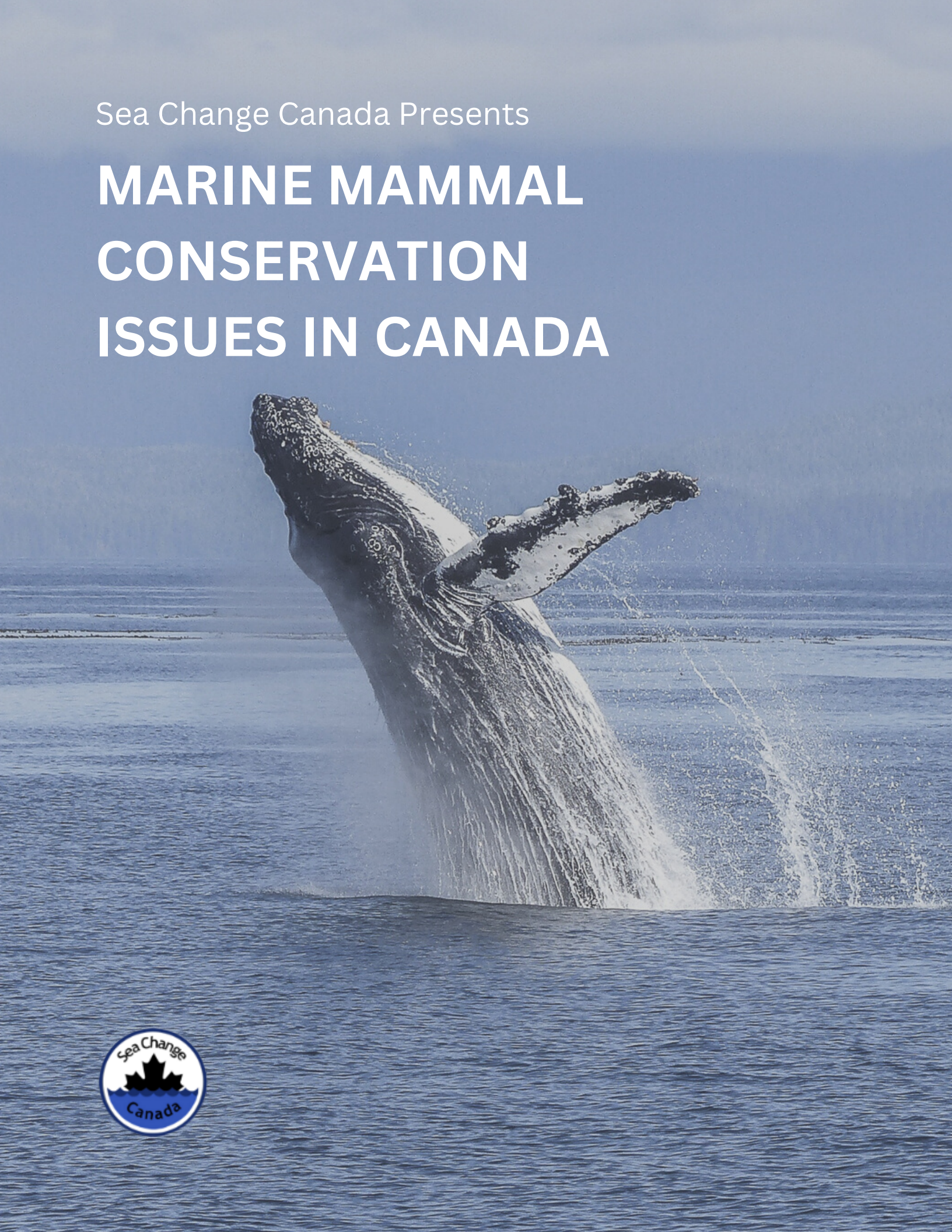
Sea Change Canada Presents

MARINE MAMMAL CONSERVATION ISSUES IN CANADA



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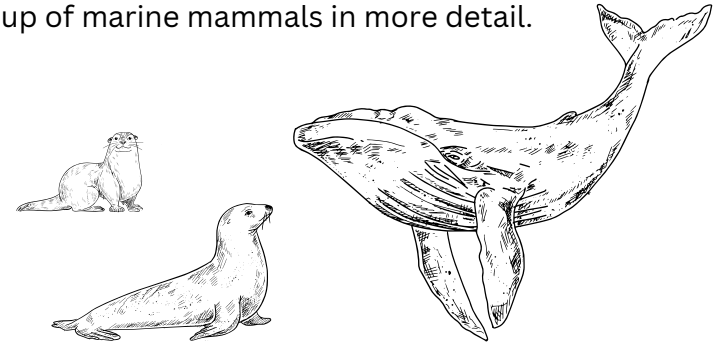
Last Updated: 01/25/2023

INTRODUCTION

Marine mammal conservation is a common topic when discussing the impacts of climate change and human activities on our planet's ecosystems. Marine mammals are often considered ecosystem indicators (representing the health state of a local area) since they play a big role in food webs and provide essential ecosystem services (Tomas & Sanabria, 2022). However, marine mammals continue to be negatively impacted by climate change and increased negative interactions with humans.

Marine mammals are a very diverse group, with four groups of marine mammals: cetaceans (whales, dolphins, and porpoises), pinnipeds (seals, sea lions, and walruses), sirenians (manatees and dugongs), and marine fissipeds (polar bears and sea otters) (National Oceanic and Atmospheric Administration [NOAA], 2019). The degree of physical adaptation to living in an aquatic environment depends on how much time each group spends in the water (Hoelzel, 2009). The following section will describe each group of marine mammals in more detail.



Cetaceans (whales, dolphins, and porpoises)

The term cetaceans include whales, dolphins, and porpoises which all have bodies adapted to spending their entire lives in the water (Department of Fisheries and Oceans Canada [DFO], 2022). Whales, dolphins, and porpoises are all long and streamlined with no hind legs, instead they have paddle-like pectoral flippers and horizontal tail flukes that help them propel themselves through the water (The Marine Mammal Centre [MMC], 2022). Another characteristic shared by cetaceans is that they breathe through one or two blowholes located on the top of their heads (DFO, 2022).

Cetaceans can be further separated into two groups: toothed and baleen whales. Toothed whales (Odontocetes) have teeth while baleen whales (Mysticetes) have hundreds of rows of baleen plates made of keratin as seen in Figure 1 (MMC, 2022). All species of dolphins and porpoises have teeth, so they are all considered toothed whales. Some whale species have teeth while others have baleen plates, dividing whales into the two separate groups. Toothed whales only have one opening for breathing at their blowhole while baleen whales have two blowholes (MMC, 2022).

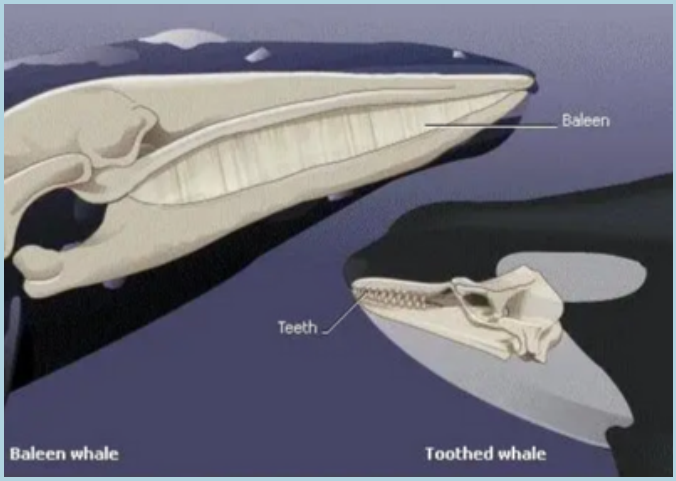


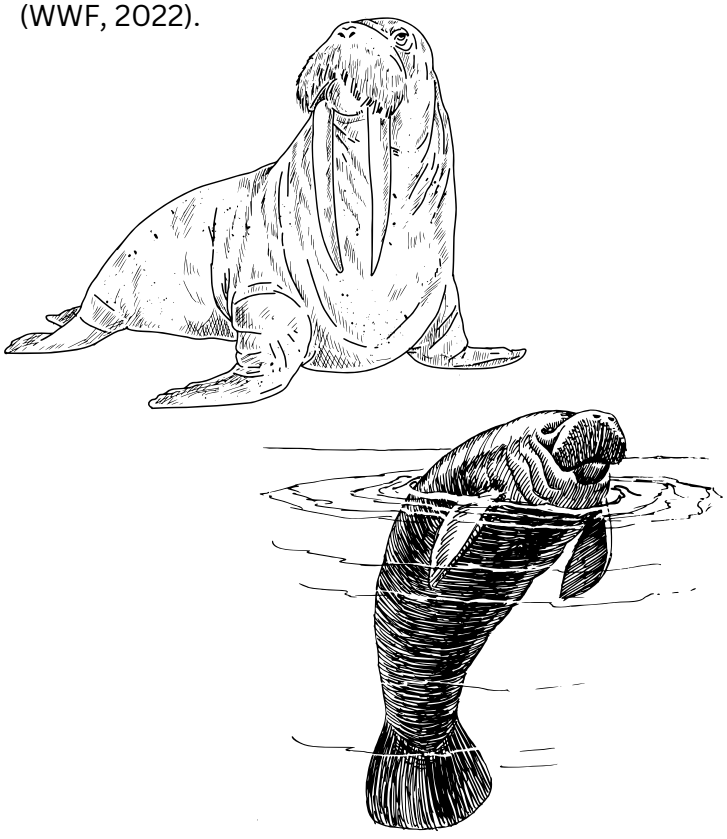
Figure 1. Comparison of baleen and toothed whales.

There are many toothed and baleen whales found in Canada. There are at least twenty-two different cetacean species inhabiting the water around Maritime provinces including New Brunswick, Nova Scotia, and Prince Edward Island (Marine Animal Response Society [MARS], 2022). Some examples of cetaceans found in Canada include common bottlenose dolphins (*Tursiops truncatus*), gray whales (*Eschrichtius robustus*), North Atlantic right whales (*Eubalaena glacialis*), humpback whales (*Megaptera novaeangliae*), harbor porpoises (*Phocoena phocoena*) and many more (DFO, 2022).

Pinnipeds (seals, sea lions, and walruses)

The term pinnipeds includes seals, sea lions, and walruses which all have front and rear flippers (MMC, 2022). Although pinnipeds spend most of their lives in or around the water, they often haul themselves out of the water onto land for various reasons including to rest, give birth, escape from predators, and molt (MARS, 2022). Molting refers to when pinnipeds shed their old fur which is replaced by a shiny, brand-new coat once a year (Paoli, 2020). Since all pinnipeds molt, the easiest way to tell seals from sea lions is to look at their ears, sea lions have small ear flaps while seals only have small holes for ears (Hall, 2021). Walruses are the only pinnipeds with tusks, making them easy to identify (Hall, 2021).

Pinnipeds common to nearshore waters in British Columbia include harbour seals (*Phoca vitulina*), California sea lions (*Zalophus californianus*), and Steller sea lions (*Eumetopias jubatus*) (Nordstrom, Majewski, & Miller, 2020). Pinnipeds are also found in Pacific Canadian waters such as Northern fur seals (*Callorhinus ursinus*) and elephant seals (*Mirounga angustirostris*) however, they are observed much less frequently (Nordstrom, Majewski, & Miller, 2020). Small populations of Atlantic walruses are located in Canada's high and central-low Arctic (WWF, 2022).



Sirenians (manatees and dugongs)

The term sirenians includes manatees and dugongs, which are usually found in shallow waters since they are herbivories which exclusively feed on aquatic plants and need to resurface for air (O'Shea & Powell, 2001). Manatees and dugongs spend their entire lives in the water like cetaceans. However, they prefer much shallower waters in estuaries, marine wetlands, and coastal environments. Manatees have been found in freshwater environments; however, dugongs never enter freshwater (Brauner, 2018). The most striking feature of the faces of manatees and dugongs is the greatly expanded area between their mouth and nose covered with vibrissae (stiff hairs like whiskers), referred to as their fleshy oral disk (Marsh et al. 2011). Manatees feed on a much wider range of plants than dugongs including seagrasses, overhanging mangrove leaves, and various aquatic plants (O'Shea & Powell, 2001). Dugongs have a fluked tail, similarly to whales, unlike Manatees which have a flat, paddle-shaped tail (Brauner, 2018).

There are three different manatee species across the globe: the Amazonian manatee (*Trichechus inunguis*), the American or West Indian manatee (*Trichechus manatus*), and the African manatee (*Trichechus senegalensis*) (Brauner, 2018). Meanwhile, dugongs can be found in shallow coastal waters of the Indian and western Pacific Oceans (World Wildlife Fund [WWF], 2022). Therefore, there are currently no manatees or dugongs found in Canada (Figure 2).

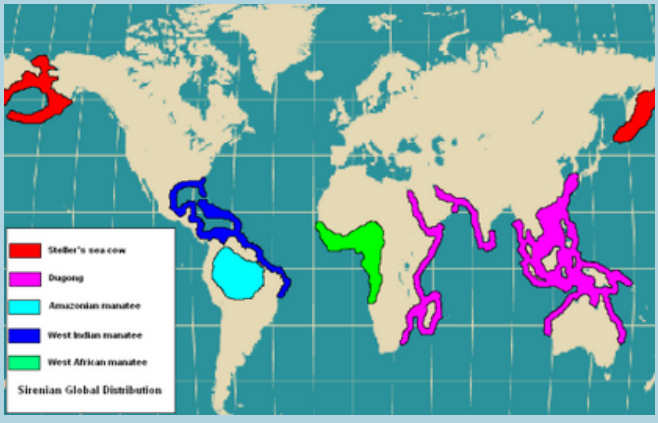


Figure 2. Map showing sirenian global distribution with no sirenians shown in Canada. (Bonde, McGuire, & Hunter, 2012)

Marine fissipeds (polar bears and sea otters)

Marine fissipeds represent a unique group of marine mammals including polar bears and sea otters, both dependent on the sea for their survival. However, polar bears and sea otters spend more time on land compared to other marine mammals and mainly rely on the sea for hunting and foraging for prey (Davis & Pagano, 2021). Because polar bears and sea otters spend most of their lifetime on ice or land along the shoreline, they are less adapted to living in aquatic environments (Tomas & Sanabria, 2022). Both polar bears and sea otters are carnivorous and hunt in the water, however sea otters are amphibious and rarely come ashore while polar bears primarily spend their time on sea ice or along the shore (Davis & Pagano, 2021).

At least two thirds of the world's polar bears live in Canada, spending most of their time on the sea ice in Canada's coldest areas (WWF, 2022). Over 90% of Canada's polar bears live in two of Canada's northernmost territories: Nunavut and the Northwest Territories (Polar Bears in Canada, 2018). The sea otter population in Canada was virtually absent from nearshore ecosystems in British Columbia for around 100 years due to the fur trade (DFO, 2022). Sea otters are now found along British Columbia's coastlines after being reintroduced to the environment from 1969-1972 (Figure 3).

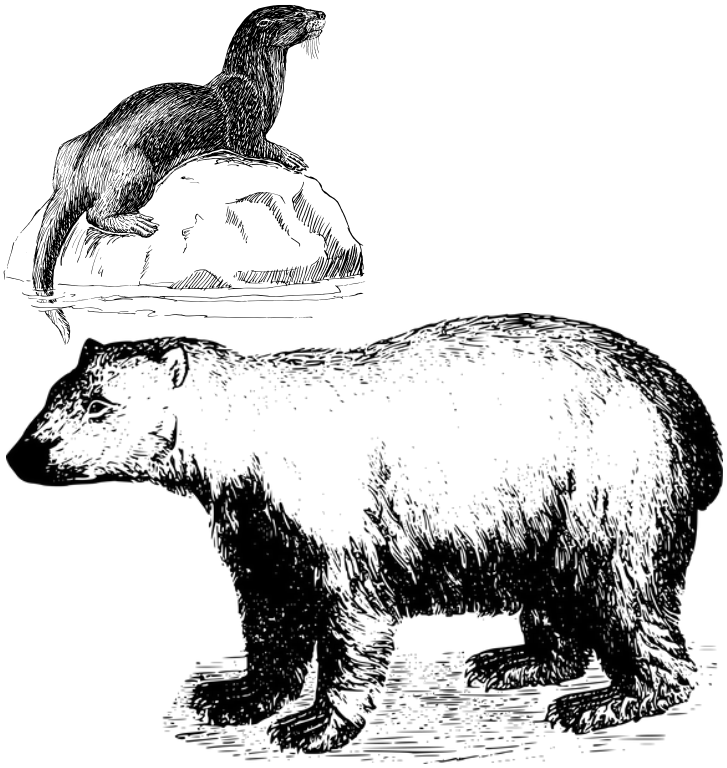


Figure 3. Map of sea otter population distribution in Canada in 2017. (DFO, 2022)

MARINE MAMMAL CONSERVATION ISSUES

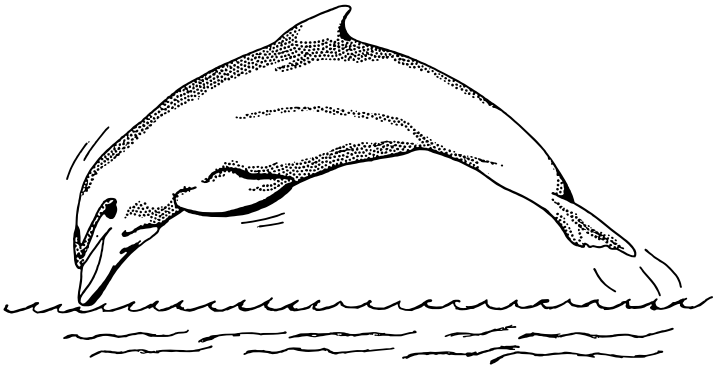
Marine mammals are known to be impacted by various human activities, directly threatening the survival of countless marine mammal species worldwide (Tomas & Sanabria, 2022). Marine mammal conservation issues can be categorized into a variety of different groups including incidental catch and fishing gear interactions (bycatch and entanglements), direct harvesting, chemical and noise pollution, vessel traffic and boat strikes, introduced species and pathogens, resource depletion, habitat degradation, and more (Tomas & Sanabria, 2022). All these conservation issues listed above have direct human activity as a source of threat, unlike changing ocean temperatures which is not directly due to human activity but to external drivers like climate change. (Tomas & Sanabria, 2022).

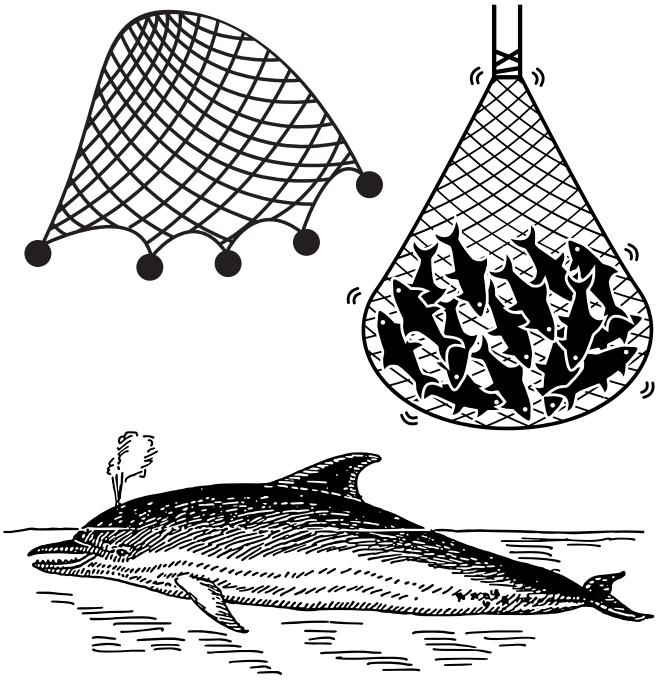
Marine mammals found in Canada are the focus of this report: cetaceans, pinnipeds, and marine fissipeds. Bycatch and entanglement, boat strikes/vessel collisions, and noise pollution will be the primary conservation issues investigated throughout the rest of this report as these three human activities directly impact cetaceans, pinnipeds, and marine fissipeds in Canada.

BYCATCH AND ENTANGLEMENTS

Human activities in ocean environments are having a profound impact on biodiversity and the sustainability and health of many marine mammal populations (Nicol et al. 2020). Many passive net fisheries (ex. gill nets, longlines, traps and pots) which are not mobile and are set for long durations, exist along the Pacific coastline of Canada, with marine mammal bycatch occurring in almost all these fisheries (Barlow et al. 1994). Bycatch is typically defined as the incidental capture of non-target species during fishing operations, causing mortality and/or injury (Hamilton & Baker, 2019; Reeves et al. 2013). Bycatch incidents have been increasingly recognized since the 1970s as a driver limiting and reducing marine mammal populations, and is one of the biggest threats to their survival (Reeves et al. 2013). Entanglements specifically refer to lines, netting, and other fishing gear materials being wrapped around the body of an animal (Hamilton & Baker, 2019). Unlike bycatch, marine mammals can become entangled in ghost fishing gear or passive net fisheries with no mobile fishing operations or fishers in their local area (Bernaldo de Quiros et al. 2018).

Bycatch and entanglements are becoming more common in Canada (Nicol et al. 2020), increasing the urgent need to find innovative solutions to decrease bycatch and entanglement occurrences with marine mammals in Canadian waters. The following sections will describe in more detail how bycatch and entanglements are impacting the survival of cetaceans, pinnipeds, and marine fissipeds in Canada.



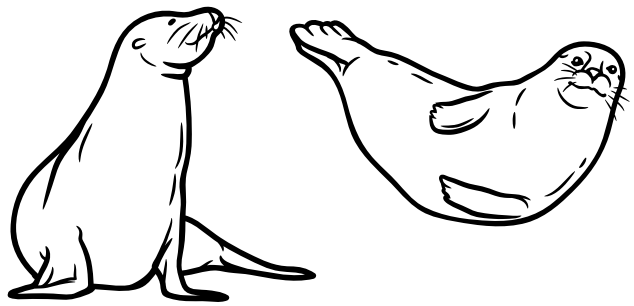


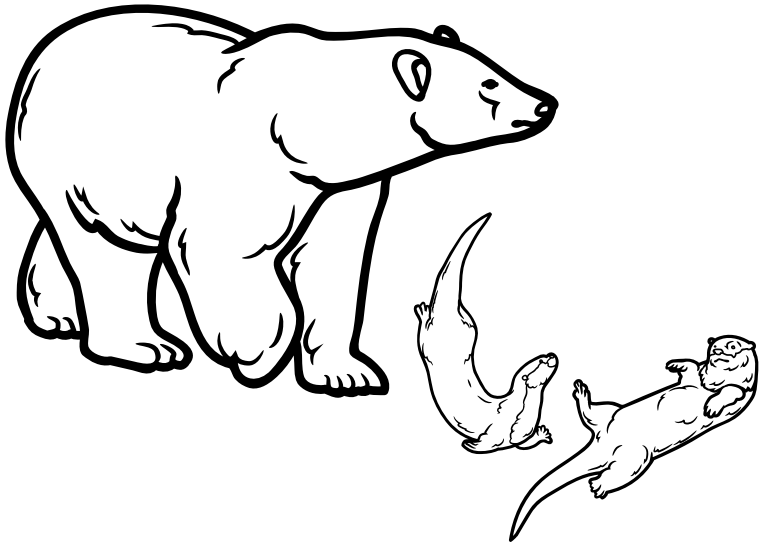
Bycatch and Entanglement Impacts on Cetaceans

Over 300,000 whales and dolphins die each year due to entanglements with fishing gear (Nicol et al. 2020). Cetacean mortality in passive fishing gear mainly occurs in gillnets (Barlow et al. 1994). More than 800 bycatch and/or entanglement incidents involving cetaceans were reported by marine mammal response networks in Atlantic Canada from 2008-2014 (Themelis, Harris, & Hayman, 2016). Cetaceans reported stranded or entangled in fishing gear in Canadian waters include both baleen (ex. humpback whales, right whales, etc.) and toothed whales (ex. Risso's dolphin, striped dolphins, harbour porpoises, etc.) (Themelis, Harris, & Hayman, 2016). North Atlantic right whales have been consistently monitored since the 1980s in Canada and are declining in abundance due to deaths associated with entanglements in active fishing gear (Stewart et al. 2021). Vertical lines being used in fixed-gear fisheries in Canadian Atlantic waters are causing high levels of entanglement with North Atlantic right whales, severely impacting their ability to reproduce (Mustain et al. 2019). Other fishing gear identified in cetacean entanglements in Canada include pot and trap, seine nets, gillnets, as well as ropes and buoys (Themelis, Harris, & Hayman, 2016).

Bycatch and Entanglement Impacts on Pinnipeds

Pinnipeds die when bycaught during fishing operations where they become entangled in fishing gear such as gillnets, trawls, and traps/pots causing them to be forcefully submerged and drown (Bernaldo de Quiros et al. 2018; Wade et al. 2021). Pinnipeds have developed adaptations for holding their breath. However, when entangled, the reaction of the animal is strenuous and requires more energy than the animal may be adapted for (Bernaldo de Quiros et al. 2018). Pinniped bycatch has been documented in large-scale drift gillnets in Canada (Barlow et al. 1994). Between 2012 and 2016, twenty eight gray seals and ten harbour seals were bycaught during bottom trawl fishing operations in Northeast and Mid-Atlantic Canada (Chavez-Rosales, Lyssikatos, & Hatch, 2018). Pinnipeds also interact with longline fishing operations frequently, such as hook and line fishing gear – depredating fish stocks, sometimes leading to the pinniped becoming hooked or entangled (Werner et al. 2015). Salmon fish farming in Canada is especially vulnerable to pinniped depredation, with fish farmers being given permission to kill pinnipeds as an attempt to control their abundance to better protect fishery resources (Jamieson & Olesiuk, 2001).





Bycatch and Entanglement Impacts on Marine Fissipeds

Sea otters returning to Canada has had substantial effects on local nearshore ecosystems, with sea otters continuing to multiply and directly competing with humans for edible shellfish and other marine invertebrates (ex. clams and sea urchins) (Committee on the Status of Endangered Wildlife in Canada [COSEWIC], 2007; Levine et al. 2017). Entanglement in fishing gear and aquaculture gear is considered a medium threat to sea otter populations in Canada, causing mortality from drowning (DFO, 2014). Declines in sea otter populations in Canada have been partially caused by entanglement in sunken gill nets, as well as entanglements in salmon fisheries and trap fisheries (COSEWIC, 2007).

Polar bears are found in the circumpolar Arctic – closely following the movements of their primary prey, ringed seals (Crompton et al. 2008). Since polar bears live out much of their life on the sea ice, their movements are also impacted by annual ice formations and thaw patterns (Crompton et al. 2008). With limited movement, polar bears have been observed entangled in plastic pollution more than fishing gear: spending time in landfills and near urban sites (Lusher et al. 2022). However, with the disappearance of sea ice from coastlines, polar bears may be forced to spend more time in open water – potentially increasing polar bear exposure to entanglements from fishing gear (Marine Mammal Commission [MMC], 2023).

Social Impacts of Bycatch and Entanglements

Bycatch and entanglements do not only impact marine mammals; these negative interactions also impact fishers (Northridge, 2018). Fishers face many loses when bycatch incidents occur, resulting in damages to their gear as well as the catches themselves (Zollett, 2009). Many fishers depend on the fish they catch for their livelihoods and do not receive any type of financial compensation when bycatch incidents occur (Filinska, 2022). Entanglements may occur even when fishers are not in the area, with fishers returning to missing gear. Since fishers and their gear are directly interacting with marine mammals, it is now becoming clearer in management that fishers need to be a part decision making and helping create new technologies to reduce entanglements and bycatch, such as ropeless gear (Myers et al. 2019). However, policies also play a critical role in how bycatch and entanglements are managed (Oceana, 2017).

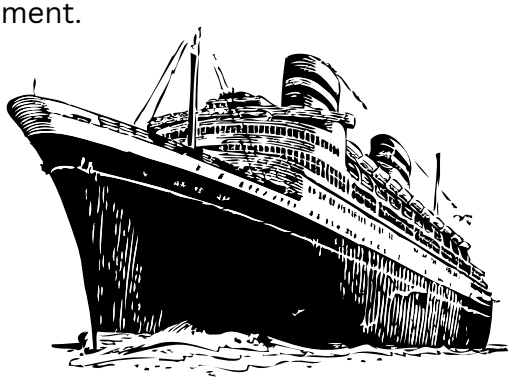
Marine Mammal Regulations in Canada govern the protection and harvest of marine mammals in Canada, including Accidental Contact with Marine Mammal regulations – making it mandatory for all interactions between vehicles or fishing gear and marine mammals to be reported to the Minister of Fisheries or in a mandatory logbook (Basran & Sigurosson, 2021). In addition to mandatory reporting, Canada has eight hotlines set up in different regions of Canada to report marine mammal entanglements (Basran & Sigurosson, 2021). However, many marine mammal bycatch and entanglement incidents are not reported – causing there to be unreliable data and understanding of the true numbers of bycatch and entanglement incidents with marine mammals in Canada (Emery et al. 2019). Policies are data driven and without having the proper data – ineffective policies have been created in Canada to try and manage bycatch (Bering et al. 2022; Oceana, 2017).

In addition to bycatch and entanglements, vessel strikes are a critical marine mammal conservation issue in Canada (Silber et al. 2021). The next section of this report will analyze the impacts of vessel strikes on marine mammals in Canada, as well as investigate the social impacts of vessel strikes in Canada.

VESSEL STRIKES

The amount of boat traffic is continuing to increase around the world due to increased trade as well as expanding fisheries (Halliday, 2020). Since there are more boats out on the water, taking up more space, vessel strikes with marine mammals have continued to increase (Kennedy, 2020). Marine mammals have been changing their migration routes to adapt to rising water temperatures from climate change – making it difficult to predict their movements and prevent vessel strikes (Bestley et al. 2020). However, since not all marine mammals spend their whole lives in the water, the threat level of vessel strikes to each group may differ depending on the species.

The following sections will describe in more detail how vessel strikes, and increased boat traffic are impacting the survival of cetaceans, pinnipeds, and marine fissipeds in Canada. This section will also explore the social impacts of vessel strikes and how vessel strikes impact Canadian policies and management.



Vessel Strike Impacts on Cetaceans

Large whales, specifically baleen whales, are especially at risk of being struck by ships due to their size and need to reach the surface to breathe, as well as forage near the surface for food (Halliday, 2020; Halliday et al. 2022). Due to large whales being more at risk for ship strikes, much research has been done focusing on collisions between vessels and larger whales such as North Atlantic right whales, fin whales (*Balaenoptera physalus*), blue whales (*Balaenoptera musculus*), humpback whales, and sperm whales (*Physeter macrocephalus*) – with less research done on vessel strikes with smaller cetaceans like dolphins and porpoises (Schoeman, Patterson-Abrolat, & Plon, 2020). Larger whales are also more at threat for ship strikes not only due to their size, but because they cannot quickly adapt and avoid ships, while dolphins and porpoises are faster moving (Kennedy, 2020). However, when boat strikes do occur with small cetaceans the impacts are devastating and usually cause serious injury or death, greatly contributing to cetacean population declines in Canada (Halliday et al. 2022).

Vessel Strike Impacts on Pinnipeds

Collisions between vessels and pinnipeds can have adverse effects on pinniped population health, and the status of some endangered pinniped species (Moore et al. 2013). Due to increased interactions between boats and pinnipeds, propeller strike cases have significantly increased in Canada (Olson et al. 2021). Pinnipeds' frequent estuarine and coastal waters, with haul-out sites located near or on a mainland – making pinniped species in coastal waters specifically at risk of collisions with small and medium-sized vessels occurring in high densities near urbanized coastal areas (Schoeman, Patterson-Abrolat, & Plon, 2020). Boat and propeller strike injuries for smaller marine mammals are often debilitating and fatal (Olson et al. 2021). Injuries small marine mammals face from vessel strikes include sharp-trauma injuries ranging from mild nonfatal nicks to severe amputations (Moore et al. 2013). Shipping activities in the Arctic have been growing, with the potential for ice-breaking vessel traffic to have detrimental impacts on ice-breeding pinnipeds in Canada including ringed seals, bearded seals (*Erignathus barbatus*), and walrus populations (Wilson et al. 2020).

Vessel Strike Impacts on Marine Fissipeds

Increased boat traffic and vessel strikes may negatively affect polar bears in Canada's Arctic, putting polar bear population numbers at risk (Cucinelli, 2020). Increased vessel traffic can affect access to feeding grounds, as well as impact migratory routes for polar bears by trapping them on broken ice sheets (Cucinelli, 2020). The reproductive success in polar bears is closely tied to ice conditions, influencing a female polar bear's ability to find food and locate suitable areas for denning (Di Sciara et al. 2016). Polar bears are estimated to be more greatly impacted by chemical pollution from increased vessel traffic, however when struck by a vessel the result is still negative with either injury or mortality (Wuestenberg, 2021).

Depending on the local environment of the specific sea otter population, vessel strikes may impact some sea otter populations more than others (Nichol et al. 2020). This is especially true for sea otter populations living in relatively remote coastal regions with low levels of vessel traffic (Fisheries and Oceans Canada, 2013). Most vessel strikes occur between sea otters and high-speed small boats operating nearshore (Fisheries and Oceans Canada, 2013). Sea otters have been observed with propeller wounds from vessel strikes, resulting in sharp-trauma wounds (Moore et al. 2013). Overall, the threat of collisions with sea otters and vessels is considered to be low compared to other factors like noise and chemical pollution (Fisheries and Oceans Canada, 2013).

Social Impacts of Vessel Strikes

Vessel collisions with live marine mammals may cause serious damage to the vessel, with the people on board at risk of injury and mortality (Neilson et al. 2012). Therefore, vessel strikes not only negatively effect marine mammals, but also the boaters involved. There are currently many vessel strike reporting biases among boaters – especially when reporting vessel strikes with smaller species such as smaller whales, dolphins, porpoises, seals, and sea otters (Schoeman, Patterson-Abrolat, & Plon, 2020). Without proper data on vessel strikes, it is difficult to create effective policies and management.

The International Whaling Commission database collects information on collisions with large whales. In 2005, the International Whaling Commission Conservation Committee established the Ship Strike Working Group to understand and reduce the threat of vessel strikes to cetaceans, specifically whales (Schoeman, Patterson-Abrolat, & Plon, 2020). However, as we now know, vessel strikes with marine mammals have only worsened since 2005.

Some management approaches used for decreasing vessel strikes in Canada include permanent mandatory rerouting measures, Traffic Separation Schemes (TSSs) in areas like the Bay of Fundy, as well as vessel traffic exclusion zones and "No Go Areas" – sometimes permanent but also voluntary in many places (Schoeman, Patterson-Abrolat, & Plon, 2020). Voluntary guidelines for vessel traffic have not been effective for long-term management of vessel strikes with marine mammals. There need to be enforced vessel traffic policies in place, with the proper financial support and involvement of local community teams monitoring Canadian waters.

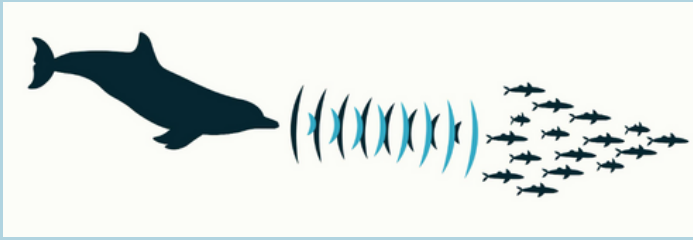
Increased boat traffic not only increases the chances of vessel strikes with marine mammals, but has also caused excessive noise pollution in Canadian waters (Chapman, 2020). The next section of this report will investigate the impacts of noise pollution on cetaceans, pinnipeds, and marine fissipeds in Canada, as well as explore the social impacts of noise pollution.

NOISE POLLUTION

Noise pollution is a threat to marine mammals since marine mammal species use sound for life functions (behaviour, energetics, and physiology) which are disrupted by ocean noise (Williams et al. 2014). An increase in marine vessel traffic has the potential to cause sensory disturbances to marine mammals including auditory injuries which reduce foraging efficiency and disrupt mating and social behaviours (Fisheries and Oceans Canada, 2015). Due to sensory disturbances, noise pollution also increases the occurrence of vessel strikes with marine mammals (Fisheries and Oceans Canada, 2015). Increased noise levels in our oceans can be attributed almost entirely to increased boat traffic, however, many other human activities create underwater noise including military sonar, pile driving, dredging, and underwater drilling (Halliday, Pine, & Insley, 2020).

The following sections will describe in more detail how noise pollution impacts the survival of cetaceans, pinnipeds, and marine fissipeds in Canada. This section will also explore the social impacts of noise pollution and how noise pollution impacts Canadian policies and management.

(DFO, 2022)



Noise Pollution Impacts on Cetaceans

Underwater noise pollution affects cetaceans and their hearing capabilities, which is very concerning since hearing is fundamental for cetaceans, and changes to their auditory capabilities may impact their ability to complete vital daily activities (Morell et al. 2021). Cetaceans show avoidance behaviours, such as changing orientation, vocal behaviour, dive cycles, and foraging when in contact with mid-frequency sonar signals (Halliday, Pine, & Insley, 2020). Intense high levels of noise (such as during underwater testing of explosives) can even cause internal bleeding of organs, leading to mass strandings of cetaceans (Chahouri, Elouahmani, & Ouchene, 2022). Since cetaceans spend their entire lives in the water, they are especially impacted by noise pollution compared to other marine mammals (Morell et al. 2021). As previously explained, cetaceans are also highly dependent on their acoustic sense - both temporary and permanent hearing loss must be considered a very serious threat to cetaceans in Canada (Hildebrand 2004).

Noise Pollution Impacts on Pinnipeds

There are conflicts between increased ship traffic and large pinnipeds in some areas of Canada associated with increased underwater noise pollution (Hartsig et al. 2012). Some pinnipeds, like ringed seals, have been found to be much more tolerant of noise compared to cetaceans, whether it be from pile driving, drilling, or seismic airguns (Halliday, Pine, & Insley, 2020). However, ice-dependent seals have been found to decrease their vocalizations in response to ocean noise, as well as show avoidance behaviours (Halliday, Pine, & Insley, 2020). Walruses have been observed in a “freeze response” when in the presence of intense noise, making them more vulnerable to predators as well as permanent auditory damage (Cucinelli, 2020). Loud noise pollution from ships, barges, and mining cause high levels of disturbance for ice-seals and walruses in Canada – causing them to flee the local area and limit pinniped access to important habitats (Gadamus et al. 2015).

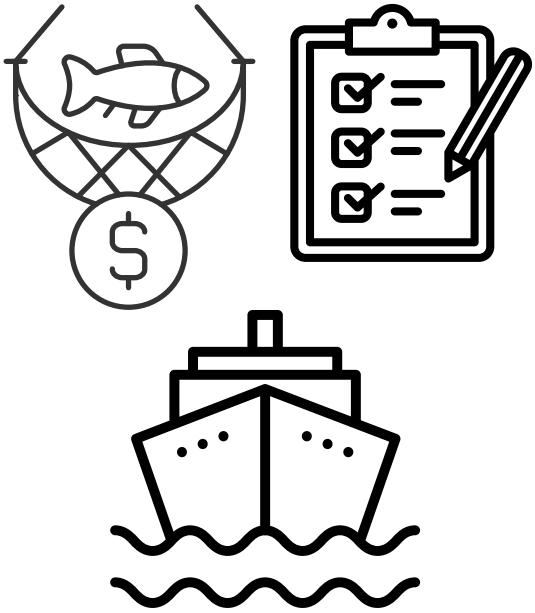
Noise Pollution Impacts on Marine Fissipeds

Unfortunately, data on the acoustic sensitivity of polar bears and sea otters is limited, as data on underwater hearing of marine mammals at low frequencies is greatly lacking (Firestone and Jarvis, 2007). Although underwater noise impacts are not well understood for sea otter populations, interactions with human activities and noise can be expected to increase as sea otter populations expand into previously unoccupied areas (Fisheries and Oceans Canada, 2013). In the Canadian Arctic, polar bears are impacted by above water noise pollution from increased shipping and ice-breaking, causing behavioural changes due to noise disturbances, specifically altering feeding and breeding practices for polar bears (Wuestenberg, 2021). Since polar bears are endemic (can only be found in one area) to the Arctic, it is especially important to protect their habitats from noise pollution (Wuestenberg, 2021).

Social Impacts of Noise Pollution

There are many legal, policy, and management issues regarding marine mammals and noise pollution prevention, which have social impacts on everyone involved (Williams et al. 2014). Policies tend to suggest that environmental impact assessments (EIAs) for activities taking place in the ocean should consider the impacts of underwater noise on marine mammals before being approved (Halliday, Pine, & Insley, 2020). However, the focus of EIAs are on either temporary or permanent hearing loss impacts, failing to mitigate more severe impacts such as habitat exclusion and auditory masking (Halliday, Pine, & Insley, 2020). Auditory masking is a common impact from vessel noise, and should be considered when completing EIAs because noise pollution interferes with the way marine mammals receive acoustic signals needed for daily tasks such as communication, social interaction, and navigation (Erbe et al. 2016; Wuestenberg, 2021). It is necessary to understand the true impacts of noise pollution on marine mammals and use proper information to create effective policies for management.

Fisheries and marine wildlife in Canada continue to be managed under overlapping legislative policies with very different goals: protecting recovering marine mammals verses managing high-value fisheries (Reidy, 2019). For example, Marine Protected Areas (MPAs) should be a safeguard from noise pollution because they are often critical habitat for marine mammals (Haren, 2007). However, many MPAs in Canada are ineffective and still allow for harmful and loud human activities to take place in their waters – with just 0.01 percent (%) of MPAs in Canada being considered “fully-protected” in 2017 (Jessen et al. 2017). Unfortunately, MPAs in Canada are currently still lacking in their ability to protect marine mammals from noise pollution

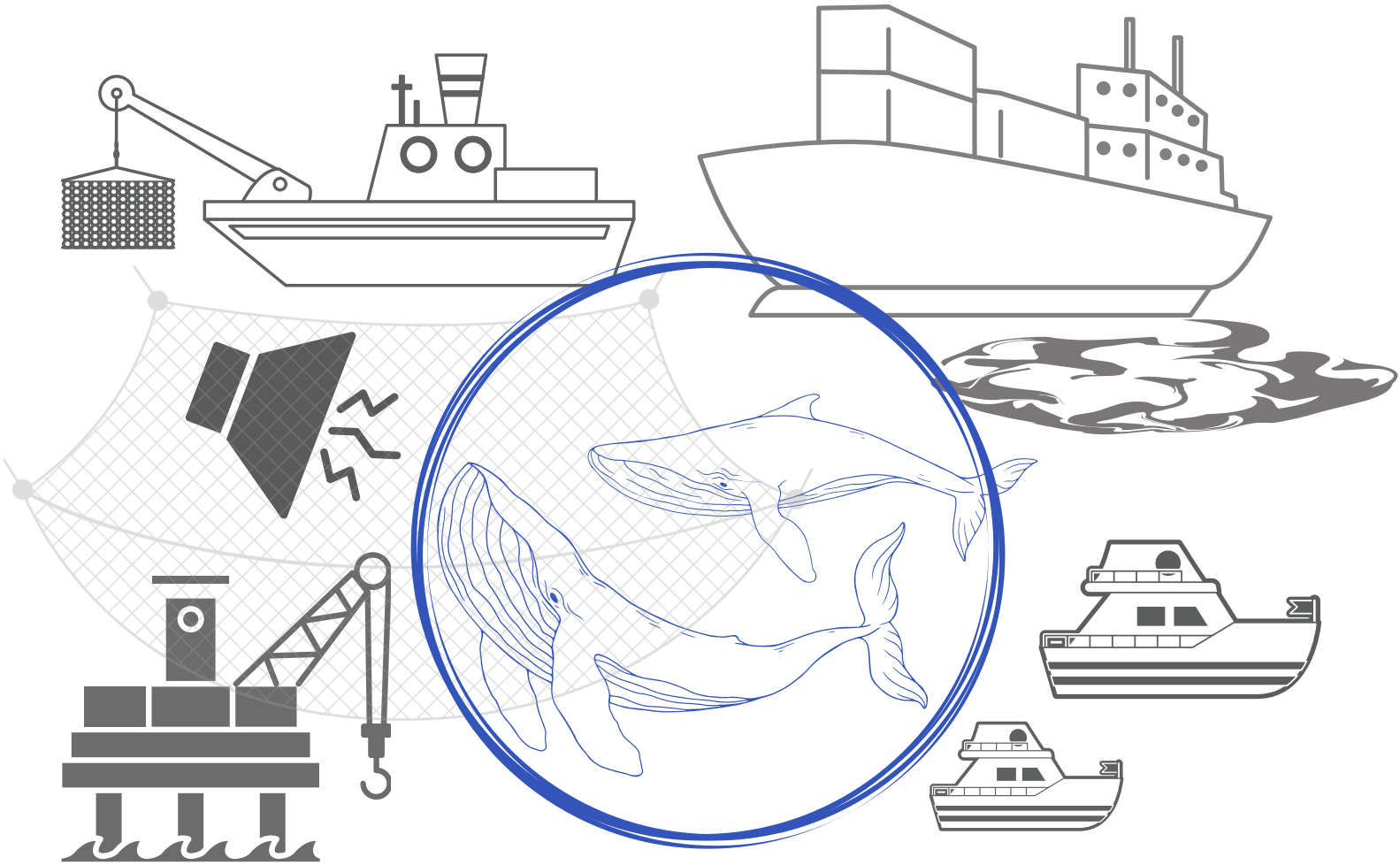


The next section of this report will cover gaps in knowledge discovered when researching the ecological and social impacts of bycatch and entanglements, vessel strikes, and noise pollution on marine mammals in Canada. Following this discussion will be future recommendations for marine mammal conservation policies and management in Canada as well as concluding thoughts on marine mammal conservation governance.

GAPS IN KNOWLEDGE

For the purpose of this report only three marine mammal conservation issues in Canada were analyzed: bycatch and entanglements, vessel strikes, and noise pollution. However, there are other conservation issues threatening marine mammals in Canada such as chemical pollution. Since chemical pollution in our oceans can come from land-based sources such as agriculture, noise pollution from ships and other ocean-based activities was focused on for this report.

The reality of our current ocean environment is that marine mammals in Canada are facing a variety of external threats daily, whether it be from bycatch and entanglements, vessel strikes, noise pollution, chemical pollution, habitat destruction, and more. Having so many overlapping conservation threats is what makes marine mammal conservation such a complex social and ecological issue.



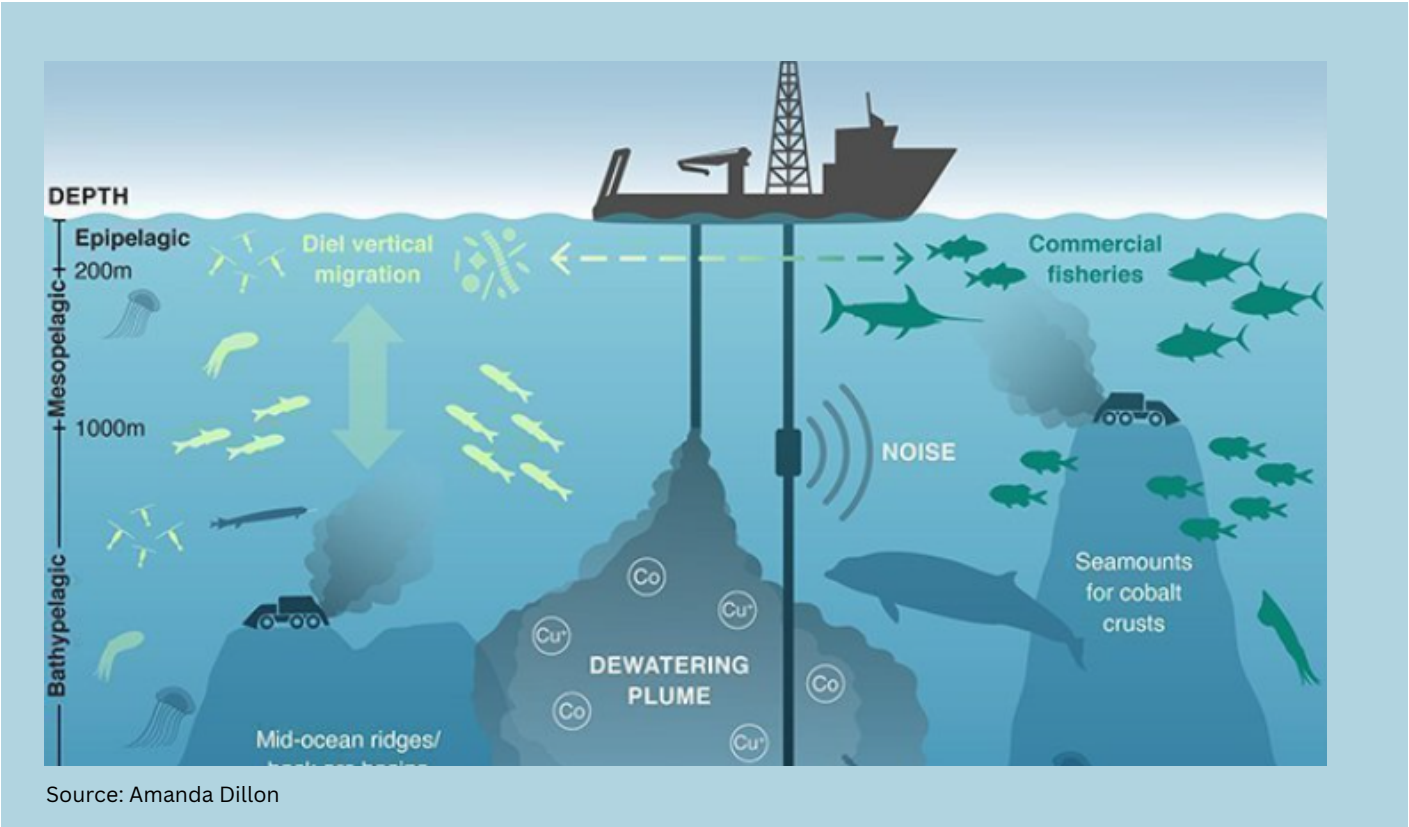
FUTURE RECOMMENDATIONS

It is clear that there is a great need to better understand both the social and ecological impacts of marine mammal conservation issues in Canada in order to create more effective policies and management initiatives.

Collecting information on social and ecological impacts of marine mammal conservation issues like bycatch and entanglements, vessel strikes, and noise pollution must involve talking with local communities and fishers. Collecting important social-ecological knowledge from local communities and fishers is especially important as there can be gaps in communication of marine mammal conservation knowledge between fishers and researchers who inform policies (Filinska, 2022). Since policies on marine mammal conservation issues directly impact local communities and fishers through area-closures and other management practices, both policy makers and those who help develop policies must understand the mindset and motivations of the local community members.

Collaborating with local communities on marine mammal conservation policies and management plans is especially important with governments currently starting to explore deep-sea mining without understanding the potential social and ecological impacts. Without understanding the social and ecological impacts of deep-sea mining, creating effective policies and management will not be possible. Marine mammals are already facing a vast amount of threats including bycatch and entanglements, vessel strikes, and noise pollution - adding deep-sea mining to this list of threats makes it unknown if marine mammals will be able to survive in our waters in the future.

We must work together to better understand the social-ecological impacts of marine mammal conservation issues in Canada and collaborate on new innovative perspectives on how to protect marine mammals in Canada through effective policies and management.



Source: Amanda Dillon

CONCLUSION

Bycatch and entanglements, vessel strikes, and noise pollution are impacting Canadian marine mammals and their ability to survive in Canadian waters. Cetaceans in Canada are experiencing high levels of threat from bycatch and entanglements, vessel strikes, as well as noise pollution since they spend their whole lives in the water. Cetaceans do not have the option of moving onto to shore in order to avoid these threats like pinnipeds and marine fissipeds. Pinnipeds in Canada experience many human-wildlife conflicts when depredating fish farms as well as becoming entangled in fishing gear and being struck by boats. However, pinnipeds in Canada are not as threatened by noise pollution like Canadian cetaceans. Marine fissipeds in Canada are the least impacted by bycatch and entanglements, vessel strikes, and noise pollution since they spend the little of their life underwater. However, with sea otters and polar bears expanding into new areas with increased human-interactions, negative interactions with human-activities may increase.

Since cetaceans in Canada are experiencing the strongest impacts from bycatch and entanglements, vessel strikes, and noise pollution, they really need our help in order to continue surviving in Canadian waters. Sea Change Canada Coastal Champions such as *Cetus Research and Conservation Society* and the *Canadian Whale Institute* are doing critical work helping protect Canadian cetaceans by actively monitoring and enforcing Whale Wise boating guidelines, as well as physically disentangling cetaceans from fishing gear, and many other projects. Being out on the water directly helping protect cetaceans from threats is the future of marine mammal conservation in Canada.

Cetus Research and Conservation Society

Canadian Whale Institute

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