

# Management Plan for the Sea Otter (*Enhydra lutris*) in Canada

## Sea Otter



2014

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## Preface

Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of management plans for listed species of special concern and are required to report on progress within five years. The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada.

The Minister of the Fisheries and Ocean and the Minister responsible for the Parks Canada Agency are the competent minister(s) under SARA for the Sea Otter and have prepared this Management Plan as per section 65 of SARA.

Success in the management of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Fisheries and Oceans Canada and the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Sea Otter and Canadian society as a whole.

Implementation of this plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

## Acknowledgments

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## Executive Summary

The Sea Otter (*Enhydra lutris*) is a marine mammal that was listed as a species of “Special Concern” under the *Species at Risk Act* (SARA) in March 2009. The Sea Otter was originally listed as “Threatened” under the Act, but was subsequently listed at a lower risk level of “Special Concern” following the 2007 assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as “Special Concern” due to the increased population growth and expansion into historic range.

Prior to the maritime fur trade of the 18<sup>th</sup> and 19<sup>th</sup> centuries, Sea Otters ranged from northern Japan to central Baja California, Mexico but commercial exploitation commencing in the 1740’s led to near extinction of the species. The last verified Sea Otter in Canada was shot near Kyuquot, British Columbia, in 1929. Between 1969 and 1972, 89 Sea Otters from Amchitka and Prince William Sound, Alaska, were translocated to Checleset Bay on the west coast of Vancouver Island (Figure 1). Recent population surveys (2008) indicate the Canadian Sea Otter population includes a minimum of 4,110 animals along the west coast of Vancouver Island and 602 animals on the central British Columbia coast. Following re-introduction, the British Columbia Sea Otter population grew rapidly (18.6% per year) from 1977 to 1995 on Vancouver Island. Growth rate slowed to about 8% per year thereafter on Vancouver Island and has been about 11% per year on the central British Columbia coast. Surveys in 2008 resulted in a count of 4,110 Sea Otters along the Vancouver Island coast and 602 on the central British Columbia coast.

Sea Otters are considered a keystone species exerting significant ecological effects on nearshore marine communities and upon the life history of their prey. In British Columbia, Sea Otters occupy exposed coastal areas with extensive rock reefs and associated shallow depths. Sea Otters segregate by sex with males and females occupying spatially-distinct areas. However, individual adult males establish and occupy breeding territories in female areas. Sea Otters show considerable site fidelity, although seasonal movements and occasional long distance movements of individuals may occur. Population range expansion typically occurs when males move *en masse* from the periphery of the occupied range into previously unoccupied habitat. Females gradually occupy the areas vacated by males. In this way population growth and range expansion are linked. The Sea Otter is a density-dependent species and population growth is ultimately regulated by resource availability.

Sea Otters are threatened by various anthropogenic factors. This management plan addresses eight classes of threats: environmental contaminants (oil spill), illegal kill, entanglement in fishing gear, environmental contaminants (persistent bioaccumulating toxins), disease and parasites, vessel strikes, human disturbance, and directed harvest. Threats to the species may arise from the effect of any combination of threats, in conjunction with limiting factors.

The management objective for the Sea Otter is to conserve abundance and distribution as observed in 2008, and promote the continued population growth and expansion into

formerly occupied regions such as Haida Gwaii, Barkley Sound, and north mainland British Columbia coast. Broad strategies and conservation measures have been identified in this plan to support the management objective, as summarized in Table 3. The activities implemented by Fisheries and Oceans Canada will be subject to the availability of funding and other required resources.

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## 1. COSEWIC<sup>1</sup> Species Assessment Information

**Date of Assessment:** April 2007

**Common Name (population):** Sea Otter

**Scientific Name:** *Enhydra lutris*

**COSEWIC Status:** Special Concern

**Reason for Designation:** The species had been extirpated in British Columbia by the fur trade by the early 1900s, and was re-introduced from 1969-72. It has since repopulated 25-33% of its historic range in British Columbia, but is not yet clearly secure. Numbers are small (<3,500) and require careful monitoring. Their susceptibility to oil and the proximity to major oil tanker routes make them particularly vulnerable to oil spills.

**Canadian Occurrence:** British Columbia, Pacific Ocean

**COSEWIC Status History:** Designated Endangered in April 1978. Status re-examined and confirmed Endangered in April 1986. Status re-examined and designated Threatened in April 1996 and in May 2000. Status re-examined and designated Special Concern in April 2007. Last assessment based on an update status report.

<sup>1</sup>COSEWIC – Committee on the Status of Endangered Wildlife in Canada

## 2. Species Status Information

This background on the status of Sea Otters draws on the COSEWIC Assessment and Update Status Report (2007). The listed status of Sea Otters changed from Threatened to Special Concern under the *Species at Risk Act* in March 2009. COSEWIC recommended the lower risk level of the population because of the successful beginnings of repopulation in its historic range since re-introduction. Federal protection of Sea Otters is provided under the *Marine Mammal Regulations*, made pursuant to the *Fisheries Act*. The current range of Sea Otters in British Columbia likely represents not more than 15% of the occupied range of the species in the North Pacific. Within British Columbia, the species is on the provincial Blue List<sup>1</sup> and has received a rank of S3 (S=provincial status, 3=special concern) (British Columbia Conservation Data Centre 2012). It is protected by the province's *Wildlife Act*<sup>2</sup> and Regulations. The provincial

<sup>1</sup> Within British Columbia, species and ecological communities are assigned to a list (e.g. Red, Blue, Yellow) on the basis of the provincial Conservation Status Rank assigned by the Conservation Data Centre.

< <http://www.env.gov.bc.ca/cdc/> > [Accessed September 4, 2012].

<sup>2</sup> Province of British Columbia. 1982. Wildlife Act [RSBC 1996] c. 488. Queen's Printer, Victoria, BC.

< [http://www.bclaws.ca/EPLibraries/bclaws\\_new/document/ID/freeside/00\\_96488\\_01](http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01) > [Accessed August 8, 2012].

government also established the Checleset Bay Ecological Reserve in 1981, protecting 33,321 ha of marine habitat, or 3% of the Area of Occurrence for the species in Canada.

Sea Otters in California and Western Alaska are listed federally under the United States of America's *Endangered Species Act* (as of 2005), and both populations are classified as Threatened. Their protection was consolidated under the *Marine Mammal Protection Act* in 1972. Within Washington State, Sea Otters are listed as State Endangered under the Special Species Policy.

Sea Otters were first protected under the International Fur Seal Treaty in 1911. They are listed as Endangered by the International Union for Conservation of Nature (IUCN). The species is also listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora's (CITES) Appendix II, which controls their trade, to prevent utilization of the species in ways that would be incompatible with their survival.

### **3. Species Information**

#### **3.1. Species Description**

Sea Otters are sexually dimorphic, although differences are not readily discernible at a distance. Adult males are slightly larger and can reach weights of 46kg and total lengths of 148cm, whereas adult females can grow to 36kg and reach lengths of 140cm. Fur colour in adults varies in shades of brown, although the fur may become progressively lighter with age creating a grizzled effect on the head, neck, chest and forelimbs (Estes 1980). There are several adaptations for an aquatic existence. Sea Otters have flattened hindfeet with elongated digits to allow them to swim efficiently while lying on their back and underwater (Kenyon 1969). Sea Otters have powerful forelimbs well adapted for grooming and prying off or digging up benthic invertebrate prey (Kenyon 1969). Rather than the shearing teeth typical of most carnivores, Sea Otters have flattened and rounded molars adapted for crushing hard-shelled invertebrate prey (Riedman and Estes 1990). While all other marine mammals have a layer of subcutaneous blubber to insulate them, Sea Otters have little body fat and instead rely on an exceptionally high metabolic rate and a layer of air trapped in their dense fur for insulation. The fur consists of an outer layer of protective guard hairs and a fine dense under fur of approximately 100,000 hairs per cm<sup>2</sup> (Kenyon 1969). Sea Otters groom frequently to maintain the integrity of their fur and its ability to hold a layer of trapped air for insulation (reviewed in Riedman and Estes 1990).

#### **3.2. Population and Distribution**

##### *Global Population*

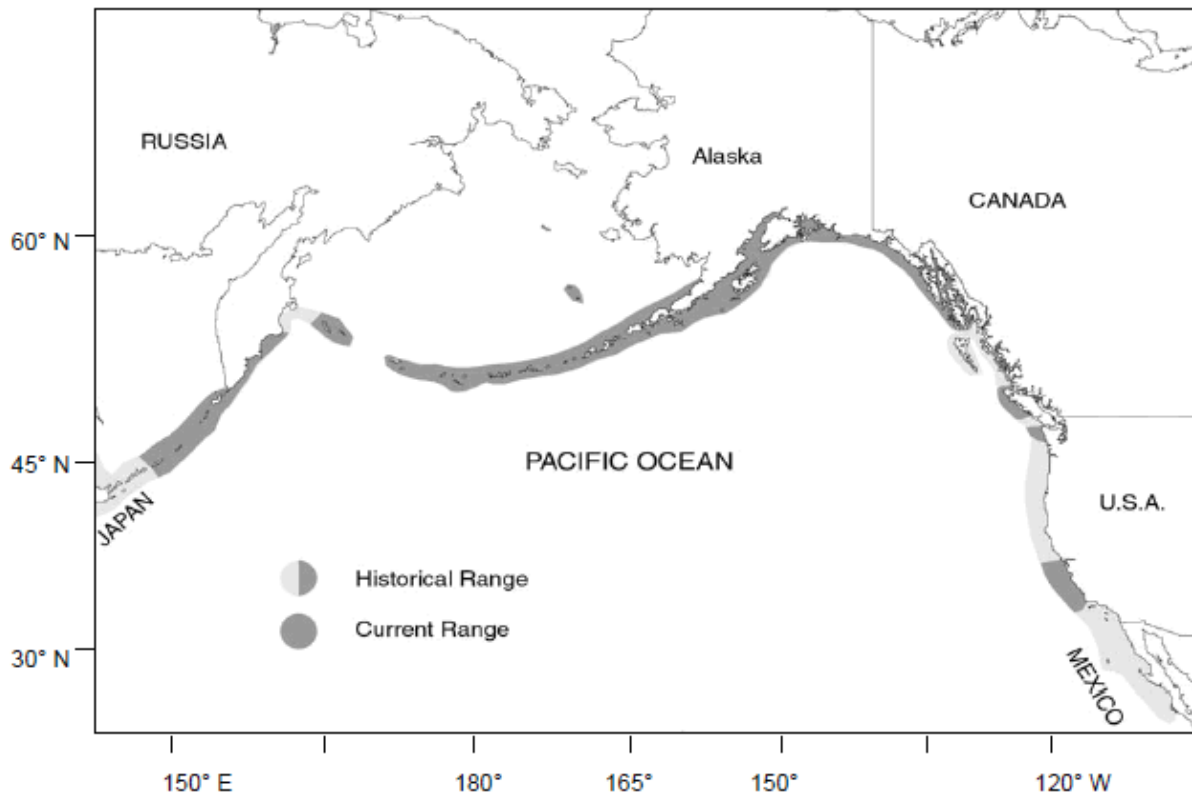
Sea Otters were hunted by indigenous peoples of the North Pacific prior to European contact, but it was the maritime fur trade commencing after 1741 that drove the species



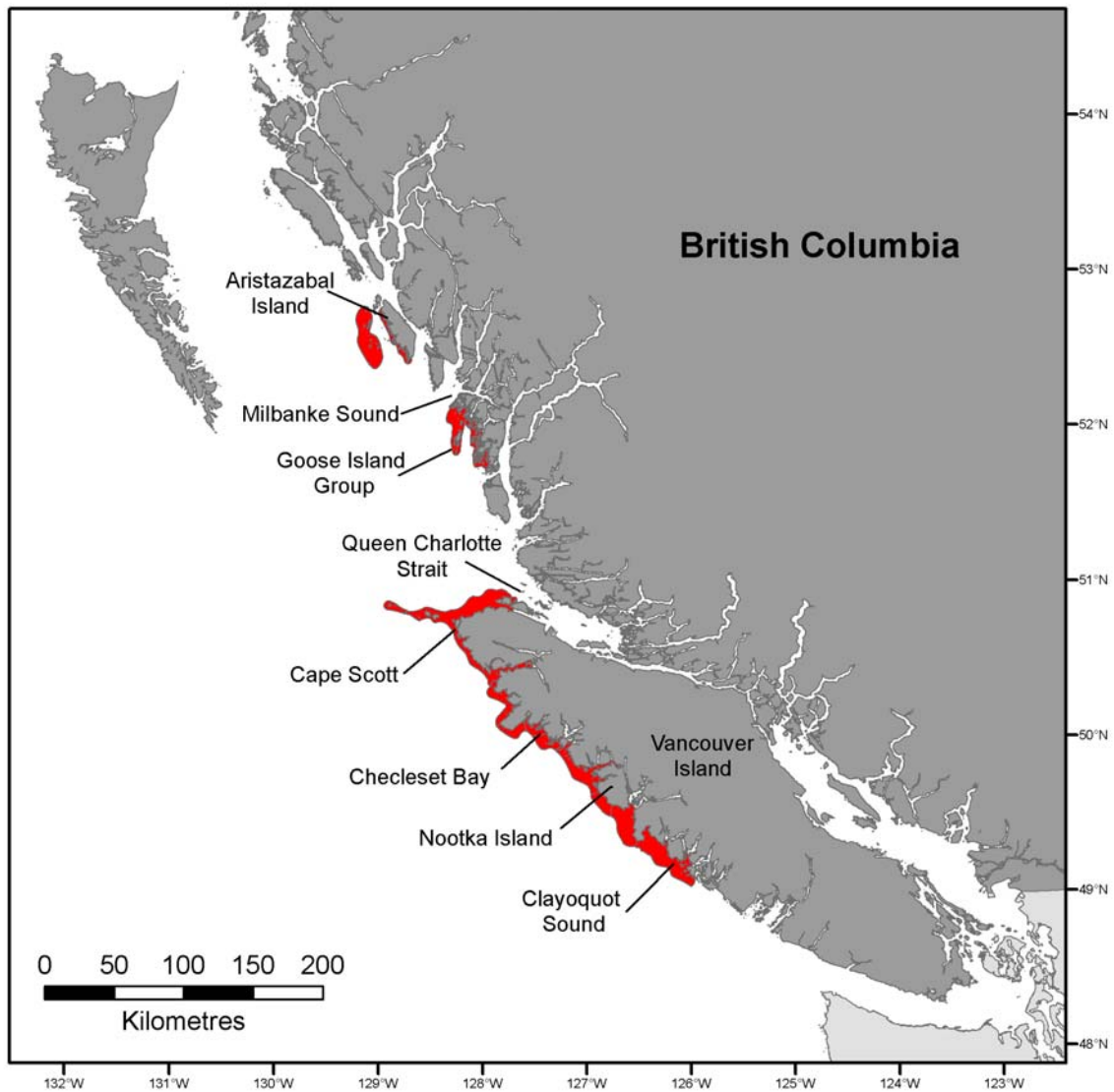
to the brink of extinction. Prior to the fur trade the total range-wide population of Sea Otters is estimated to have been 150,000 to 300,000 Sea Otters, although some authors suggest the number may have been even larger (Kenyon 1969; Johnson 1982). By 1911, the world population numbered fewer than 2,000 animals (Kenyon 1969). The remnant populations in southcentral and southwestern Alaska were subsequently able to recover as a result of the small protection afforded the species under the International Fur Seal Treaty, and/or because of changes in commercial hunting interest, and/or because of the remoteness of the region the Sea Otters occupied. By the 1950s, the population in south western Alaska, in the Aleutian Islands in particular, was sizable and until the early 1980s the bulk of the global population occurred in the Aleutian Islands (55,100 to 73,700 individuals) (Calkins and Schneider 1985). Gorbics *et al.* (2000) provides a compilation of population estimates for North America and Russia of about 126,000 otters based on data from the late 1990s. However, dramatic declines in the Aleutian Islands started in the mid-late 1980s and by 2000, the Sea Otter population had declined to 8,742 individuals in the Aleutian Islands (Estes *et al.* 1998; Doroff *et al.* 2003). As a result the Sea Otter in south western Alaska was listed as Threatened in 2005 under the US *Endangered Species Act* (United States Fish and Wildlife (USFW) 2006). Table 1 presents recent population estimates made of populations in North America.

**Table 1.** Recent population estimates reported by region in North America.

<b>Region</b>	<b>Most Recent Population Size</b>	<b>Year of Population Estimate</b>	<b>Source</b>
California	2,711	2010	USGS 2010
Washington	1,004	2010	Jameson and Jeffries 2010
British Columbia	4,712	2008	Nichol <i>et al.</i> 2009
Southeast Alaska	10,563	2006-2007	USFW 2008c
Central Alaska	15,090	2000-2003	USFW 2008b
Western Alaska	47,676	2000-2004	USFW 2008a Doroff et al. 2003



**Figure 1.** Historical and current global range of all three subspecies of Sea Otters.



**Figure 2.** Range of Sea Otters in British Columbia (red shaded area) as of 2008, with place names mentioned in the text (based on Nichol *et al.* 2009).

### *Canadian Population*

The size of the British Columbia pre-fur trade Sea Otter population is unknown; the fur trade records are incomplete but indicate that Sea Otters were abundant. By 1850, Sea Otters in Canada were considered commercially extinct, and may have been ecologically extinct (i.e. ceased to function as a keystone species) earlier than this (Watson 1993). Sea Otters in British Columbia are descendants of the successful re-introductions of 89 Sea Otters (1969 to 1972). Following re-introduction, the British Columbia Sea Otter population grew rapidly; Watson *et al.* (1997) estimated population growth to be 18.6% per year from 1977 to 1995 on Vancouver Island. Surveys in 2001 resulted in a count of 2,673 Sea Otters along the Vancouver Island coast and 507 on the central British Columbia coast (Nichol *et al.* 2005). Surveys in 2008 resulted in a count of 4,110 Sea Otters along the Vancouver Island coast and 602 on the central British Columbia coast (Nichol *et al.* 2009). Since 1995, the growth rate on Vancouver Island appears to have slowed to 8.4% per year (1995 to 2008) (Nichol *et al.* 2009). On the central British Columbia coast growth has been 11.4% per year (1990 to 2008) (Nichol *et al.* 2009).

As noted earlier, although the size of the population of Sea Otters in coastal BC prior to commercial exploitation is unknown, records from the maritime fur trade give an indication of the magnitude of the hunt and the supporting population of Sea Otters. Sea otter pelt landings in BC between 1785 and 1809 total 55,000. Without a complete record of ship logbooks from which it would be possible to ascertain where each trading event occurred, it is difficult to determine the geographic source of these pelts. Some of them could have come from Washington, Oregon or Southeast Alaska, but at least 6,000 of these came from the west coast of Vancouver Island (Fisher 1940; Rickard 1947; Mackie 1997). Based on surviving 18th century logbooks and voyage accounts between 1787 and 1797, at least 11,000 pelts were obtained in trade in the Queen Charlotte Islands alone. The aggregate landings of four ships from the Queen Charlotte Islands in 1791 alone were at least 3,000 pelts (Dick 2006).

### *Distribution*

Prior to the maritime fur trade of the 18<sup>th</sup> and 19<sup>th</sup> centuries, Sea Otters ranged from northern Japan to central Baja California, Mexico but commercial exploitation commencing in the 1740's led to near extinction of the species (Kenyon 1969). By 1911, when Sea Otters were protected under the International Fur Seal Treaty, only 13 remnant groups were known to exist. Several of these, including those in Haida Gwaii, declined to extinction (Kenyon 1969).

Sea Otters were likely widely distributed along the coast of British Columbia. Historical accounts from explorers and maritime fur traders indicate that the west coast of Vancouver Island, Haida Gwaii and the central and northern mainland coast were important trading destinations, implying an abundance of Sea Otters (Dixon 1789; Howay 1973; Lillard 1989; Dick 2006). There are also historical observations of Sea Otters in inland waterways on the northern British Columbia coast (Lamb 1984).

Sea Otters were extirpated from British Columbia by 1929 (Cowan and Guiguet 1960). A total of 89 Sea Otters were reintroduced to Checleset Bay, British Columbia from Amchitka Island and Prince William Sound in 1969, 1970 and 1972. During this time Sea Otters were also reintroduced to parts of Southeast Alaska, Washington and Oregon. All but the Oregon reintroduction were successful in establishing population (Jameson *et al.* 1982).

In British Columbia, following the reintroductions to Checleset Bay, Sea Otters occupied two locations along the west coast of Vancouver Island, an area of Checleset Bay as well as Bajo Reef off of Nootka Island, 75 km southeast of Checleset Bay by 1977 (Figure 2) (Watson *et al.* 1997). By 2008, Sea Otters along Vancouver Island ranged from Vargas Island, in Clayoquot Sound, northward to Cape Scott and eastward into Queen Charlotte Strait (Nichol *et al.* 2009).

In 1989, females with pups were reported near the Goose Islands on the central British Columbia coast indicating establishment of Sea Otters in the area (British Columbia Parks 1995). By 2008, Sea Otters on the central British Columbia coast ranged continuously from the southern end of the Goose Group, northward through Queens Sound to Cape Mark at the edge of Milbanke Sound and also in an area off Aristazabal Island (Figure 2). Single Sea Otters are periodically reported outside the continuous range.

Throughout the North Pacific, the Sea Otter presently occupies about one half to two thirds of its historical range. It is estimated that by 2004 the Sea Otter occupied 25-33% of its historical range within British Columbia (DFO, 2007). Sea Otter populations that have re-established naturally after exploitation extend from the Gulf of Alaska westward through the Aleutian Archipelago to the Kamchatka Peninsula and the Kuril Archipelago and along the California coast. Reintroduced Sea Otter populations extend through Southeast Alaska, British Columbia and Washington (Estes 1990) (Figure 1).

In Washington State the Sea Otter population may be approaching equilibrium density on the outer coast (Jameson and Jeffries 2010). Northward expansion of this population across Juan de Fuca Strait to Vancouver Island where there is suitable Sea Otter habitat is a future possibility (Gerber *et al.* 2004; Lance *et al.* 2004; Laidre *et al.* 2009).

### **3.3. Needs of the Sea Otter**

#### **3.3.1. Habitat and biological needs**

The extent of Sea Otter habitat is defined by water depth and the availability of food on the sea floor. Sea Otters often occur within 1-2 km of shore but can also be abundant far from shore in areas where water is less than 40m deep (Riedman and Estes 1990). When present, kelp beds are often used habitually as rafting sites (Loughlin 1980; Jameson 1989). Areas with complex rocky benthic habitats are typically occupied. Soft-

bottom communities that support clam species are also very important foraging habitat for Sea Otters and can sustain high densities of Sea Otters (Kvitek *et al.* 1992; Kvitek *et al.* 1993). Areas with irregular rocky substrate appear to support more Sea Otters than areas with little relief (Riedman and Estes 1990; Laidre *et al.* 2001).

In British Columbia, Sea Otters occupy exposed coastal areas with extensive rock reefs and associated shallow depths along the west coast of Vancouver Island and the central British Columbia coast. High wave energy habitats in these areas likely support a variety of invertebrate prey in a variety of microhabitats (e.g. rocky crevices, boulders, and patches of soft sediment) at various depths. This complex habitat of reefs and rocky islets and variable depths likely provides a variety of nearby resting and rafting locations suitable during different conditions. Although Sea Otters are non-migratory, sea conditions may influence their use of habitat at certain times of the year. For example, during extended periods of inclement sea conditions in the winter, Sea Otters may aggregate in slightly more protected areas within their home ranges (Morris *et al.* 1981; Watson 1993). Access to bivalves in the soft sediment habitat found in these more protected areas may be important for winter survival.

Sea Otters segregate by sex with males and females occupying spatially-distinct areas. However, individual adult males establish and occupy breeding territories in female areas (Garshelis *et al.* 1984; Jameson 1989; Riedman and Estes 1990; Watson 1993). During the peak breeding season, male rafts are composed largely of sub-adult males, because adult males have established territories closer to female raft areas. Territorial males re-join the male rafts, although some males maintain territories year-round (Garshelis *et al.* 1984; Jameson 1989). Male rafts occur throughout the range of established populations as well as at the periphery of the range of expanding populations (Jameson 1989; Watson 1993).

Sea Otters show considerable site fidelity, although seasonal movements and occasional long distance movements of individuals may occur (Garshelis 1983; Jameson 1989). Sea Otters occupy relatively small overlapping home ranges varying in size from a few to tens of kilometres of coastline (Loughlin 1980; Garshelis *et al.* 1984; Jameson 1989). Population range expansion typically occurs when males move *en masse* from the periphery of the occupied range into previously unoccupied habitat. Females gradually occupy the areas vacated by males (Loughlin 1980; Garshelis *et al.* 1984; Wendell *et al.* 1986; Jameson 1989). In this way population growth and range expansion are linked.

### **3.3.2. Ecological role**

Sea Otters are considered a keystone species exerting significant ecological effects on nearshore marine communities and upon the life history of their prey (Estes and Palmisano 1974; Estes *et al.* 2005). They primarily eat herbaceous invertebrates, thereby reducing the abundance of these species. With grazing pressure reduced, kelp grows more extensively, thereby altering the community from one dominated by grazers with little kelp to one that supports kelp and associated communities of fish and

invertebrates (Breen *et al.* 1982; Watson 1993; Estes and Duggins 1995). Studies in the Aleutian Islands indicate that communities dominated by Sea Otters are up to two to three times more productive than systems without Sea Otters because of the kelp-derived carbon (Duggins *et al.* 1989). These communities also support a greater abundance and diversity of fish species (Reisewitz *et al.* 2006). The keystone role of Sea Otters in rocky subtidal habitats has been demonstrated in British Columbia as well. Watson and Estes (2011) observed that, in areas where Sea Otters were continuously present, urchins were rare and algae dominated, whereas in areas where Sea Otters were continuously absent, urchins were abundant and algae were rare. Although the two states are well defined, there was variability in the transition between these two states in terms of species composition and abundance, being mediated by variation in recruitment and succession of kelps and also by prey behavioural response (Watson and Estes 2011). It has also been shown that the presence of Sea Otters in British Columbia results in increases in rockfish settlement rates and recruitment through their affect on the size and extent of kelp forest habitat (Markel 2011). Other ecological-effects studies seek to investigate the effect of Sea Otters and other ecological and human factors on recovery of Northern Abalone (Lee *et al.* 2010).

### 3.3.3. Limiting factors

The Sea Otter is a density-dependent species and population growth is ultimately regulated by resource availability. The abundance of prey affects juvenile survival, whereas female reproductive rates in the population remain relatively constant regardless of whether the population is growing or stable and at equilibrium. Female reproductive rates are estimated to be 0.83 to 0.94 pups per year (Siniff and Ralls 1991; Bodkin *et al.* 1993; Jameson and Johnson 1993; Monson *et al.* 2000b). As the number of Sea Otters in an area increases and food becomes limiting, Sea Otter density in the area is maintained at equilibrium through mortality and emigration (Estes 1990). Pre-weaning survival ranges from 22- 40% in populations near equilibrium to 85% in growing populations. Survival post-weaning to one year of age tends also to be lower in populations near equilibrium (Monson *et al.* 2000b). Sea Otters older than two years of age generally have high rates of annual survival, approaching 90% regardless of population status (Monson *et al.* 2000b).

Other limiting factors that may impact population growth are disease, predation and ingestion of marine biotoxins. Disease is discussed in section 1.5.2 as a threat because of the potential interaction between human influences from contaminant exposure and introduction of novel infectious diseases in Sea Otters and their habitat. Predation is a limiting factor that contributes to demography. Pup carcasses found at eagle nests suggest eagles may be a source of pup mortality in British Columbia (Watson *et al.* 1997). In the Aleutian Islands, Sea Otter pups comprise five to 20% (by frequency) of the eagle diet during the Sea Otter pupping season (Anthony *et al.* 1998). Killer Whales (*Orcinus orca*) are not thought to be a significant source of mortality in British Columbia, although there is one anecdotal account of Killer Whales pursuing Sea Otters in Kyuquot Sound (Watson *et al.* 1997). In contrast, Killer Whale predation may be significant in western Alaska, where dramatic declines in the Sea Otter population are

underway. Estes *et al.* (1998) hypothesize that because of dramatic declines in seal and sea lion populations in response to a large-scale ecosystem shift, mammal-eating Killer Whales have switched to preying on Sea Otters in western Alaska and are the cause of the observed decline in the Sea Otter population. There is some debate about this hypothesis but it has been accepted by the US recovery team as the most likely explanation for the observed decline (Kuker and Barrett-Lennard 2010; USFW 2010). The decline in western Alaska suggests that a better understanding and appreciation of sources of density-independent factors impacting the Canadian Sea Otter population may be warranted. White Shark (*Carcharodon carcharias*) predation is a significant cause of mortality in the southern Sea Otter population and has increased through time, particularly during the current and recent period of the southern Sea Otter population decline (Estes *et al.* 2003). However, White Sharks occur rarely in our waters and shark attack is not considered a source of predation in British Columbia.

The toxin responsible for Paralytic Shellfish Poisoning (PSP), produced by certain dinoflagellate species, can accumulate to toxic levels in filter-feeding bivalves. Butter Clams (*Saxidomus gigantea*), which tend to accumulate the biotoxin causing PSP, form an important component of the Sea Otter diet. A large die-off of Sea Otters in the Kodiak Archipelago in the summer of 1987 was in part attributed to PSP poisoning, suggesting Sea Otters are susceptible to this natural phenomenon (DeGange and Vacca 1989). One study, however, suggests that Sea Otters may be able to detect PSP and avoid clams with lethal concentrations so the contribution of this limiting factor to population regulation is not known (Kvitek *et al.* 1991). Domoic acid, a biotoxin produced by certain diatom species and some marine algae, can accumulate in filter feeding shellfish and is also passed up through the food chain as an accumulating toxin. First detected on the west coast of North America in 1991, domoic acid has been identified as the cause of several large die-offs of fish-eating sea birds and sea lions in California. Recently, the incidence of myocarditis and dilated cardiomyopathy in southern Sea Otters, found to be the cause of death in 13% of beach cast carcasses between 1998 and 2001, has been linked to exposure to domoic acid (Kreuder *et al.* 2005; Kreuder *et al.* 2003). In British Columbia, dilatory cardiomyopathy has been seen infrequently in the stranded animals examined by necropsy, which may be related to a low sample size of beach cast carcasses to examine and/or because of a relatively low incidence of domoic acid outbreaks in British Columbia (Stephen Raverty pers. comm. 2011). The Canadian Food Inspection Agency's database of domoic acid sampling from marine invertebrates from the west coast of Vancouver Island (1994 – 2004), and information in the scientific literature indicates that domoic acid has been detected in British Columbia but typically at low levels (only 9 of 166 samples between 1994 and 2004 exceeded 20ppm). Overall, domoic acid outbreaks seem less common in Canadian Pacific coastal waters than in Washington and California (Klaus Shailie pers. comm. 2004) and seem to be strongly influenced by oceanographic characteristics (Whyte *et al.* 1997; Trainer *et al.* 2002).

Although the occurrence of toxic phytoplankton is a natural phenomenon, the problem of harmful algae blooms appears to have increased over the past two decades. Coastal pollution in particular, increased levels of nitrogen and phosphorus abundant in sewage



and coastal runoff, is at least partly to blame and in this way a natural phenomenon (marine biotoxins) and its impact (mortality) may be influenced by human activity (Anderson 1994; Miller *et al.* 2010b; Taylor 1990).

## 4. Threats

The Sea Otter is threatened by various anthropogenic factors. Eight classes of threats are identified in this Management Plan: (1) environmental contaminants – oil spill; (2) illegal kill; (3) entanglement in fishing gear; (4) environmental contaminants – persistent bioaccumulating toxins; (5) disease and parasites; (6) vessel strikes; (7) human disturbance; and (8) directed harvest. The influence of some or all of these current threats may affect behaviour, physiology, immune response, habitat use, and result in direct or indirect mortality. Historically, uncontrolled human exploitation during the maritime fur trade and into the 1920's was the single biggest threat that resulted directly, through increased mortality, to the near extinction of the species. Today, threats to the species may arise from the effect of any combination of threats (Table 1), in conjunction with limiting factors (see Section 3.3.3 'Limiting Factors'). The consequence of these interactions may be more serious than those of a single threat acting upon the population in isolation. For example, increased runoff from agriculture and urban development (an anthropogenic threat) increases nutrient loading in the marine environment which increases the incidents of harmful algae blooms; these algal blooms may in turn expose Sea Otters to prey contaminated with marine biotoxins and cause mortality (a natural limiting factor). The link between mortality from disease as a result of exposure to pathogens introduced from land via runoff and sewage is demonstrated in California. Mortality results directly from disease (limiting factor) caused by the novel pathogens (threat) and possibly influenced by reduced immune-competence resulting from contaminant body burden (threat), but also via increased predation (a limiting factor) by sharks of sick animals.

### 4.1. Threat Assessment

Assessment of threats to the population (Table 2) allows for the prioritization of recommended management and other actions to prevent the Sea Otter from becoming threatened or endangered. The following threats have been identified and ranked by level of concern with the greatest threat to the conservation of the species appearing at the top of the table. Prioritization of threats listed as 'low level of concern' was assessed by causal certainty for extent of threat in Canadian Pacific waters as well as ability to mitigate the threat. Definitions of the terms used for ranking are available in Appendix A.

**Table 2.** Threat Classification Table

<b>1 Environmental Contaminants – Oil Spill</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Pollution	<b>Extent</b>	Widespread
<b>General Threat</b>	Transport of oil and use of hydrocarbons to fuel vessel	<b>Occurrence</b>	Anticipated
		<b>Frequency</b>	Recurrent
<b>Specific Threat</b>	Oil spill	<b>Causal Certainty</b>	High
		<b>Severity</b>	High
<b>Stress</b>	<ul style="list-style-type: none"> <li>• Immediate stresses include high mortality from hypothermia, inhalation of fumes or ingestion of oil from fur causing damage to internal organs.</li> <li>• Long-term stresses include reduced reproductive success; chronic contamination through exposure to contaminated sediment and prey (degradation of habitat as a result of contaminated sediment and prey)</li> </ul>	<b>Level of Concern</b>	High
<b>2 Illegal Kill</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Disturbance or Harm	<b>Extent</b>	Widespread
<b>General Threat</b>	Shooting, trapping	<b>Occurrence</b>	Current
		<b>Frequency</b>	Continuous
<b>Specific Threat</b>	Illegal kill	<b>Causal Certainty</b>	Medium
		<b>Severity</b>	Unknown
<b>Stress</b>	Mortality	<b>Level of Concern</b>	Medium
<b>3 Entanglement in Fishing Gear</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Accidental Mortality	<b>Extent</b>	Widespread
<b>General Threat</b>	Entanglement or entrapment	<b>Occurrence</b>	Unknown
		<b>Frequency</b>	Unknown
<b>Specific Threat</b>	Entanglement/entrapment in fishing or aquaculture gear	<b>Causal Certainty</b>	High
		<b>Severity</b>	Unknown
<b>Stress</b>	Mortality (drowning)	<b>Level of Concern</b>	Medium
<b>4 Environmental Contaminants – Persistent Bioaccumulating Toxins</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Pollution	<b>Extent</b>	Widespread
<b>General Threat</b>	Deposition of industrial and agricultural chemicals in marine food webs	<b>Occurrence</b>	Current
		<b>Frequency</b>	Continuous

<b>Specific Threat</b>	Bioaccumulating toxins	<b>Causal Certainty</b>	Low
		<b>Severity</b>	Unknown
<b>Stress</b>	Reduced reproductive success, reproductive impairment, reduced immune competence, mortality	<b>Level of Concern</b>	Low
<b>5 Disease and Parasites</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Changes to Ecological Dynamics or Natural Processes	<b>Extent</b>	Widespread
<b>General Threat</b>	Introduction of diseases and parasites	<b>Occurrence</b>	Current
		<b>Frequency</b>	Continuous
<b>Specific Threat</b>	Exposure to novel disease and parasites	<b>Causal Certainty</b>	Medium
		<b>Severity</b>	Unknown
<b>Stress</b>	Mortality, loss of reproductive potential	<b>Level of Concern</b>	Low
<b>6 Collision with Vessels</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Accidental Mortality	<b>Extent</b>	Widespread
<b>General Threat</b>	Vessel traffic	<b>Occurrence</b>	Current
		<b>Frequency</b>	Unknown
<b>Specific Threat</b>	Collisions with vessels	<b>Causal Certainty</b>	Low
		<b>Severity</b>	Unknown
<b>Stress</b>	Mortality, loss of reproductive potential	<b>Level of Concern</b>	Low
<b>7 Human Disturbance</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Disturbance and Harm	<b>Extent</b>	Widespread
<b>General Threat</b>	Human activities on the water, vessel traffic, Sea Otter viewing	<b>Occurrence</b>	Current
		<b>Frequency</b>	Ongoing
<b>Specific Threat</b>	Behavioural disruption	<b>Causal Certainty</b>	Low
		<b>Severity</b>	Unknown
<b>Stress</b>	Physiological stress; interruption of life processes	<b>Level of Concern</b>	Low
<b>8 Directed Harvest</b>		<b>Threat Information</b>	
<b>Threat Category</b>	Biological Resource Use	<b>Extent</b>	Widespread
<b>General Threat</b>	First Nation Directed Harvest	<b>Occurrence</b>	Anticipated
		<b>Frequency</b>	Unknown
<b>Specific Threat</b>	Harvest	<b>Causal Certainty</b>	Medium
		<b>Severity</b>	Low
<b>Stress</b>	Mortality, Injury	<b>Level of Concern</b>	Low

## 4.2. Description of Threats

The following is a description of the threats presented in Table 2. In 2007, a Recovery Potential Assessment was prepared for Sea Otters including an estimate of the level of human induced mortality that the population could sustain and still continue to increase and recover (Nichol 2007). The Potential Biological Removal (PBR) method was used to estimate a limit for all sources of human-induced mortality of 143 Sea Otters per year. The PBR value represents total allowable harm from all sources of human-induced mortality (DFO 2007).

### *Environmental Contaminants – Oil Spills*

Oil contamination from a spill has both immediate and long-term effects on Sea Otters and the recovery of their populations. Overall, the threat of oil spills is considered to be a “high” level of concern because of the highly vulnerable nature of the Sea Otter to oil, and the trend of increased volume and frequency of transport of heavy oil products in Canadian Pacific waters. While this section considers the effects of hydrocarbon spills, spills of other chemicals and substances may also be of concern depending on their toxicity and persistence in the environment. Both catastrophic (acute) spills as well as chronic spills are described in the following paragraphs.

The following five points summarize Sea Otter vulnerability to oil contamination:

- Sea Otters depend upon the integrity of their fur for insulation. Oil destroys the water repellent nature of the fur. As oil penetrates the pelage, it eliminates the air layer and reduces insulation by 70%, leading to hypothermia (Williams *et al.* 1988).
- Once the fur is fouled, Sea Otters ingest oil as they groom themselves. Ingested oil contains polycyclic aromatic hydrocarbons (PAHs) that damage internal organs, and lead to chronic and acute effects on Sea Otter health and survival (Lipscomb *et al.* 1993, Albers and Loughlin 2003).
- Sea Otters are nearshore animals with strong site fidelity, and will remain in or return to oiled areas. Additionally, they often rest in kelp beds, which can collect and retain oil (Reidman and Estes 1990).
- Sea Otters are found in single sex aggregations, which can include 100 or more animals. Thus, large numbers of Sea Otters, representing a substantial portion of the reproductive potential of a population, can become simultaneously fouled by oil. The loss of a raft of male Sea Otters may have less reproductive impact than the loss of a raft of female Sea Otters because of the species’ polygynous mating system.
- Sea Otters feed on benthic invertebrates, which can accumulate and store toxic hydrocarbons during, and after, an oil spill (Meador *et al.* 1995, Meador 2003).

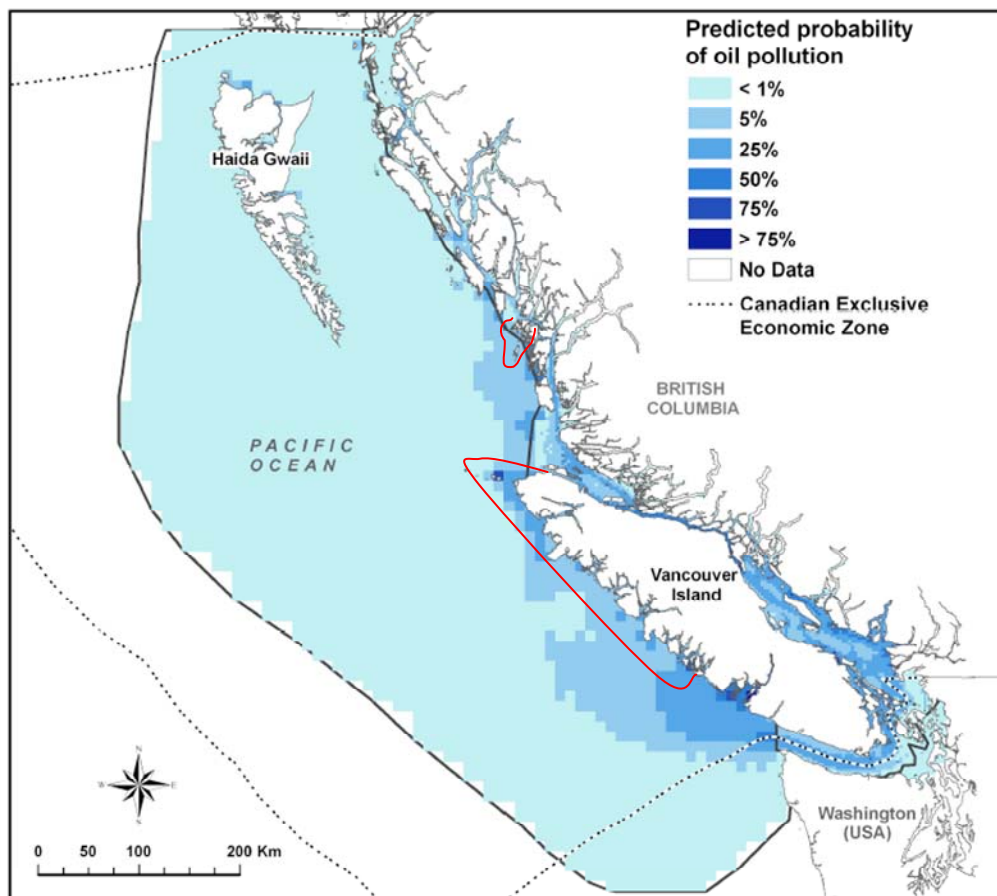
The status of the Sea Otter population in Prince William Sound in Alaska illustrates both short-term and long-term impacts of oil contamination from a catastrophic spill. In the spring of 1989, the oil tanker *Exxon Valdez* ran aground in Prince William Sound, spilling 42 million litres of crude oil. Nearly 1,000 Sea Otter carcasses were recovered

within the first six months, and acute mortality estimates ranged from 2,650 (Garrott *et al.* 1993) to 3,905 (DeGange *et al.* 1994). Population modeling using data from 1976 to 1998 showed that Sea Otters in Prince William Sound had decreased survival rates in all age-classes in the nine years following the spill and the Prince William Sound Sea Otter population had not yet fully recovered to pre-spill levels (Monson *et al.* 2000a). Additional evidence indicates that Sea Otters are being subjected to chronic oil exposure from residual oil in local sediments, which are causing lasting effects on the population's recovery and health (Bodkin *et al.* 2002, Ballachey *et al.* 2003, Peterson *et al.* 2003, Short *et al.* 2006, Monson *et al.* 2011, Bodkin *et al.* 2012). These results highlight that while oil spill response may include physical removal of some oil and rehabilitation of oiled animals there are long term effects to the ecosystem via on-going toxic contamination of prey and habitat. Further, more than 10 years after the *Exxon Valdez* oil spill, Sea Otters in parts of the Sound that were most heavily oiled have elevated levels of CYP1A<sup>3</sup> in liver samples suggesting continued exposure to residual oil in prey and habitat and it is thought that population recovery is constrained at least in part by residual oil effects, despite an adequate food supply (Bodkin *et al.* 2002).

Sea Otters are at risk from chronic oil spills. Data compiled from Transport Canada's National Aerial Surveillance Program (NASP) from October 1997 to March 2006 indicates that Sea Otters are found in areas with relatively high predicted chronic oil spill occurrences over a ten year period (Figure 3).

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<sup>3</sup> Cytochrome P4501A (CYP1A) is a type of liver enzyme associated with metabolism of toxic compounds including polyaromatic hydrocarbons (PAHs).

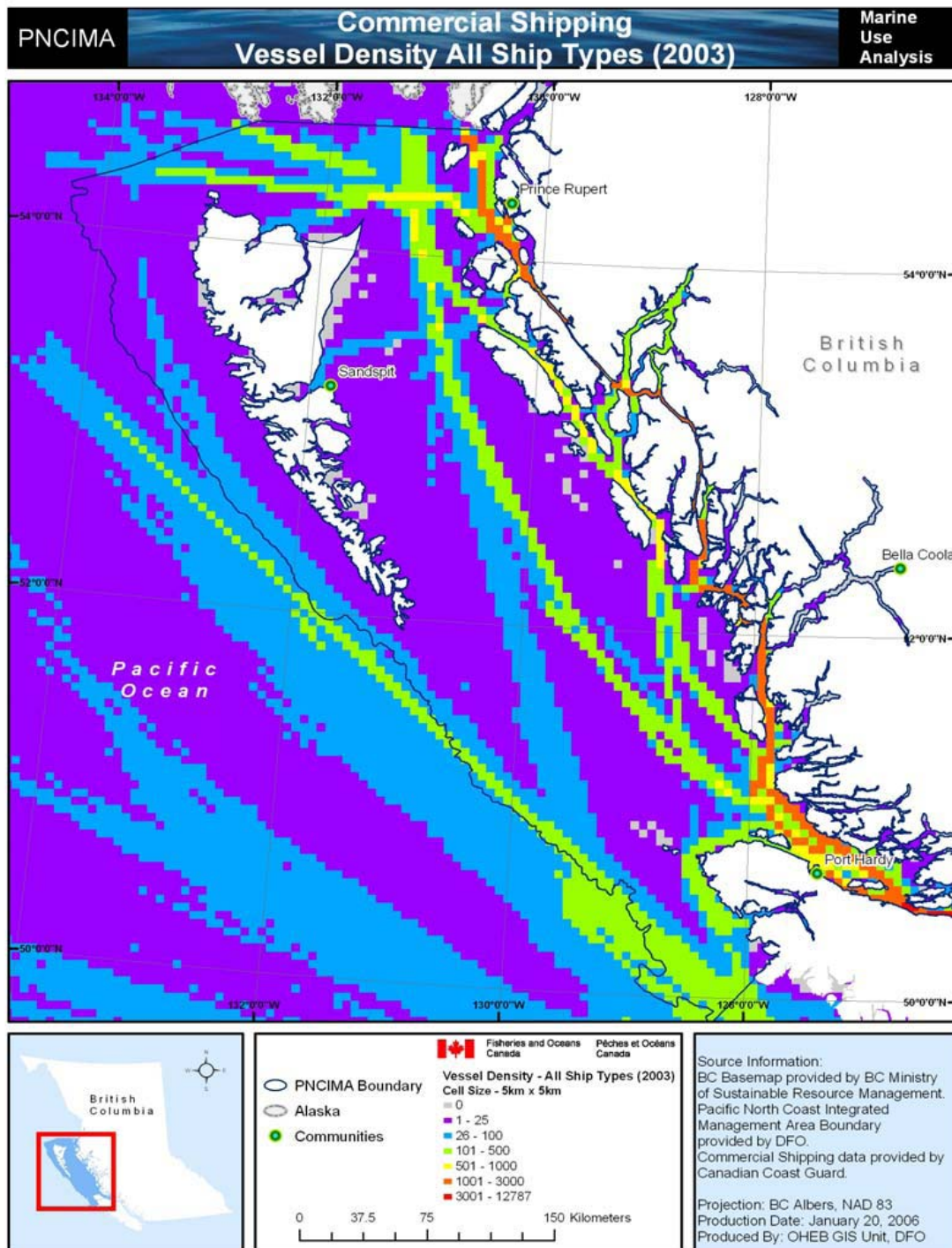


**Figure 3.** The distribution of chronic oil spill probability of occurrence (in percentage) based on data collected by NASP from 1998 to 2007 in the study area. Red lines indicate current Sea Otter range. Map altered from Serra-Sogas 2010.

Polyaromatic hydrocarbons (PAHs) are persistent constituent contaminants in petroleum although they can also occur naturally. Direct releases to the aquatic environment from anthropogenic sources occur through the use and spillage of petroleum products, coal, and creosote. Chronic exposure of Sea Otters to PAHs may also occur from chronic oil spills. Chronic oil spills are frequent but typically small discharges of less than 1000 litres where the point sources typically remain unidentified (O'Hara *et al.* 2009). Using samples from 42 live-captured Sea Otters on the British Columbia coast in 2003 and 2004 and invertebrate prey samples, Harris *et al.* (2011a) showed Sea Otters in British Columbia are exposed to PAHs via dietary uptake from prey, which are exposed through sediment contamination. Due to potential chronic oil exposure, Harris *et al.* (2011b) measured hydrocarbons from the habitat of Sea Otter in coastal British Columbia and found that PAHs in the sediment exceed quality guidelines designed to protect aquatic biota at 20% of the sites. Harris *et al.* (2011a) also found

that though Sea Otters appear to readily metabolize or excrete parent PAHs, there is a retention and biomagnification of alkyl PAHs. At 20% of sites where sediment was sampled in the British Columbia Sea Otter range, PAH sediment quality guidelines were exceeded. This suggests Sea Otters in BC are vulnerable to hydrocarbon contamination even in the absence of catastrophic oil spills (Harris *et al.* 2011b). Brancato *et al.* (2009) speculated that PAH residue levels they found in Sea Otters in Washington State may have been contributed from three oils spills that have occurred on that coast in the Sea Otter range over the past two decades. The health impact of the residue levels found in Sea Otters in British Columbia and Washington are not clear. Even in the absence of catastrophic oil spills Sea Otters are still vulnerable to hydrocarbon contamination.

The British Columbia coast is an active waterway with heavy vessel traffic (Figure 4) and oil spills are an ever-present threat in British Columbia waters as acute or chronic spills may occur from the cargoes of tankers and barges, bilges, fuel tanks of marine vessels, shore-based fuelling stations and even shore-based industries such as pulp mills (Shaffer *et al.* 1990; MacConnachie *et al.* 2007). The volume of petroleum transported in marine waters has increased over the decades. For example, approximately 1 million litres of crude oil were transported out of the Port of Vancouver in 1988 (Kinder Morgan 2010). Since then the demand for oil has increased to over five billion litres through the Port of Vancouver in 2010 and further substantial increases are proposed (Vancouver Metro Port Authority 2010; Kinder Morgan 2010). These shipments are transported through Juan de Fuca Strait. At this time, the areas of the British Columbia coast most at risk from oil spills, based on intensity of shipping activity, are Juan de Fuca Strait, west coast Vancouver Island and west coast Haida Gwaii (MacConnachie *et al.* 2007).



**Figure 4.** Vessel Traffic Density for all ships in 2003, as reported by Marine Communications and Traffic Services (from MacConnachie *et al.* 2007).



Continued increases in the shipment of petroleum along the British Columbia coast is anticipated in the near future. A proposal has been made to increase the volume of crude oil transported through the Port of Vancouver from 5 billion litres annually in 2010 to 26 billion litres annually (Kinder Morgan 2010). There is also a proposed development for the Northern British Columbia coast to transport dilute bitumen from Kitimat, British Columbia to Asia Pacific and US markets via 149 outbound transits per year using Very Large Crude Carrier tankers (more than two times the size of the *Exxon Valdez*) and 71 inbound transits of tankers carrying condensate (Enbridge Northern Gateway Project 2010). Increased volumes transported, increased frequency of transits, and expanded area of transport would increase the risk from Vancouver Island to include the northern British Columbia coast and Hecate Strait.

Although there is a voluntary Tanker Exclusion Zone (TEZ) which pushes petroleum carrying tankers to 50 km from the coast of Vancouver Island and Haida Gwaii, this applies to tankers transiting from Alaska to southern U.S. states, but not to vessels and barges transporting these products through Canadian Pacific waters (MacConnachie *et al.* 2007). Further, this does not apply to vessels carrying other cargo which could still be of concern due to their fuel tanks in the event of a grounding.

Oil spills when they happen, are difficult to manage, particularly when they occur at sea and where the location is remote and exposed to open ocean conditions. For these reasons only 10 to 15% (and often less) of the oil can be successfully contained and recovered (International Tanker Owners Pollution Federation 2010). Oil spill risk is greatest in winter months and major vessel routes that transit close to shore present the highest environmental risk to sensitive nearshore ecosystems. There are two key drivers to this risk: 1) major vessels carry large volumes of heavy oil or bitumen; and 2) if a major vessel loses engine power and thus steering and runs aground spilling its cargo. In the latter situation, the use of tugboats to tow the tanker away from shore and confined waterways is a key response to reduce oiling of sensitive shorelines and attempt to confine the impact to ocean areas where it is hoped that the impact is less acute. However, British Columbia has limited tugboat capacity relative to the amount of coastline to ensure timely rescue in such a situation (Reid 2008).

### *Illegal kill*

Overall, the threat of illegal kill is considered to be a “medium” level of concern because it has the potential to significantly impact the population by uncontrolled removals of animals, especially reproductive aged females (Bodkin and Ballachey 2010). The current level of illegal kills is unknown and the paucity of information makes it difficult to estimate the total number of illegal kills.

There are verified reports of illegal killing of Sea Otters in British Columbia (DFO Marine Mammal Response Program, unpublished data). For terrestrial game species it is conservatively estimated that only 10% of illegal kills are accounted for (Todesco 2004). In southeast Alaska, the Sea Otter population growth rate slowed to 4.7% per year from 1988 to 2003, despite ample amounts of unoccupied habitat still available for expansion

(Esslinger and Bodkin 2006). The slowing growth rate does not appear to be attributable to disease, predation or limiting resources and may be related to illegal and legal harvest (Esslinger and Bodkin 2006).

### *Entanglement in fishing gear*

Overall, the threat of entanglement in fishing gear is currently considered to be a “medium” level of concern. However with expansion of the population range and the spatial overlap with fishing activities and aquaculture operations, instances of entanglement may increase and should be monitored. Of concern are crab traps and gillnets, as well as pen netting at aquaculture sites and nets used for predator avoidance.

Fishing gear that can cause entanglement and drowning, including nets, traps, and fishing debris, is a conservation concern for many marine species; with respect to Sea Otters, this threat is difficult to quantify as drowned Sea Otters sink and are largely undetected. Even localized small-scale fisheries can result in unsustainable levels of by-catch (Peckham *et al.* 2007) and at any scale it is difficult to detect and quantify the effects on population demography. Incidental entanglements of Sea Otters in salmon set-nets have been reported in Alaska and Washington (USFW 1994; Gearin *et al.* 1996; Gerber and VanBlaricom 1998). In California, incidental drowning in sunken gill nets was determined to be a significant cause of mortality contributing to population decline in southern Sea Otters during the late 1970s and early 1980s (UFWS 2003). As a result, restrictions in the use of gill and trammel nets in waters less than 65 metres were implemented and the population decline reversed (Riedman and Estes 1990). However, the impact of by-catch from new or expanded fisheries since the 1980s (crab, lobster and finfish traps) in California has become of concern as a possible cause of the lack of recovery of the southern Sea Otter population (Hatfield *et al.* 2011). Studies with captive Sea Otters demonstrate that Sea Otters will attempt to enter a trap and can do so through relatively small openings (Hatfield *et al.* 2011). Modeling of the ability of observer programs of various sizes to detect the number of drowned Sea Otters showed that even a mortality rate of 50 Sea Otters per year, a level of mortality sufficient to cause a 2.5% change in the rate of population growth in California, would require monitoring of 1,200 traps per year to detect at least 1 death with 95% or greater probability (Hatfield *et al.* 2011).

Given the difficulty in assessing Sea Otter by-catch rates, the use of proactive measures (e.g. gear modifications that restrict Sea Otters from entering traps or switching gear types in areas occupied by Sea Otters) is the best approach to address this threat. While the extent of accidental drowning of Sea Otters in fishing gear in coastal British Columbia is unknown, there are verified reports of Sea Otter accidental drownings related to net and crab gear (DFO Marine Mammal Response Program, unpublished data).

There are no known interactions at this time between open water shellfish aquaculture or finfish aquaculture operations and Sea Otters on the British Columbia coast.

However, Sea Otters have a diverse diet and use a variety of methods to obtain their prey. The occurrence of drowned Sea Otters in crab and fish traps in California and Alaska indicates that Sea Otters will investigate and try to remove prey from man-made structures. Finfish and shellfish aquaculture are growing industries on the British Columbia coast and the potential spatial overlap with Sea Otters will increase.

#### *Environmental Contaminants – Persistent Bioaccumulating Toxins, Persistent Organic Pollutants (POPs)*

Overall, the threat of persistent bioaccumulating toxins is considered to be a “low” level of concern at this time. Although levels of contaminants in Sea Otters have not been measured within British Columbia, this assessment of the level of risk is based upon the following: 1) the Sea Otter population within British Columbia at this time does not occupy areas near industrial, military or agricultural development; 2) the Sea Otter population appears to be growing within British Columbia; and 3) while levels of various contaminants have been measured in other populations, the levels reported have not, to date, been linked to population effects with the exception of Poly Aromatic Hydrocarbons (see Oil Spill section). In the absence of information regarding levels of persistent organic contaminants in Sea Otter population in British Columbia, information from other populations is presented here for review.

In general, persistent organic pollutants are of considerable concern for marine mammals because many are persistent organic pollutants including polychlorinated biphenyls (PCBs) 2,2-bis (p-chlorophenyl)-1,1,1-trichloroethane (DDT) and poly aromatic hydrocarbons (PAHs) are considered immunotoxic (Ross *et al.* 1996). Laboratory animal studies have conclusively demonstrated that such chemicals are endocrine disrupting, with effects observed on reproduction, the immune system, and growth and development. Thus, contaminant exposure could threaten Sea Otters by negatively affecting immune response to disease and/or disrupting reproduction and development resulting in reproductive failure. The interaction between contaminant burden and disease is considered a possible factor in the high rate of disease-caused mortality in the southern Sea Otter population (Thomas and Cole 1996; Reeves 2002; Ross 2002). In a small sample of beach-cast carcasses retrieved for contaminant analysis in California, those that died from infectious disease contained, on average, higher concentrations of butyltin compounds (components in antifouling paint) and DDTs than animals that had died from trauma and unknown causes (Kannan *et al.* 1998; Nakata *et al.* 1998).

Polychlorinated Biphenyls (PCBs) were used and imported into Canada primarily from the US until their manufacture in the US was formally banned in 1979. However large legacy repositories of PCBs in soils and bottom sediments are available for recycling via atmospheric transport to other areas (Garrett and Ross 2010). PCB concentrations have been measured in some Sea Otter populations and were found to be higher in Alaskan Sea Otters from the Aleutian Islands (309µg/kg wet weight) compared to Sea Otters from California (185µg/kg wet weight) and southeast Alaska (8µg/kg wet weight) (Bacon *et al.* 1999). The levels of PCBs measured in California and Aleutian Sea Otters

is considered to be of concern, since similar levels cause reproductive failure in mink, a closely related species (Risebrough 1984 *in* Riedman and Estes 1990). Levels in Washington Sea Otter samples were on the lower to mid-range of means reported from the Aleutians to California but even at the low levels measured in the whole blood samples from live captured animals, the results suggest that continued monitoring of PCB in the Washington population is warranted (Branacto *et al.* 2009).

2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane (DDT) is a broad spectrum pesticide that was developed to control insect pests on crops. Most pesticidal uses of DDT were phased out in the early to mid-1970s but in many tropical countries DDT is still used for the control of malaria and hence transport of DDT likely occurs by atmospheric transport (Garrett and Ross 2010). Total DDT concentrations were measured in some Sea Otter populations and were found to be highest in California Sea Otters (850µg/kg wet weight), compared to the Aleutian Islands (40µg/kg wet weight) and southeast Alaska (1µg/kg wet weight), likely reflecting the greater degree of agricultural activity in California than in Alaska. Mean DDT concentrations in liver of Washington beach-cast animals were considerably lower than that observed in California Sea Otters (a level not considered to be exceptionally high when compared to other marine mammals) but higher than that observed in Alaskan Sea Otters (Bacon *et al.* 1999; Brancato *et al.* 2009).

Perfluorinated compounds (PFCs) used in fabrics, packaging and other items primarily as a fire retardant, have received world-wide attention because of their toxic and persistent properties (Garrett and Ross 2010). These compounds have recently been measured in Sea Otters in Alaska from 1992 to 2007 (Hart *et al.* 2009). While some PFC congeners decreased in liver concentrations in Alaska Sea Otters from 1992 to 2007 corresponding to a phase out of production in the US in 2000, another group, perfluorononanoic acid (PFNAs) have increased ten-fold since 2004 and the levels are now similar to those found in Sea Otters in California (Hart *et al.* 2009).

### *Disease and Parasites*

While there is evidence of exposure to various diseases in the Sea Otter population within British Columbia, there is as yet little evidence of significant mortality resulting from disease. Significant mortality could be demonstrated by an increase in the number of carcasses reported washed up on beaches or a detectable decline in population in a particular area. For these reasons the threat is considered to be a “low” level of concern at this time. However, disease may become a greater concern in the event that continued increase in population size and range expansion results in spatial overlap with urban areas.

In general, disease is not thought to be a major cause of mortality among most Sea Otter populations (Riedman and Estes 1990). However the emergence of novel infectious disease is of concern in the southern Sea Otter population, which occurs along the California coast adjacent to high densities of human population (Thomas and Cole 1996; Estes *et al.* 2003). Of recent concern is the emergence of infection and

mortality arising from protozoal encephalitis caused by *Toxoplasma gondii* parasites for which Sea Otters are thought not to be the normal host. It is unclear where the *T. gondii* variant found in Sea Otters has come from but it appears most likely to be a terrestrial source whereby infectious oocysts of the parasite are washed into the marine environment from urban and agricultural areas by rain. In the marine environment the oocysts are taken up by filter feeding invertebrates that the Sea Otters feed on (Lafferty and Gerber 2002; Miller *et al.* 2002; Conrad *et al.* 2005; Miller *et al.* 2008). *Sarcocystis nerona* is another parasite thought to be terrestrial in origin causing mortality among southern Sea Otters (Kreuder *et al.* 2003; Miller *et al.* 2010a). The observed prevalence of disease and variety of diseases in southern Sea Otters are of concern, and it is speculated that, in addition to the effect of pathogens transported into the Sea Otters' habitat, decreased immune function may be a factor influencing Sea Otter immune response. Reduced immune competence could result from environmental toxins, genetic factors, or habitat degradation leading to nutritional stress (Thomas and Cole 1996; Reeves 2002; Brancato *et al.* 2009). Whatever the cause, increased mortality in the southern Sea Otter population is significant at the population level (the cause of poor population growth) because of the loss of prime age females to disease (Tinker *et al.* 2006).

Mortality or evidence of exposure (in live captured animals) to the following diseases has been documented in the northern Sea Otters: *T. gonadi*, *S. nerona* (British Columbia, Alaska, Washington); *Leptospirosis* (Washington); and Canine Distemper Virus (CDV) (Washington) and Phocine Distemper Virus (PDV) (Alaska), both of the genus *Morbillivirus* (Thomas and Cole 1996; Reeves 2002; Gill *et al.* 2005; Shrubsole *et al.* 2005; Raverty pers. comm. 2006; Brancato *et al.* 2009; Goldstein *et al.* 2009). In the British Columbia samples, exposure to *T. gondii* was found in live captured animals (DFO Sea Otter program unpubl.) and *S. neurona* was the cause of mortality in one beach cast carcass (S. Raverty pers. comm. 2011). A Sea Otter in Washington was confirmed to have died from CDV in 2004, the first reported case, but 80% of 32 live-captured Sea Otters in Washington in 2000 and 2001 and 20% of 42 live-captured Sea Otters in British Columbia in 2003 and 2004 tested seropositive for exposure to morbilliviruses (Shrubsole *et al.* 2005; Brancato *et al.* 2009). Mortality or evidence of exposure (in live captured animals) to PDV is reported from Alaska, PDV first appeared in the North Pacific Ocean in 2000 and it is thought the introduction of this disease may have been facilitated by reduced sea ice in Arctic waters allowing east to west transmission from the Atlantic to the Pacific (Gill *et al.* 2005; Goldstein *et al.* 2009). The introduction of both CDV and PDV highlight the potential role of growing human population densities in coastal marine areas and the potential effect of climate change. Morbillivirus diseases can cause mortality in populations that have not previously been exposed. Persistent organic pollutants that suppress immune function appear to exacerbate morbillivirus-related outbreaks in other marine mammals (Ross 2002).

### *Vessel Strikes*

Overall, the threat of collisions with vessels is considered to be a "low" level of concern for the Sea Otter population because most of the population occurs in relatively remote

coastal regions with low levels of vessel traffic. Most Sea Otters occupy exposed rocky shorelines that are often not suited to high speed transit close to shore. As the population expands into areas adjacent to human settlement this threat may increase.

For the Sea Otter this threat can be characterized as collisions with high speed small boats operating in nearshore waters. There have been a few incidents in British Columbia in which carcasses have been recovered with evidence of boat propeller marks or blunt force trauma associated with impact from a boat (DFO Marine Mammal Response Network unpubl.). However, relatively few carcasses, with which one can assess cause of mortality, are recovered each year in British Columbia and so the frequency of collisions is not well understood. This may be due to the remoteness of much the Sea Otter range and/or scavenging of carcasses by wolves and bears (Watson *et al.* 1997).

### *Human Disturbance*

Overall, the threat of human disturbance is considered to be a “low” level of concern due to the remote distribution of most of the Sea Otter population. However with continued range expansion and increasing eco-tourism activity seeking out Sea Otter viewing opportunities or that may cause disturbance while viewing other species local areas of concern from disturbance may be emerging.

The extent of disturbance of resting and foraging Sea Otters from boat traffic is largely unknown. It has been thought not to be significant although this may change at local levels as the Sea Otter population expands its range and comes in closer proximity to human-populated areas. The possibility of viewing Sea Otters is included in the promotional material of ecotour operators on the west coast of Vancouver Island, although not yet as a primary species of interest. Summer resident grey whales occupy the same habitat as Sea Otters in some areas on the west coast of Vancouver Island. Whale-watching activity drawn to these nearshore feeding grey whales may disrupt rafts of resting Sea Otters which are sensitive to vessel presence. Research is needed to investigate this interaction.

### *Directed Harvest*

Overall, directed harvest is a “low” level of concern because it is an anticipated but not yet occurring threat, and the extent of threat is unknown at this time. As this is an emerging threat, it is anticipated the level of concern will likely increase in the event that directed harvest is approved. Adequate monitoring and management will be necessary to ensure harm and mortalities are minimized, and do not pose a threat to the population in British Columbia.

A food, social and ceremonial (FSC) harvest by First Nations is anticipated on the west coast of Vancouver Island. The Potential Biological Removal model was reviewed for use in estimating limits to all sources of human caused mortality for the Sea Otter population within British Columbia (DFO 2007). A method has been developed for

calculating an allocation for this harvest from the total allowable harm estimate that considers other sources of human induced mortality such as illegal killing, entanglement and vessel strikes. This method also takes into consideration the distribution of animals within the range as well as the sex distribution of the animals. Although a harvest is not itself a threat, close monitoring of this activity will be required. The activity will result in mortality of individuals most of which will be retrieved but there will inevitably be a number of struck and lost. There is also a possibility that the availability of pelts within First Nation communities may inadvertently create an interest in the acquisition of pelts by unauthorized people and development of an illegal market.

### 4.3. Knowledge Gaps

#### *Habitat*

Significant knowledge gaps exist with regard to understanding habitat use and seasonal habitat use is not well understood. Although Sea Otters are observed using exposed rocky coastal areas during spring and summer under good weather conditions, anecdotal observations of Sea Otters have been made in inlets and protected areas during winter and severe storms. These observations suggest that there may be limited seasonal movement. Sea Otters lack a blubber layer and thus rely on a high metabolic rate and their fur to maintain their body temperature. To fuel their metabolism they need adequate food. During periods of extended inclement sea and weather conditions available foraging habitat may be limited. Thus mortality may be higher in winter months when conditions limit access to foraging areas. There is a need to document and describe the characteristics of habitats used during winter and inclement sea-state conditions as these habitats may be key to their survival and conservation if they support Sea Otters through winter and periods of inclement weather.

#### *Genetic diversity*

Although genetic samples have been collected, genetic diversity, typically measured using microsatellite DNA, has not yet been estimated for the Canadian Sea Otter population. Larson *et al.* (2002) show that other Sea Otter populations of Washington and Alaska have significantly less genetic diversity compared to their pre-fur trade ancestors. Although it is likely that genetic diversity of the British Columbia population is similar to the other translocated populations that Larson *et al.* (2002) examined, the genetic diversity of the Canadian Sea Otter population compared to other extant populations, as well as pre-fur trade ancestors, is not known. Insight into the genetic relationship (possibility of gene flow) between British Columbia and Washington State Sea Otters is underway (Shawn Larson pers. com. 2010).

#### *Sources of mortality*

Sources and impacts of natural predation on the Sea Otter population in coastal British Columbia are not well documented. Although natural predation is thought to be

relatively low (Watson *et al.* 1997), a greater consideration of this limiting factor may be warranted given the relatively small numbers of Sea Otters and the hypothesized role of killer whale predation in the decline occurring in western Alaska (see Section 1.3 Populations and Distribution). The extent of mortality from other sources such as entanglement in fishing gear, vessel strikes and illegal killing is only crudely estimated at this time.

### *Emerging threats*

Additional threats that could be significant but are not well understood and for which the level of concern, or potential future threat, should be clarified include: disease, contaminant levels, illegal kills, human disturbance, directed harvest, acoustic disturbance, and struck and lost. Underwater noise disturbances are not well understood for Sea Otter, but Southall *et al.* (2007) suggest further exposure criteria be considered. Interactions with human activities can be expected to increase as the Sea Otter population expands into previously unoccupied areas. These are threats that have been identified and found to be significant in other Sea Otter populations (see Section 4 Threats).

### *Interactions with other species*

Although there has been considerable research examining the ecological role of Sea Otters and their influence on nearshore rocky habitats and upon the life history of their prey (see Section 3.3.2 Ecological Role), further research is required to determine Northern Abalone population parameters in the presence of Sea Otters, to determine objectives for Northern Abalone recovery. More study is needed and is underway (University of British Columbia (UBC), Simon Fraser University (SFU)) to examine the extent of ecological effects of Sea Otters to kelp forest ecosystems in British Columbia and the species they support.

### *Density-independent factors regulating population growth*

In Southwestern Alaska, the Sea Otter is now listed as Threatened under the US *Endangered Species Act* because of a precipitous decline since the mid to late 1980s. The current leading hypothesis to explain the decline is that it has occurred as a result of increased predation by killer whales, although the reason for the shift is complex (see Section 3.3.3 Limiting Factors). Maintaining information exchange and/or collaboration with researchers and managers working on populations of Sea Otters in other jurisdictions will assist in understanding factors that may regulate population growth in British Columbia.



## 5. Management Objective

The management objective for the Sea Otter is to conserve abundance and distribution in Canada as observed in 2008<sup>4</sup>, and promote the continued population growth and expansion into formerly occupied regions such as Haida Gwaii, Barkley Sound, and north mainland British Columbia coast.

The Sea Otter Management Plan recommends an approach to conservation that recognizes that Sea Otter populations have the potential to recover from depletion, but also that threats could limit or even reverse the current population trend if not addressed. Therefore, the approach focuses on identifying and reducing threats that may negatively affect abundance and distribution of Sea Otters.

Sea Otter distribution and abundance are inter-related. Unoccupied habitat is sequentially occupied as the number of Sea Otters in an area approaches carrying capacity. Given the relationship between range size and population abundance, coupled with the localized movements of individuals, it follows that increasing the geographic range to reduce the risk from human-induced mortality will also result in an increased abundance of Sea Otters. The expansion of the geographic range of Sea Otters in coastal British Columbia will reduce population-level vulnerability to catastrophic events such as oil spills.

## 6. Broad Strategies and Conservation Measures

### 6.1. Actions Already Completed or Currently Underway

#### *Surveys (1977 – present)*

Between 1977 and 1987, survey counts were conducted collaboratively by Fisheries and Oceans Canada (DFO), British Columbia Parks, and West Coast Whale Research (see Watson *et al.* 1997). Between 1988 and 2000, comprehensive counts were led by Dr. Jane Watson as part of her Ph.D. work and then an on-going study of the effects of Sea Otters on nearshore communities; see Watson *et al.* (1997) for a summary of survey effort and results up to 1995. Since 2001 DFO has led boat based and aerial surveys of Sea Otters throughout their range (Nichol *et al.* 2009).

#### *Development of standardized survey procedure (2001 to 2004)*

In 2001, Fisheries and Oceans Canada began work to standardize a survey method suitable for on-going assessment of the Sea Otter population and this method has been used during aerial and boat-based counts of the population. A population survey procedure has now been developed that provides an index of population abundance and growth trends (Nichol *et al.* 2005). Assessment of trends in abundance and growth

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<sup>4</sup> Refer to Figure 1 and Table 1 for Sea Otter abundance estimates *and* distribution.

are dependent on a time series of survey data and therefore on-going population surveys at regular intervals are important. The most recent full population range survey was completed in 2008 (Nichol *et al.* 2009).

*Sampling collection and assessment of genetic origin, disease exposure and contaminants in Sea Otters (2003 - present)*

Eighteen Sea Otters were live-captured on the central British Columbia coast in 2003 and in 2004, 24 Sea Otters were live-captured on the west coast of Vancouver Island; blood and skin biopsy samples were collected during each capture. In 2010, a further 46 Sea Otters were live-captured on the west coast of Vancouver Island and blood and skin biopsy samples were collected. Genetic samples were collected in 2003 to determine the origin of the central coast Sea Otters (i.e. a remnant population or a result of reintroduction) and samples were collected in 2004 and 2010 for further research on genetic structure and diversity in the population. Blood samples were collected to determine disease exposure (i.e. what diseases has the population been exposed to) and to identify pathogens of concern and emerging diseases. Additional samples have been stored for further study of contaminants and health effects. Through DFO's Marine Mammal Response Program, Sea Otters found dead are collected for necropsy and disease screening. The first case of mortality from *Sarcocystis nerona* in British Columbia was detected this way. Necropsy and disease screens continue with beach-cast carcasses as a means of monitoring some sources of mortality and disease. Sea Otters occupy coastal marine habitats and these are the interface between the terrestrial and the marine. Biological pollutants including pathogens from terrestrial sources are appearing in marine habitats as a result of agricultural animals, human sewage, domestic animals, and habitat alteration in coastal regions. Sampling Sea Otters and carcasses and screening for diseases allows the monitoring of emergent multihost epizootics and changes in Sea Otter health and these can serve as indicators of the health of the marine environment (Jessup *et al.* 2004).

*Oil spill response (1995 - 2007)*

A symposium was held in 1995 at the Vancouver Aquarium to discuss procedures necessary in the event of a spill to effectively protect the population (Watson 1995). There are oil spill response plans in place, although they are not specific to conservation of wildlife, or Sea Otters in particular. The Canada-U.S.A. Joint Marine Pollution Contingency Plan includes a plan for transboundary waters in southern British Columbia (CANUSPAC) and a plan for the transboundary waters to the north in Dixon Entrance (CANUSDIX) (<http://www.ccg-gcc.gc.ca/e0003874>). So far, only CANUSDIX includes a section regarding response procedures for wildlife in the event of a pollution incident.

The effect of oil spills on Sea Otters is well documented (e.g. *Nestucca* and *Exxon Valdez*) (Waldichuk 1989; Loughlin 1994) and the risk of an oil spill and sources of oil in British Columbia are documented (see section 2.3). The (Canadian) Sea Otter Recovery Team formed a Sea Otter oil spill response Recovery Implementation Group

in 2004 and has developed a Sea Otter oil spill response plan working document. In 2005, the Nuuchahnulth Tribal Council (NTC) and Vancouver Aquarium held oil spill response and wildlife response training as part of their Habitat Stewardship Program projects. The oil spill response planning document highlighted the current state of oil spill response in British Columbia and identified a ramp-up procedure depending on the situation from monitoring to pre-emptive capture and finally capture of oiled Sea Otters. The plan identified where the Sea Otter response team would fit within the Canadian oil spill response command structure and listed the equipment and personnel that should be called upon in the event of a spill.

*Promoting and enforcing compliance with legislation that protects sea otters*

Since the *Species at Risk Act* came into force, DFO's Conservation and Protection Branch has dedicated over 1000 hours specifically to Sea Otter protection and enforcement in Canadian Pacific waters. Federal Fishery Officers have been protecting sea otters under the Marine Mammal Regulations of the *Fisheries Act* for decades, responding to situations involving sea otter disturbance, shootings and sales of pelts. Over 20 investigations have been initiated on offences committed by individuals during this time (as of 2012). Fishery Officers are dedicated to raising the public's awareness of the recovery of Sea Otters, threats and the legislation that protects them by attending community meetings, delivering public and school presentations and during their patrols in areas where Sea Otters are found. Officers also work with local First Nations to promote Sea Otter conservation. The public is encouraged to report suspicious behaviour immediately to the 24-hour Observe, Record Report line at 1-800-465-4336. Timely information greatly increases the ability of officers to respond to reports.

*Education / Information Exchange - Nuuchahnulth Tribal Council and West Coast Aquatic Management Association, Habitat Stewardship Program project (2002-2010)*

The NTC and West Coast Aquatic Management Association have developed and presented workshops to their community members to inform them of the biology and ecology of the Sea Otter and conflicting views about Sea Otters' role in the ecosystem. In addition to annual surveys (2002 – 2010) and the work on oil spill response listed above, community mapping sessions and reporting of incidental sightings are also conducted. Skeletons and skins collected from dead animals brought in by DFOs Marine Mammal Response Program have been made available to museums and interpretative centres (e.g. Pacific Rim National Park, Johnstone Strait Marine Mammal Interpretative Society Museum and others).

*Surveys and Sightings – Nuuchahnulth Tribal Council, Habitat Stewardship Program project (2002-2008)*

The NTC carried out summer boat surveys using dedicated and incidental survey methods in several areas (e.g. Checleset Bay, Kyoquot Sound, Nuchatlitz, Nootka Island and Clayoquot Sound) as well as winter aerial surveys in Clayoquot Sound (2002-2008).

*Surveys, sightings and communications – Heiltsuk First Nation, Habitat Stewardship Program project (2006-2009)*

Heiltsuk fisheries staff has been involved in developing communication and education materials for central British Columbia coast communities about Sea Otters and Northern Abalone. They have also carried out surveys and collected incidental sightings of Sea Otters to document raft locations in fall and winter (Carpenter 2009).

*Sea Otter viewing guidelines (2004)*

The West Coast Aquatic Management Association and the Bamfield Marine Sciences Centre developed guidelines for viewing Sea Otters as part of their Habitat Stewardship Program project in 2004.

*Johnstone Strait Marine Mammal Interpretative Society Museum (2002)*

In 2002, under their Habitat Stewardship Program project, the Johnstone Strait Marine Mammal Interpretative Society created a museum in Telegraph Cove depicting local marine mammals, including Sea Otters. The museum is open May to September. <http://www.killerwhalecentre.org/>.

*Communication material (2002)*

The British Columbia Ministry of Water, Land and Air Protection revised and re-issued a booklet on Sea Otters as part of their Species at Risk series in 2002.

*Sea Otter Program, Fisheries and Oceans Canada web page.* DFO Pacific region has a web page describing the Sea Otter Program and also provides information for reporting sightings of Sea Otters (<http://www.pac.dfo-mpo.gc.ca/science/species-especies/otter-loutre/index-eng.htm>).

*Habitat Protection (1981)*

The Checleset Bay Ecological Reserve was established in 1981 by the Province of British Columbia to protect Sea Otter habitat. The area is closed to shellfish harvesting.

*Re-introduction (1969-1972)*

Between 1969 and 1972, the Province of British Columbia, the State of Alaska and the Canadian government re-introduced 89 Sea Otters from Amchitka Island and Prince William Sound, Alaska, to the Bunsby Islands in Kyuquot Sound on the west coast of Vancouver Island, British Columbia in a series of three translocations.

*Scott Islands marine National Wildlife Area proposal (draft), Environment Canada* (<http://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=90605DDB-1>)

A proposed marine National Wildlife Area is being considered for the Scott Islands area off the northwestern tip of Vancouver Island. The proposed area includes the Scott Islands archipelago (Lanz, Cox, Sartine, Bereford and Triangle Islands) and surrounding marine area. Sea Otters are known to occupy this area (see Figure 1). While the proposed National Wildlife Area is primarily intended to support the protection and conservation of seabird populations nesting on the Scott Islands, this designation may nonetheless provide further management and protection for Sea Otter habitat.

## 6.2. Broad Strategies

The following three broad strategies support the management objectives outlined in Section 5. Many of the conservation measures that fall under these broad strategies are currently underway (see Section 6.1 'Actions Already Completed or Currently Underway'). Broad strategies and subsequent conservation measures are summarized and prioritized in Table 3.

### 6.2.1. Management

Effective management and protection will be key to the continued success of Sea Otter repopulation and range growth in British Columbia. Conservation measures under the broad strategy of management are provided in Table 3. These conservation measures should include but are not limited to the following:

- Support the Pacific Marine Mammal Response Program to monitor Sea Otter health and causes of mortality.
- Support the enforcement of the *Fisheries Act*, Marine Mammal Regulations, Aboriginal Communal Fishing Licenses Regulations, *Oceans Act*, *Canada National Parks Act*, *National Marine Conservation Areas Act*, and British Columbia provincial *Wildlife Act*.
- Develop Sea Otter-specific measures for inclusion into catastrophic spill response programs, such as the Oiled Wildlife Regulatory Agency Working Group.
- Support oversight and monitoring of any future First Nation harvest of Sea Otters.
- Support the development of Sea Otter viewing guidelines.
- Examine and support mitigation options, such as spatial/temporal closures, in areas where fisheries interactions are known to occur.

### 6.2.2. Research and Monitoring

To protect Sea Otters from threats to their conservation, research is needed to identify and clarify the significance of threats and factors that may limit Sea Otter population growth and range expansion. These include threats not only to Sea Otters but also to their habitat. Collaboration with First Nations, academia, environmental non-government

organizations (ENGOS), and other government agencies on Sea Otter research initiatives is beneficial to the species. Research activities may include:

- Undertake annual surveys of the Sea Otter population in index areas, areas of range expansion, and other portions of their range as needed, as well as a total population survey every five years to monitor population trends and distribution.
- Support development and use of alternative population survey methods to better quantify uncertainty in population estimates.
- Assess the vulnerability of the Sea Otter population to oil spills by modeling spatial and temporal risk.
- Improve estimation of all sources and magnitude of human-induced mortality.
- Monitor and assess Sea Otter health through indicators such as body condition, disease exposure and contaminant burdens.
- Assess the potential impacts of fisheries including competition for prey resources, bycatch and entanglement in fishing gear, and illegal mortality.
- Assess the potential impacts of human disturbance such as wildlife viewing and other boating activities.
- Improve our understanding of the degree of interchange with adjacent populations to assess potential for rescue effect.

### **6.2.3. Outreach and communication**

Communication to the public and others is important to promote understanding and support and for the need to protect Sea Otters. Sea Otters were absent from Canada's fauna for almost a hundred years. With their return, there is a need to raise the level of understanding of the role of Sea Otters in structuring nearshore ecosystems and the threats to Sea Otters and their habitat. This approach should include but is not limited to the following:

- Establish and maintain communication with First Nations, stakeholders, coastal communities, and the public about Sea Otter conservation and research; promote community involvement in stewardship and research.
- Promote Sea Otter viewing guidelines for commercial and recreational wildlife viewing.

## **6.3. Conservation Measures**

Fisheries and Oceans Canada and the Parks Canada Agency encourage other agencies and organizations to participate in the conservation of the Sea Otter through the implementation of this Management Plan. Table 3 summarizes those conservation measures that are recommended to support the management goals and objectives. The activities implemented by responsible jurisdictions will be subject to the availability of funding and other required resources. Where appropriate, partnerships with specific organizations and sectors will provide the necessary expertise and capacity to carry out the listed action. However, this identification is intended to be advice to other agencies,

and carrying out these actions will be subject to each agency's priorities and budgetary constraints.

Conservation measures have been recommended where implementation is deemed to be practical and feasible, and most likely to result in successful protection of the population in Canada. The conservation measures listed in Table 3 are prioritized on a high, medium, or low scale relating to the direct contribution each measure would have on the conservation of the Sea Otter in Canada. The assigned prioritization of each measure may change with time as new information emerges. Unless otherwise stated, these measures are specific to the Sea Otter population in Canada.

**Table 3.** Conservation Measures and Implementation Schedule

Conservation Measure	Priority <sup>5</sup>	Threats or Concerns Addressed	Timeline
<b>Broad Strategy: Management</b>			
Support the Pacific Marine Mammal Response Program to monitor Sea Otter health and causes of mortality.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Illegal kill</li> <li>• Environmental contaminants – persistent bioaccumulating toxins</li> <li>• Disease and parasites</li> <li>• Entanglement in fishing gear</li> <li>• Vessel strikes</li> <li>• Human disturbance</li> </ul>	Ongoing
Support the enforcement of the <i>Fisheries Act</i> , Marine Mammal Regulations, Aboriginal Communal Fishing Licenses Regulations, <i>Oceans Act</i> , <i>Canada National Parks Act</i> , <i>National Marine Conservation Areas Act</i> , and British Columbia provincial <i>Wildlife Act</i> .	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Illegal kill</li> <li>• Environmental contaminants – persistent bioaccumulating toxins</li> <li>• Entanglement in fishing gear</li> <li>• Vessel strikes</li> <li>• Human disturbance</li> <li>• Directed harvest</li> </ul>	Ongoing
Develop Sea Otter-specific measures for inclusion into catastrophic spill response programs, such as the Oiled Wildlife Regulatory Agency Working Group.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Environmental contaminants – persistent bioaccumulating toxins</li> </ul>	2018
Support oversight and monitoring of any future First	H	<ul style="list-style-type: none"> <li>• Illegal kill</li> <li>• Directed harvest</li> </ul>	TBD

<sup>5</sup> Priority reflects the degree to which the action contributes directly to the conservation of the species or is an essential precursor to an action that contributes to the conservation of the species.

Nation harvest of Sea Otters.			
Support the development of Sea Otter viewing guidelines.	M	<ul style="list-style-type: none"> <li>• Vessel strikes</li> <li>• Human disturbance</li> </ul>	2018
Examine and support mitigation options, such as spatial/temporal closures, in areas where fisheries interactions are known to occur.	L	<ul style="list-style-type: none"> <li>• Illegal kill</li> <li>• Entanglement in fishing gear</li> <li>• Human disturbance</li> </ul>	Ongoing (*as required)
<b>Broad Strategy: Research and Monitoring</b>			
Undertake annual surveys of the Sea Otter population in index areas, areas of range expansion, and other portions of their range as needed, as well as a total population survey every five years, to monitor population trends and distribution.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Illegal kill</li> <li>• Environmental contaminants – persistent bioaccumulating toxins</li> <li>• Disease and parasites</li> <li>• Entanglement in fishing gear</li> <li>• Vessel strikes</li> <li>• Human disturbance</li> <li>• Directed harvest</li> </ul>	Ongoing
Support development and use of alternative population survey methods to better quantify uncertainty in population estimates.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Illegal kill</li> <li>• Entanglement in fishing gear</li> <li>• Vessel strikes</li> <li>• Directed harvest</li> </ul>	2018
Assess the vulnerability of the Sea Otter population to oil spills by modeling spatial and temporal risk.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> </ul>	2018
Improve estimation of all sources and magnitude of human-induced mortality.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Illegal kill</li> <li>• Entanglement in fishing gear</li> <li>• Vessel strikes</li> <li>• Directed harvest</li> </ul>	2018
Monitor and assess Sea Otter health through indicators such as body condition, disease exposure and contaminant burdens.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Environmental contaminants – persistent bioaccumulating toxins</li> <li>• Disease and parasites</li> </ul>	Ongoing
Assess the potential impacts of fisheries including competition for prey resources, bycatch and entanglement in fishing gear, and illegal mortality.	M	<ul style="list-style-type: none"> <li>• Illegal kill</li> <li>• Entanglement in fishing gear</li> <li>• Vessel strikes</li> </ul>	TBD



Assess the potential impacts of human disturbance such as wildlife viewing and other boating activities.	M	<ul style="list-style-type: none"> <li>• Vessel strikes</li> <li>• Human disturbance</li> </ul>	TBD
Improve our understanding of the degree of interchange with adjacent populations to assess potential for rescue effect.	L	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Disease and parasites</li> </ul>	TBD
<b>Broad Strategy: Communication and Outreach</b>			
Establish and maintain communication with First Nations, stakeholders, coastal communities, and the public about Sea Otter conservation and research; promote community involvement in stewardship and research.	H	<ul style="list-style-type: none"> <li>• Environmental contaminants – oil spill</li> <li>• Illegal kill</li> <li>• Environmental contaminants – persistent bioaccumulating toxins</li> <li>• Disease and parasites</li> <li>• Entanglement in fishing gear</li> <li>• Vessel strikes</li> <li>• Human disturbance</li> <li>• Directed harvest</li> </ul>	Ongoing
Promote Sea Otter viewing guidelines for commercial and recreational wildlife viewing.	M	<ul style="list-style-type: none"> <li>• Vessel strikes</li> <li>• Human disturbance</li> </ul>	2018

## 7. Measuring Progress

The performance indicators presented in the management objective provide a way to define and measure progress toward achieving the broad strategies and conservation measures.

Reporting on *implementation* of the Management Plan, under s. 72 of SARA, will be done by assessing progress towards implementing the broad strategies and conservation measures.

The implementation of this Management Plan will be monitored within five years after the plan has been posted to the SARA Registry. The objective-based performance measures that will be used to monitor progress are:

- Did the geographic range of Sea Otters continue to expand naturally beyond the 2008 continuous range?
- Did the number of Sea Otters increase (compared to the 2008 estimate) to correspond to the range expansion?
- Were threats better identified or clarified? Were threats to Sea Otters and their habitat mitigated to provide for continued conservation?

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## Appendix A: Threat Attributes Terminology

**Table 4. Details on terms used for assessment of threats to the Sea Otter. Terms were obtained from Environment Canada’s “Guidelines for Identifying and Mitigating Threats to Species at Risk” (Environment Canada, 2008).**

<b>Attribute</b>	<b>Level of Effect</b>	<b>Description</b>
<b>Extent</b>	Widespread	Across the species range.
	Localized	
	Unknown	
<b>Occurrence</b>	Historical	Contributed to decline but no longer affecting the species.
	Current	Affecting the species now.
	Imminent	Is expected to affect the species very soon.
	Anticipated	May affect the species in the future.
<b>Frequency</b>	Unknown	Due to migration or particular seasons. Ongoing. Reoccurs from time to time, but not on annual/seasonal basis.
	One-time	
	Seasonal	
	Continuous	
	Recurrent	
<b>Severity</b>	Unknown	Very large population-level effect.
	High	
	Medium	
	Low	
<b>Causal Certainty</b>	Unknown	Evidence causally links the threat to stresses on population viability. Correlation between the threat and population viability, expert opinion, etc. Assumed or plausible threat only.
	High	
	Medium	
<b>Level of Concern</b>	Low	Overall level of concern for recovery of the species, taking into account all of the above factors.
	Medium	
	High	

## **Appendix B: Effects on the environment and other species**

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Management planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the plan itself, but are also summarized below.

This Management Plan will clearly benefit the environment by promoting the conservation of the Sea Otter. The potential for the plan to inadvertently lead to adverse effects on other species was considered. Section 3.3.2 (Ecological Role) discusses changes to the ecosystem that result in the presence of sea otters, which impacts shellfish abundance. This impact has been raised as a concern by First Nations as well as commercial shellfish harvesters. The SEA concluded that, while changes to the nearshore ecosystem will result from the restoration of the Sea Otter to its ecological role, the strategy itself recommends research, population assessment, protection and communication which will benefit the environment and not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: Habitat and biological needs; Ecological role; Limiting factors; and Conservation Measures.

## Appendix C: Record of Cooperation and Consultation

The Sea Otter (*Enhydra lutris*) is a marine mammal that was listed as a species of “special concern” under the *Species at Risk Act* (SARA) in March 2009. The Sea Otter was downlisted from “Threatened” status to “Special Concern” under SARA following the 2007 assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as *Special Concern* due to the increased population growth and range expansion. The Minister of Fisheries and Oceans (DFO) and the Minister of Environment, responsible for the Parks Canada Agency, are the competent ministers for the Sea Otter in Canadian waters. The Sea Otter resides within the West Coast of Vancouver Island and the central coast of British Columbia, and has been seen within waters administered by the Parks Canada Agency. DFO established a small internal working group of technical experts to develop the initial draft of this Management Plan. See Acknowledgements section of this document for a list of Technical Team members.

Letters were sent out to all coastal First Nations, in which traditional territories overlap with Sea Otter range, soliciting participation in the development of this Management Plan. The draft Management Plan was sent to Parks Canada Agency, Environment Canada, and the Province of British Columbia for review and comment.

This draft Management Plan was posted to the DFO Pacific Region Consultation website (<http://www.pac.dfo-mpo.gc.ca/saraconsultations>) for a public comment period from **September 26 – October 29, 2012**. This consultation period was primarily web-based, and included mail-outs of hard copy letters, emails, and faxes to all coastal First Nations soliciting input and feedback on the draft Management Plan as well as an offer for bilateral meetings. Comments were received from the Nuu-chah-nulth Tribal Council. Upon request, a bilateral was held with the Gwa’Sala-Nakwaxda’xw Nation. An initial draft of the management plan, along with a discussion guide and feedback form, was made available on the website noted above. Notification of this consultation period was also sent by electronic mail to a distribution list of stakeholders and environmental non-government organizations (ENGOS), to former Sea Otter recovery team participants, as well as other government agencies. Four feedback forms were received, including comments from academic, ENGO, and industry representatives. Where appropriate, all feedback received during this consultation period has been incorporated into the final management plan.