

7. Critical habitat

7.1 Identification of the species' critical habitat

7.1.1 General description of the species' critical habitat

Critical habitat is defined in SARA section 2(1) as "...the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in a recovery strategy or in an action plan for the species."

SARA defines habitat for aquatic species at risk as "... spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced" [s. 2(1)].

Partial critical habitat was identified for both Northern and Southern Resident Killer Whales in the 2008 recovery strategy. Northern Resident Killer Whale critical habitat included the waters of Johnstone Strait and southeastern Queen Charlotte Strait (Figure 4), while Southern Resident Killer Whale critical habitat included the transboundary waters in southern BC, including the southern Strait of Georgia, Haro Strait, and Juan de Fuca Strait (Figure 5). These critical habitat areas were protected through the making of a SARA Critical Habitat Order in 2009. In 2011, minor amendments were made to the critical habitat section of the 2008 recovery strategy. These amendments clarified that attributes of critical habitat identified in the 2008 recovery strategy are a part of critical habitat.

Two additional areas were identified for consideration as critical habitat for Resident Killer Whales in DFO (2017b). These areas include: i) waters on the continental shelf off southwestern Vancouver Island, including Swiftsure and La Pérouse Banks (Northern and Southern Resident Killer Whale critical habitat, Figures 4 and 5) and ii) the waters of western Dixon Entrance along the north coast of Graham Island from Langara Island to Rose Spit (Northern Resident Killer Whale critical habitat, Figure 4).

For Northern and Southern Resident Killer Whales, critical habitat is identified in this recovery strategy to the extent possible, using the best available information. A description of the functions, features, and attributes that support the identification of critical habitat is provided in section 7.1.3.

Under SARA, critical habitat must be legally protected within 180 days of being identified in a recovery strategy or action plan through a SARA Critical Habitat Order or under any other Act of Parliament, and through prohibitions to the destruction of any part of critical habitat.

This recovery strategy identifies critical habitat for Resident Killer Whales as four distinct geographic areas. These include: 1) the waters of Johnstone Strait and southeastern Queen Charlotte Strait (Northern Resident Killer Whale critical habitat); 2) transboundary waters in southern British Columbia, including the southern Strait of Georgia, Haro Strait, and Juan de Fuca Strait (Southern Resident Killer Whale critical habitat); 3) waters on the continental shelf off southwestern Vancouver Island, including Swiftsure and La Pérouse Banks (Northern and Southern Resident Killer Whale critical habitat); and 4) waters of west Dixon Entrance, along the north coast of Graham Island from Langara to Rose Spit (Northern Resident Killer Whale critical habitat).

It is unknown if the critical habitat identified in this recovery strategy is sufficient to achieve the species' recovery goal and objectives. The schedule of studies outlines the research required to identify additional critical habitat and to acquire more detail about the critical habitat identified to achieve the species' recovery goal and objectives. Additional critical habitat may be identified in future amendments to this recovery strategy.

7.1.2 Information and methods used to identify critical habitat

The movement patterns of Resident Killer Whales are influenced by the availability of their preferred prey. During the summer and fall months, Resident Killer Whale distribution is associated spatially and temporally with the migratory routes of Chinook Salmon as this important prey species returns to natal streams to spawn (Ford and Ellis 2005). For the rest of the year there is less information available on the diet, distribution, and movement patterns of Resident Killer Whales, though surveys, passive acoustic monitoring, and satellite tagging studies have been conducted to address these knowledge gaps (Riera 2012; Hanson et al. 2013; DFO 2017b). Determining whether there are additional habitats that the whales utilize during winter and spring that are critical for the survival or recovery of these populations has been and continues to be a priority. This will need to take into account the likelihood that changes in the availability of major stocks of key prey species may cause corresponding shifts in the geographic location of critical habitat for Resident Killer Whales.

Methods and rationale used to designate each of the four critical habitat areas identified to date are detailed below.

Northern Resident Killer Whale critical habitat: Johnstone Strait and southeastern Queen Charlotte Strait

Analyses of existing data on coast-wide occurrence patterns of Northern Resident Killer Whales provide quantitative documentation of the importance of Johnstone Strait and southeastern Queen Charlotte Strait (Figure 4) to these whales (Ford 2006). These analyses, along with previously published information, form the basis for this area's critical habitat designation.

One or more Northern Resident matriline are sighted in this area on most days during July through October, with peak numbers generally in mid-July to mid-September (Nichol and Shackleton 1996; Ford 2006). Sightings become more sporadic in the area during November, are scarce from December through May. Although all Northern Resident pods have been identified in the area, different pods do not use the area equally (Ford et al. 2017). For example, 75% of encounters documented during 1990-2004 included all or part of A1 pod, while only 0.7% of encounters during this same period included I18 pod, a group of similar size. Northern

Resident Killer Whales in the Johnstone Strait area spend the majority of time foraging for salmon, primarily Chinook during July-September and Chum in October (Ford 1989; Ford et al. 1998; Ford 2006; Ford et al. 2010; DFO 2017b). Other activities undertaken in the area include resting, socializing, and beach rubbing (Ford 1989; Ford et al. 2000; Ford 2006).

Beach rubbing appears to be an important activity for Northern Resident Killer Whales. More than 90% of the Northern Resident Killer Whales observed in Johnstone Strait visit the rubbing beaches, and spend about 10% of their time there (Briggs 1991). During this time they are very sensitive to disturbance. In recognition of the importance of this habitat to Resident Killer Whales, in 1982 the Province of British Columbia established the Robson Bight–Michael Bigg Ecological Reserve to protect a portion of western Johnstone Strait and the foreshore near Robson Bight, where the rubbing beaches are located. This Ecological Reserve includes the primary foraging areas for Killer Whales utilizing the Johnstone Strait area, as well as at least six beaches used to various degrees by these whales for rubbing, and is included as critical habitat within the Johnstone and southeastern Queen Charlotte Straits boundaries (see Table 4).

Given the importance of this area to a significant component of the Northern Resident community for a major portion of the salmon feeding season, and the traditional use of rubbing beaches located there, this area has been designated as critical habitat as defined in SARA.

Southern Resident Killer Whale critical habitat: transboundary waters of the southern Strait of Georgia, Haro Strait, and Juan de Fuca Strait

The transboundary waters of southern BC and Washington State (Figure 5) represent an important area of high concentration of Southern Resident Killer Whales. This area includes waters under both Canadian and U.S. jurisdiction. Analyses of existing data on coast-wide occurrence patterns of Southern Resident Killer Whales have been completed by NOAA as part of the ESA designation of critical habitat in collaboration with DFO (NMFS 2006a). This assessment provided quantitative documentation of the importance of these transboundary areas to these whales and forms, along with previously published information, the basis for the critical habitat identification.

This critical habitat area is utilized regularly by all three Southern Resident pods during June through October in most years (Osborne 1999; Wiles 2004). J pod appears to be present in the area throughout much of the remainder of the year, but two Southern Resident pods, K and L, are typically absent during December through April. This critical habitat is of great importance to the entire Southern Resident community as a foraging range during the period of salmon migration, and thus has been designated as critical habitat under SARA.

Northern and Southern Resident Killer Whale critical habitat: southwestern Vancouver Island; and Northern Resident Killer Whale critical habitat: western Dixon Entrance

Southwestern Vancouver Island and western Dixon Entrance were identified as habitats of special importance to Northern and Southern Resident Killer Whales based on photo-identification, predation, and acoustic data. Passive acoustic monitoring was used to supplement the boat-based photo-identification studies, as these areas are remote and exposed to open ocean conditions, making small boat studies difficult. Using both photo-identification and detections of Resident Killer Whale vocalizations on acoustic recording devices allowed for year-round assessment of Resident Killer Whale occurrence in these areas. Tissue samples and scales were collected at predation sites to identify prey and assess Resident Killer Whale

diet. See DFO (2017b) for detailed information about the methods used to identify these two areas as Resident Killer Whale critical habitat.

Critical habitat off southwestern Vancouver Island (Figures 4 and 5) includes the Canadian portions of Swiftsure Bank, where acoustic monitoring between August 2009 and July 2011 indicated considerable habitat use by both Southern and Northern Resident Killer Whales over much of the year. Additionally, it encompasses several other relatively shallow banks, including La Pérouse Bank which, like Swiftsure Bank, is among the most productive fishing areas for Chinook Salmon on the west coast of North America. During this acoustic monitoring, all three Southern Resident Killer Whale pods were detected in this area, with L pod being the most frequently documented (Ford et al. 2017). The area is important for Southern Resident Killer Whales, both during summer, when groups of whales spend time west of the critical habitat area in the transboundary waters in southern BC, and in winter, when whales are mostly absent from the southern BC critical habitat area, but were detected frequently off southwestern Vancouver Island (DFO 2017b). Northern Resident Killer Whales were detected in all months of the year, especially in March and April. Fifteen of the 16 pods in the Northern Resident Killer Whale population were also encountered during boat surveys in this area. Given the importance of southwestern Vancouver Island to both Northern and Southern Resident Killer Whales throughout most of the year, it meets the definition for critical habitat under SARA for both of these populations.

Critical habitat in western Dixon Entrance (Figure 4) is an important foraging area for Northern Resident Killer Whales, and is situated on migratory routes for a wide variety of Chinook Salmon stocks. Northern Resident Killer Whales were detected during acoustic monitoring activities between September 2009 and June 2012 in this area in all months of the year, but most frequently during late winter and spring (DFO 2017b). Certain pods that are rarely encountered in Northern Resident Killer Whale critical habitat in Johnstone and eastern Queen Charlotte Straits at any time of year were frequently detected in western Dixon Entrance (DFO 2017b). As habitat needed for recovery, western Dixon Entrance appears to be far more relevant for these pods than the Johnstone /Queen Charlotte Straits critical habitat area. Pods belonging to G clan were documented in western Dixon Entrance most often, followed by R01 pod (R clan). The use of western Dixon Entrance by members of the population that are rarely documented in the Johnstone Strait area and during times of year when detections of this population in the Johnstone Strait area are infrequent indicates its importance to Northern Resident Killer Whales. This area thus meets the definition for critical habitat under SARA.

7.1.3 Identification of critical habitat

Geographic information

Four critical habitat areas have been identified for Resident Killer Whales. Critical habitat has been identified using the bounding box approach. This means that critical habitat is not composed of the entire area within the identified boundaries but only those areas within the identified geographical boundaries where the described biophysical features, attributes, and the functions they support occur, as described in Table 4 and defined by the coordinates in Appendix D. The critical habitat's biophysical functions, features, and attributes are described below and summarized in Table 4.

Northern Resident Killer Whale critical habitat: Johnstone Strait and southeastern Queen Charlotte Strait

The boundaries of the existing critical habitat area for Northern Resident Killer Whales include the waters of Johnstone Strait and southeastern Queen Charlotte Strait, and the channels connecting these straits as depicted in Figure 4. This area is approximately 905 km².

Southern Resident Killer Whale critical habitat: Transboundary waters of the southern Strait of Georgia, Haro Strait, and Juan de Fuca Strait

Critical habitat for Southern Resident Killer Whales includes the transboundary areas of southern BC and Washington State. The portion of this critical habitat that is in Canadian waters is approximately 3,390 km² in size, and includes the Canadian side of Haro and Juan de Fuca Straits, as well as Boundary Pass and adjoining areas in the Strait of Georgia, as depicted in Figure 5.

Much of the area that qualifies as critical habitat for Southern Resident Killer Whales falls within U.S. jurisdiction, and the identification of critical habitat under SARA only applies to the portion of the area that is within Canadian waters (Figure 5). In November 2005, the U.S. listed Southern Resident Killer Whales as Endangered under the ESA (NMFS 2006a). As a result, 6,630 km² of U.S. inland waters of Washington State and Juan de Fuca Strait were designated as critical habitat under the ESA in November 2006 (NMFS 2006b, see Figure 5).

Northern and Southern Resident Killer Whale critical habitat: Southwestern Vancouver Island

Critical habitat for Northern and Southern Resident Killer Whales located off southwestern Vancouver Island forms a contiguous westward extension of the critical habitat area for Southern Resident Killer Whales described above. The southern boundary is formed by the Exclusive Economic Zone of Canada and extends to the 200 m isobath, or depth contour. See Figures 4 and 5 for the boundaries of this critical habitat, which encompass an area of 5,025 km².

Northern Resident Killer Whale critical habitat: Western Dixon Entrance

Critical habitat for Northern Resident Killer Whales in western Dixon Entrance includes most of the coastal waters off the north side of Graham Island. The shallow waters of Naden Harbour, Massett Inlet, and McIntyre Bay are not included as critical habitat, due to limited use of these areas by Resident Killer Whales. See Figure 4 for the boundaries of this critical habitat, which encompass an area of 1,394 km².

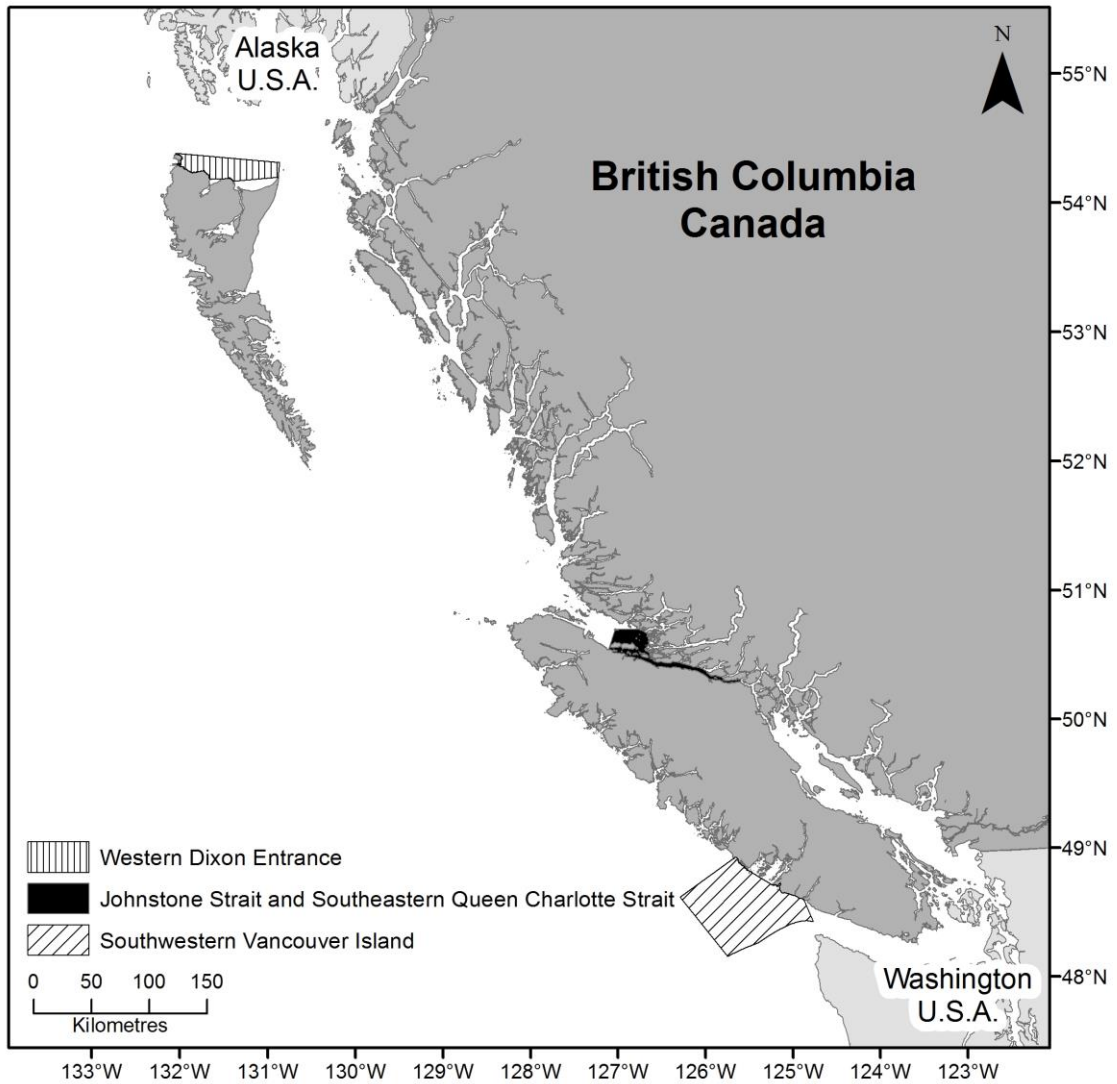


Figure 4. Critical habitat areas identified for Northern Resident Killer Whales. Critical habitat is not composed of the entire area within the identified boundaries but only those areas within the identified geographical boundaries where the described biophysical features and the functions they support occur, as described in Table 4.

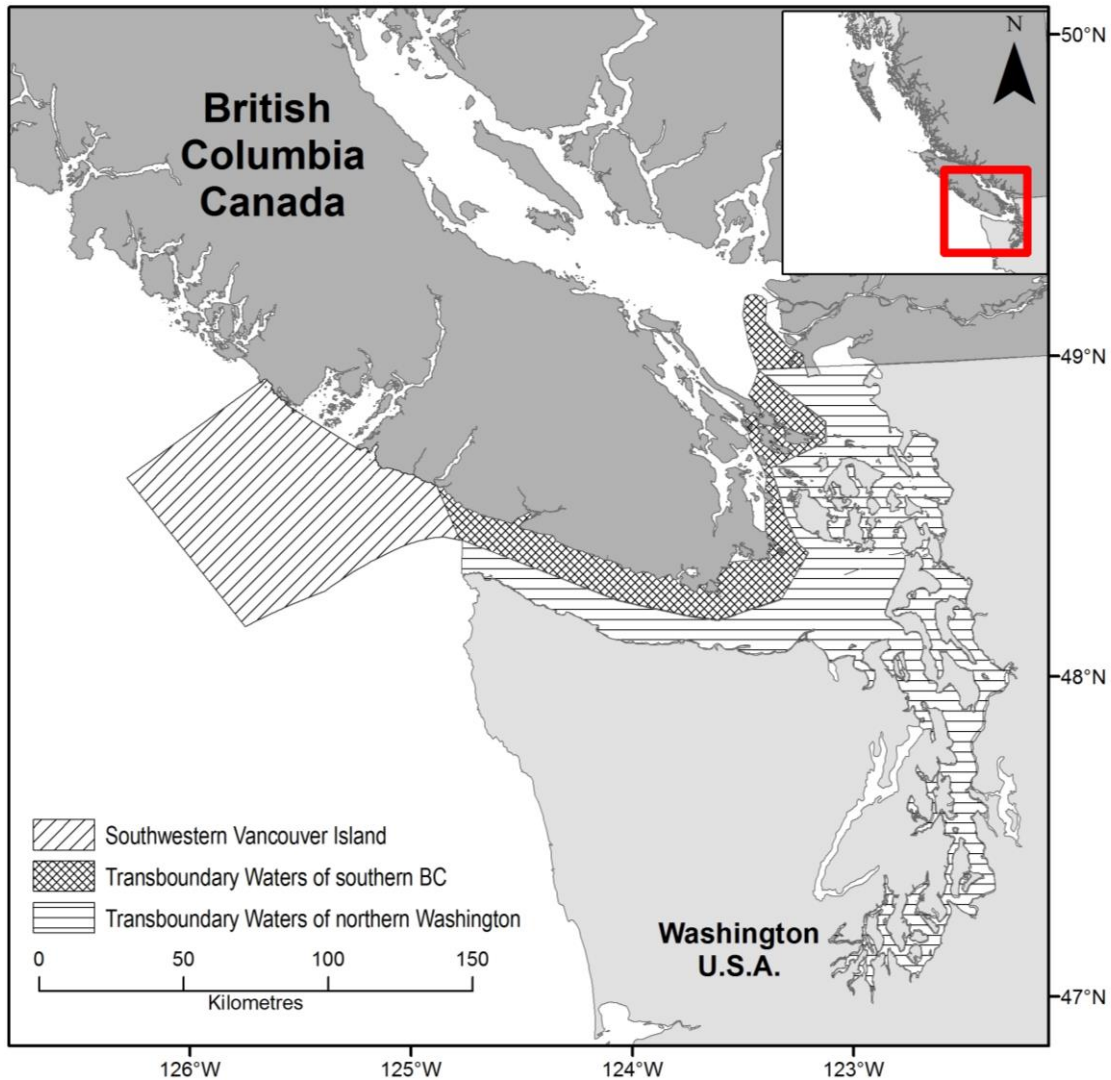


Figure 5. Critical habitat areas identified for Southern Resident Killer Whales. Critical habitat is not composed of the entire area within the identified boundaries but only those areas within the geographical boundaries where the described biophysical features and the functions they support occur, as described in Table 4. The hatched areas in the transboundary waters of southern BC and off southwestern Vancouver Island are the critical habitat areas in Canadian waters for Southern Resident Killer Whales, as designated under SARA. The hatched area in the transboundary waters of northern Washington State is designated as Southern Resident Killer Whale critical habitat under the U.S. ESA.

Biophysical functions, features, and attributes

Seasonal distribution and movement patterns of Resident Killer Whales in Canadian Pacific waters are strongly associated with the availability of their preferred prey, Chinook Salmon, and secondarily Chum Salmon (Ford 2006; Ford and Ellis 2006; Ford et al. 2010; Hanson et al. 2010). Habitats that are important for the survival or recovery of Resident Killer Whales are those that provide for profitable foraging on these key prey species, including the acoustic and

physical space required to successfully pursue and capture prey. Other activities, including resting and socializing, similarly depend on an acoustic environment that does not impede effective communication among whales.

The only activity that is strictly associated with particular geographic locations is beach rubbing by Northern Resident Killer Whales, which only takes place at specific traditional sites. Several of these sites are included in the Northern Resident Killer Whale critical habitat located in Johnstone Strait (Ford 2006). These rubbing beaches are composed of small rounded pebbles approximately 1 – 5 cm in diameter and are usually situated along otherwise rocky shorelines (Ford pers. comm. 2018).

Table 4 summarizes the best available knowledge of the biophysical functions, features, and attributes for Northern and Southern Resident Killer Whales. Note that not all attributes in Table 4 must be present in order for a feature to be identified as critical habitat. If a feature as described in Table 4 is present and capable of supporting the associated functions, the feature is considered critical habitat for the species.

The features, functions, and attributes described in Table 4 are based on narrative provided in the 2011 recovery strategy and on Table 1 of DFO (2017b). They apply to all four critical habitat areas and to both populations, with the exception of those associated with beach rubbing, a function that is known to be important for Northern Resident Killer Whales but has not been documented for Southern Residents. As Resident Killer Whales travel with their matriline throughout their lives, the features, functions, and attributes described also apply to all life stages of Resident Killer Whales.

There is currently insufficient information with which to quantify the levels of many of the attributes listed in Table 4 required to support the features and functions of critical habitat. For example, the density, quantity, and quality of prey needed to support Resident Killer Whale populations are unknown. Additionally, although it is assumed that Chinook remains the primary prey species of Resident Killer Whales throughout the year, the vast majority of Resident Killer Whale prey samples have been collected during summer and fall, and their year-round diet is not well-understood. It is therefore possible that additional important prey species may be identified in the future. Broad studies focused on identifying additional habitats that are important to Resident Killer Whales, and to better understand threats to critical habitat are included in section 7.2. In addition, the action plan for Northern and Southern Resident Killer Whales includes several recovery measures to refine knowledge of the functions, features and attributes of critical habitat. The descriptions of the attributes in Table 4 may be refined in the future, as additional information becomes available.

Table 4. Summary of the biophysical functions, features, and attributes of critical habitat necessary for the survival or recovery of Northern and Southern Resident Killer Whales

Function	Feature	Attribute
Feeding and foraging	Availability of Chinook Salmon, Chum Salmon, and other important prey species	Sufficient quantity and quality of Chinook Salmon to provide for profitable foraging Diversity of Chinook stocks with a variety of spatial and temporal migration patterns sufficient to maintain availability

		Sufficient quantity and quality of Chum Salmon and other species that comprise part of the Resident Killer Whale diet
Feeding and foraging Reproduction, socializing, resting Beach rubbing (Northern Resident Killer Whales)	Acoustic environment	Anthropogenic noise level that does not impede effective acoustic social signaling and echolocation to locate prey Anthropogenic noise level that does not result in loss of habitat availability or function
Feeding and foraging Reproduction, socializing, resting	Water quality	Water quality of a sufficient level to support Chinook stocks Water quality of a sufficient level to support Chum Salmon and other species that comprise part of the Resident Killer Whale diet Water quality of a sufficient level so as not to result in loss of function
Feeding and foraging Reproduction, socializing, resting	Physical space	Unimpeded physical space surrounding individual whales (minimum vessel approach distance 200m)
Beach rubbing (Northern Resident Killer Whales)	Rubbing beach	Suitable physical habitat to allow for beach rubbing behaviour

Summary of critical habitat relative to the recovery goal and objectives

Critical habitat areas identified in this recovery strategy are areas that, based on current best available information, the Minister of Fisheries and Oceans and the Minister responsible for the Parks Canada Agency consider necessary to partially achieve the recovery goal and objectives required for the survival or recovery of Northern and Southern Resident Killer Whales.

It is unknown if critical habitat identified in this recovery strategy is sufficient to achieve the species’ recovery goal and objectives. The schedule of studies outlines the research required to identify additional critical habitat and to acquire more detail about the critical habitat identified to achieve the species’ recovery goal and objectives. Additional critical habitat may be identified in future updates to the recovery strategy.

7.2 Schedule of studies to identify critical habitat

Further research is required to refine the understanding of the functions, features, and attributes of the currently identified critical habitat, to identify potential additional critical habitat necessary to support the species’ recovery goal and objectives and to protect the critical habitat from destruction. This additional work includes the studies listed in Table 5. Refer to the report on the progress of recovery strategy implementation for the Northern and Southern Resident Killer Whales in Canada (DFO 2016b) for more details regarding the progress made and the status of the studies outlined in Table 5. In addition to the broad studies outlined in Table 5, the Action Plan for the Northern and Southern Resident Killer Whales (*Orcinus orca*) in Canada (DFO

2017a) includes more specific recovery measures focused on refining the understanding of the features, functions, and attributes outlined in Table 4, on threats to critical habitat and on supporting identification of additional areas for critical habitat identification.

Table 5. Schedule of studies to refine critical habitat and identify potential additional critical habitat areas for Northern and Southern Resident Killer Whales

Study	Status
Year-round comprehensive surveys to identify areas of occupancy	Underway
Identify key feeding areas throughout the year to determine whether they should be proposed as additional critical habitat	Underway
Identify activities other than foraging that may be important functions of critical habitat	Underway
Identify sources of acoustic disturbance that may negatively impact or affect access to critical habitat	Underway
Identify sources of physical disturbance that may negatively impact or affect access to critical habitat	Underway
Identify sources of biological and chemical contaminants that may negatively impact critical habitat	Underway
Identify factors that may negatively affect an adequate and accessible supply of prey in areas of critical habitat	Underway

7.3 Activities likely to result in the destruction of critical habitat

Under SARA, critical habitat must be legally protected within 180 days of being identified in a recovery strategy or action plan. Northern Resident Killer Whale critical habitat in Johnstone and southeastern Queen Charlotte Straits and Southern Resident Killer Whale critical habitat in the transboundary waters of southern BC has been protected through a SARA Critical Habitat Order since 2009. It is anticipated that protection of the four Resident Killer Whale critical habitat areas identified in this recovery strategy will be accomplished through a SARA Critical Habitat Order made under subsections 58(4) and (5), which will invoke the prohibition in subsection 58(1) against the destruction of any part of the identified critical habitat. The term “recovery strategy” is defined in subsection 2(1) of SARA as meaning “a recovery strategy included in the public registry under subsection 43(2), and includes any amendment to it included in the public registry under section 45”. Thus, reading the definition of “critical habitat” in conjunction with the definition of “recovery strategy,” the Critical Habitat Order will apply not only to the critical habitat identified in the recovery strategy, but also to any modification to the critical habitat subsequently made in an amended recovery strategy, without the need to amend the Critical Habitat Order.

The following examples of activities likely to result in the destruction of critical habitat are based on known human activities that are likely to occur in and around critical habitat and would result in the destruction of critical habitat if unmitigated. The list of activities is neither exhaustive nor exclusive and has been guided by the threats described in section 4 of this recovery strategy. The absence of a specific human activity does not preclude or restrict the Department or Parks

Canada Agency's ability to regulate that activity under SARA. Furthermore, the inclusion of an activity does not result in its automatic prohibition and does not mean the activity will inevitably result in destruction of critical habitat. Every proposed activity must be assessed on a case-by-case basis and site-specific mitigation will be applied where it is reliable and available. Where information is available, thresholds and limits have been developed for critical habitat attributes to better inform management and regulatory decision making. However, in many cases knowledge of a species and its critical habitat's thresholds of tolerance to disturbance from human activities is lacking and must be acquired.

Reduced prey availability

Availability of Chinook and Chum Salmon is key to the presence of Resident Killer Whales in critical habitat areas (Ford and Ellis 2005; DFO 2017b). Maintaining an adequate food supply for Resident Killer Whales depends on many factors, including the body size and condition of prey, as well as sufficient stock diversity of key prey species to maintain prey availability over time. Activities that result in insufficient abundance, quality, or availability of Chinook Salmon, Chum Salmon, or other Resident Killer Whale prey species could therefore lead to destruction of critical habitat. These include fishing for Chinook Salmon, Chum Salmon, and other important prey species, as well as activities that impact the survival and prey supply of these species such that they are not of sufficient abundance, quality, or availability for Resident Killer Whales.

Acoustic disturbance

There is growing awareness of the impacts of anthropogenic noise on cetaceans (Nowacek et al. 2007; Weilgart 2007). As Killer Whales rely on sound to carry out their life functions, including foraging and socializing, the acoustic environment is an important component of critical habitat. Threats to the acoustical integrity of critical habitat include both acute and chronic noise, and are discussed in detail in section 4.2.3 Underwater noise. Acute noise, including seismic surveys, military and commercial sonars, pile driving and underwater explosions, can result in behavioural changes and displacement from habitat for cetaceans (Morton and Symonds 2002; Weilgart 2007). Chronic noise is primarily associated with vessel traffic, and can result in masking of communication and echolocation signals of Killer Whales (Erbe 2002; Foote et al. 2004; Holt et al. 2009).

Environmental contaminants

Environmental contaminants pose a serious threat to Killer Whales. These contaminants and their sources are discussed in section 4.2.1. As high trophic level, long-lived animals, Killer Whales are particularly vulnerable to persistent bioaccumulating toxins (PBTs) that accumulate in their fatty tissues as they feed on already contaminated prey. The introduction of high levels of contaminants is therefore a threat to Resident Killer Whale critical habitat. While many contaminants are airborne and dispersed throughout the coastal waters of BC, the waters surrounding the lower mainland and Vancouver Island are particularly at risk due to their proximity to human settlement.

The threat of a spill of oil or other toxic material within the areas of critical habitat poses not only an immediate and acute risk to the health of Resident Killer Whale populations (see section 4.2.4), but has the potential to make critical habitat areas uninhabitable for an extended period of time.

Physical disturbance

Vessels in close proximity to Killer Whales have the potential to disrupt behaviours, including foraging and beach rubbing (Williams et al. 2006; Lusseau et al. 2009). Additionally, prey must be physically accessible to Resident Killer Whales and physical obstacles at the surface and underwater which interfere with whales' abilities to pursue and capture prey represent a threat to critical habitat.

Killer Whales are particularly sensitive to disturbance while beach rubbing (Williams et al. 2006); the physical presence of vessels and other obstacles can not only disrupt beach rubbing, but can also prevent Killer Whales from approaching rubbing beaches to initiate this behaviour.

Geophysical disturbance

A key feature of the Northern Resident Killer Whale critical habitat in Johnstone and southeastern Queen Charlotte Straits is the presence of several rubbing beaches. Activities associated with the geophysical destruction of rubbing beaches are therefore threats to critical habitat. Rubbing beaches may also be vulnerable to activities that alter stream flow and siltation; thus, activities that occur upstream of these beaches, even outside of the designated critical habitat area, can pose a threat to critical habitat.

Table 6. Examples of activities likely to result in the destruction of critical habitat of Northern and Southern Resident Killer Whales

Threat	Activity	Effect - pathway	Function affected	Feature affected	Attribute affected
Reduced prey availability	<p>Fishing for Chinook Salmon, Chum Salmon, and other important prey species</p> <p>Other activities that are detrimental to habitat and survival of prey (e.g. fishing for forage fish species)</p>	<p>Loss of prey</p> <p>Loss of forage fish for prey species</p>	Feeding and foraging	Availability of Chinook Salmon, Chum Salmon and other important prey species	<p>Sufficient quantity and quality of Chinook Salmon to provide for profitable foraging</p> <p>Diversity of Chinook stocks with a variety of spatial and temporal migration patterns sufficient to maintain availability</p> <p>Sufficient quantity and quality of Chum Salmon and other species that comprise part of the Resident Killer Whale diet</p>
Acoustic disturbance	<p>Vessel traffic</p> <p>Seismic surveys, military, and commercial sonars</p> <p>Pile driving, underwater explosions</p>	<p>Chronic noise resulting in masking of communication and echolocation</p> <p>Acute and chronic acoustic disturbance resulting in disruption of behaviour or displacement from habitat</p>	<p>Feeding and foraging</p> <p>Reproduction, socializing, resting</p> <p>Beach rubbing (Northern Resident Killer Whales)</p>	Acoustic environment	<p>Anthropogenic noise level that does not impede effective acoustic social signaling and echolocation to locate prey</p> <p>Anthropogenic noise level that does not result in loss of habitat availability or function</p>
Environmental contaminants	<p>Release of deleterious substances</p> <p>Point source and non-point source pollution</p>	<p>Loss of prey or reduction in prey quality</p> <p>Loss of water quality</p>	<p>Feeding and foraging</p> <p>Reproduction, socializing, resting</p>	<p>Availability of Chinook Salmon, Chum Salmon, and other important prey species</p> <p>Water quality</p>	<p>Water quality of a sufficient level to support Chinook stocks</p> <p>Water quality of a sufficient level to support Chum Salmon and other species that comprise part of the Resident Killer Whale diet</p> <p>Water quality of a</p>

					sufficient level so as not to result in loss of function
Physical disturbance	<p>Vessel approach to whales (within 200m)</p> <p>Vessel anchoring in vicinity of rubbing beaches</p> <p>Activities that prevent approach of whales to rubbing beaches; or that displace or disrupt rubbing behaviour</p> <p>Human presence on rubbing beaches when whales present or nearby</p>	<p>Reduction of physical space available to whales</p> <p>Displacement of whales from rubbing beaches, prevention of use of rubbing beaches</p>	<p>Feeding and foraging</p> <p>Reproduction, socializing, resting</p> <p>Beach rubbing (Northern Resident Killer Whales)</p>	Physical space	Unimpeded physical space surrounding individual whales (minimum vessel approach distance 200m)
Geophysical disturbance	<p>Shore-based industrial activities that could alter beach substrate</p> <p>Activities that result in alteration of stream flow to rubbing beaches, beach sediment, and siltation</p>	Geophysical disturbance resulting in loss of function	Beach rubbing (Northern Resident Killer Whales)	Rubbing beach	Suitable physical habitat to allow for beach rubbing behaviour

