asia from British Columbia is expected to increase by 300 percent from 2007 levels,[131] further increasing the possibility of injury or mortality. Ship strikes are a growing concern for killer whales, fin whales, and humpback whales in particular.[132]

The BC coast is a naturally fragmented archipelago, and home to maritime animals that rely on healthy and abundant food supplies for survival. Often in search of food and other resources, terrestrial mammals swim among islands and insular mainland areas that are not large enough to support populations, or individuals, over time.

Although terrestrial animals are proficient swimmers, they do not have the burst acceleration or diving ability to avoid ship strikes compared with their marine cetacean cousins, which themselves occasionally fall victim. Accordingly, while these terrestrial animals do not spend as much time in the water as marine mammals, they are likely much more at risk when they are. These vulnerabilities, combined with significant increases predicted in vessel traffic on the BC coast,[133] suggest that terrestrial animals are at risk from ship strikes.

Toxicity exposure

In Chapter six we touched on the toxicity of oil to marine mammals. However, a suite of terrestrial animals, less studied in this context, is also at risk from toxicity. The first route

is the external exposure to oil on shorelines and/or from the water surface. For example, both bear species, wolves, weasels (e.g. mink), rodents, and birds regularly come in direct and prolonged contact with shoreline environments, overturning seashore rocks, excavating intertidal sediments or swimming, as they search for prey.[134] Consumption of food provides the second route for exposure to toxic oil residues.

Common fare consumed by terrestrial wildlife includes suspension-feeding clams and mussels, and ground fishes. Shellfish and ground fish slowly metabolize hydrocarbons and have shown chronically high levels from oil exposure.[135] Consequently, when ingested, they can cause acute and long-term adverse effects in the health and diet of the animal. For example, detailed studies showed that for four years after the *Exxon Valdez* oil spill (1989-92), river otters living in oiled areas had lower body mass and elevated hydrocarbon biomarkers in their blood compared with otters inhabiting "non-oiled" areas. Similarly, otters from oiled areas had higher levels of fecal porphyrins (proteins that bind metals) and consumed a less diverse diet before 1992, after which these conditions started to improve.[136]

Food supply concerns from oil spills. Whether swimming or not, many terrestrial animals can still be at risk from oil spills through consumption of oiled marine resources or through declines in food supply. Declines in intertidal invertebrates, herring, and salmon all occurred post *Exxon Valdez* oil spill.[137]
PHOTO: N. DEBRUYN. PHOTO BELOW: D. BROWN

Concerns for food supply

Because coastal grizzlies, black bears, and wolves rely on salmon to maintain individual and population health, declines in coastal salmon runs are of considerable concern. Compared with historic abundance, most salmon runs are already depressed. Some are very depressed.[138]

More recently, wild runs of chum, sockeye, and pink salmon that are particularly important to bears have experienced substantial declines in catch and escapement. Consequently, many commercial fisheries are being closed.[139] These declines in salmon abundance are attributable to specific or cumulative impacts in marine survival, mixed-stock and over fishing, and habitat loss.[140] Impacts to salmon survival from oil spills would add to these existing problems.

More than 100 terrestrial species rely on salmon at some stage in their life and often have aspects of their life cycle linked to salmon presence.[146] Oil spills have the potential to adversely affect salmon, jeopardizing salmon stocks that are already in decline. The loss of salmon has substantial negative implications for coastal bears and other wildlife.
PHOTO: N. DEBRUYN

Declines in salmon abundance occurred after the *Exxon Valdez* oil spill, and have been attributed to elevated mortality through several life stages and repeated exposure of eggs to oil on spawning grounds through multiple generations. Pink and chum salmon would be most vulnerable to these conditions because of their fidelity to spawning in the lower reaches of streams and rivers.

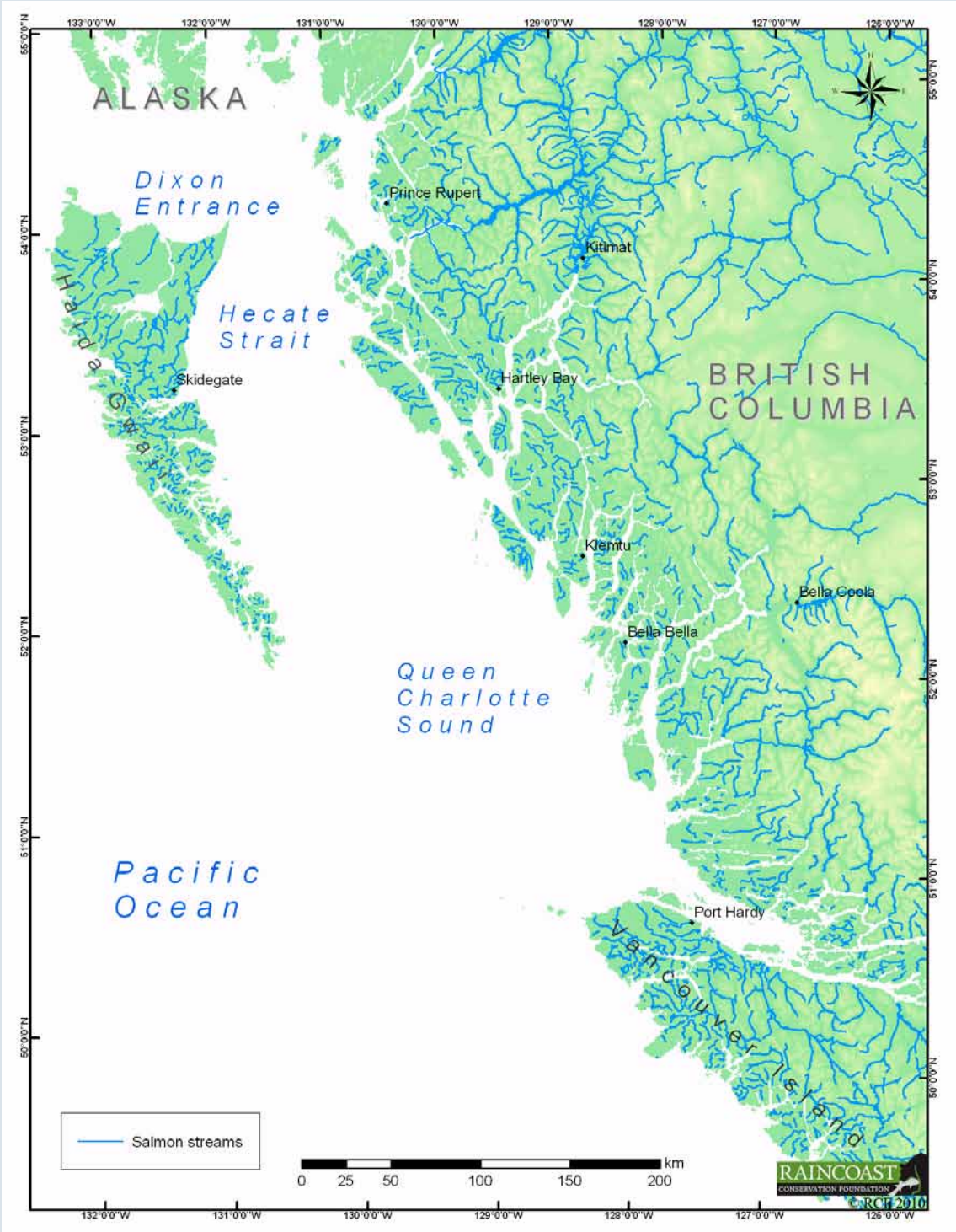
Laboratory studies have shown that poly aromatic hydrocarbons (PAHs) in crude oil are toxic to salmon eggs at concentrations as low as 1 ppb[141]; hence many eggs exposed to oiled spawning grounds would have been affected. Weathered oil with this level of toxicity can persist for years after a spill.[142] Mortality would also have occurred at the juvenile stage from impaired growth rates,[143] which would have reduced survival, in some cases up to 50%.[144] Reduced embryo survival in the second generation was also likely.[145]

Exposure and uptake of oil pollutants at early development stages in fish can increase mortality and reproductive impairment through endocrine disruption and developmental abnormalities.[147] Such impaired development in both salmon and herring was observed after the *Exxon Valdez* spill. The Alaskan demonstrations of compromised survival and reproduction from sub lethal doses of hydrocarbons have increased scientific understanding and public concern over the impacts of oil on salmon. Concomitantly, we are concerned that further declines in salmon from a catastrophic oil spill could exert strongly negative effects on bears and a wide diversity of terrestrial wildlife.

Why large populations of animals are important

Globally, marine mammals have been under threat from a variety of pressures including hunting, pollution, and competition for habitat and prey. Consequently, many of these mammals, including sei whales, right whales, and sea otters have been reduced to small and remnant populations. Small

Figure 16. Salmon streams of the BC coast. Federally catalogued salmon rivers and streams on British Columbia's north and central coast and in Haida Gwaii. Over 2,500 salmon runs spawn and rear in these freshwater habitats that drain to the coast. This is a minimum number of salmon streams as field work by Raincoast with the Heiltsuk and Gitga'at First Nations shows that many more small salmon streams exist, and could be at risk in the event of an oil spill.[148]



Extinction scenario: the AT1 Alaskan transient killer whales. Small populations are more vulnerable to extinction through several mechanisms, one of which is the impact of random events like oil spills. The breeding females of the AT1 transient killer whale pod died following the Exxon Valdez oil spill. Now, with only males left (shown here), the extinction of this unique group of whales appears inevitable, as the males will not leave to find mates within other populations.

populations behave differently from larger populations which makes them more vulnerable to extinction.[149] There are three main reasons for this:[150]

First is the role of "chance variability." This occurs when there is a random drop in birth rate, an increase in death rate, or repeated offspring of the same sex in a generation all these can lead to extinction.

Secondly, when these small populations experience random events such as food shortages, disease, pollutants, or toxic spills, the loss of individuals, (especially breeding females), can have dire consequences. This is an important concept that underscores the importance of numbers to maintain the resilience and adaptive abilities of populations that are faced with disturbances.

A prime example of this is the loss of all the breeding females from the AT1 transient killer whale population in Prince William Sound after the *Exxon Valdez* oil spill. Killer whale culture is such that even though reproductive females are gone, males will not leave the population to find mates within other populations, hence their extinction is highly likely.[151]

Thirdly, small populations are vulnerable due to reduced genetic variation. By their very nature, small populations are a narrow subset of individuals from what was once a much larger population. As small populations breed, the role of chance error in genetic make up becomes much higher. For populations to adapt and evolve with changing conditions genetic variability must be present. Hence reducing genetic variation results in decreased survival (i.e. increased mortality). Like a negative feedback loop, increased mortality leads to further reduction in genetic variation resulting in what scientists call an "extinction vortex." Loss of genetic diversity through random genetic drift is the most commonly invoked evolutionary concern in conservation biology.