Chapter 5 Marine Mammals (Other than Western Gray Whales)

5.1 INTRODUCTION

During the review of environmental documentation for the Sakhalin II development, the stakeholders to the project outlined a number of concerns and items requiring clarification as a result of reviewing the international-style Environmental Impact Assessment (EIA) report (SEIC 2003). In brief, the focus of the questions raised by interested parties regarding non western Pacific gray whale included the following matters:

- Provision of a map showing locations referred to in the EIA-A text;
- Summary information on each of the key referenced surveys to describe the spatial extent in relation to project activities, the experiences of observers, a description of observed mammal behaviour and other relevant data that facilitates reader interpretation;
- Further information on Steller's sea lions, particularly with reference to potential winter use of waters around Aniva Bay and potential impact of project activities on this species;
- Assessment of acoustic impacts from project activities on Cuvier's beaked whale;
- Consideration of vessel collision risk, particularly with respect to the North Pacific Right Whale and bowhead whale.

Specifically, this section provides additional detail to the baseline information supplied in Section 1.7: Chapter 1 of Environmental Impact Assessment Volume 2: Platforms, Offshore Pipelines and Landfalls (SEIC 2003) - referred to throughout this section as the "EIA" - that describes the characteristics, distribution and protected status of marine mammals in the vicinity of the Sakhalin II Project operations. The additional information covers north-east Sakhalin Island and Aniva Bay and has been drawn from existing and recently published reports and monitoring data that have become available since publication of the original EIA.

Surveys providing data on the presence and distribution of marine mammals, including a number of dedicated surveys, have been undertaken for the project since 1995. Marine Mammal Observers (MMOs) have also been trained and there is an ongoing programme of observation and recording during all offshore activities.

Information from the surveys, along with supporting studies and assessments have been used to develop specific mitigation measures and operational procedures to reduce the potential impacts of the Sakhalin II development on marine mammals.

Of particular relevance is a literature review produced by LGL Limited on behalf of SEIC, detailing the distribution of marine mammals in Aniva Bay (LGL 2003).

A summary of the information provided within the LGL report, and other relevant documents and data, has been incorporated in this addendum chapter under subsection headings based on marine mammal taxonomic order and species, as previously set out in Section 1.7 of the EIA. Information regarding the protected status and populations of marine mammals in the vicinity of the Sakhalin II Project operations is presented at the beginning of each section. Table 5.3 at the end of this Chapter, provides a list of the marine mammal species present within Sakhalin Island waters and includes summary of the information presented.

Figure 5.1 shows the key geographic locations referred to in this chapter.

Figure 5.1 Key Locations and Focal Points on Sakhalin Island

5.2 BASELINE SURVEYS AND AVAILABLE DATA

Data on the presence and distribution of marine mammals (excluding western gray whales) around Sakhalin has been obtained from a number of published sources, specific surveys for marine mammals in the project area and observations obtained during other marine surveys. These data sources are listed in Table 5.1 and are accompanied by a summary of survey techniques and results.

Project specific marine mammal surveys were undertaken for the north-east coastal waters of Sakhalin covering the Piltun-Astokhskoye (PA) and Lunskoye areas during 1999 and 2000 (Sobolevsky 2000 and 2001). These surveys noted the location and numbers of cetaceans and pinnipeds throughout the survey area. Surveys in the PA area specifically undertaken since the late 1990s to determine the distribution and abundance of western gray whales, also recorded the locations and numbers of other marine mammals encountered.

Marine mammal observations have also been recorded by dedicated Marine Mammal Observers (MMOs) on a number of multidisciplinary marine surveys within the PA, Lunskoye and Aniva Bay areas.

The dedicated project survey information, combined with historic data provides an overview of cetacean and pinniped distribution around the eastern and southern coastal waters of Sakhalin. A summary of the various marine mammal surveys and relevant literature, providing details of cetacean and pinniped distribution around eastern and southern Sakhalin Island, is presented in Table 5.1. Further descriptive information on population levels and distribution are provided in the main text.

Table 5.1 Summary of Marine Mammal Surveys and Relevant Literature

Author	Title	Summary of Survey / Notes
Sobolevsky, 1984	Marine mammals of the Sea of Okhotsk, their distribution, abundance and role as predators of other animals.	No surveys were conducted. Information gained from existing literature, personal communication with other scientists and fishery data. Report includes a summary of marine mammals occurring in the Sea of Okhotsk, calculation of population levels and the amount of food that they are taking.
Sobolevsky, 2000	Marine mammal studies offshore north-east Sakhalin, 2000.	Aerial surveys with Helicopter MI-8MTV on July 8, 17, 18 and 26; August 4, 7, 30; September 21 and 22; October 8 and 9 and November 18 and 20. Additional observations from small vessels and motorboats (sometimes landing onshore to observe seal behaviour). Observations conducted by three experienced marine mammal scientists. Study area: Okha to Lunsky Bay. Information collected included: • Date and time of observation • Species (seals are noted as seals unless specific determination could be made) • Position • Number of animals and description of behaviour. Maps with sightings of gray whales, killer whales and seals are included in the report. Information on seal distribution and haul out sites at Piltun, Chaivo, Nabil and Nyisky Bays. Killer whale was the only non-WGW cetacean noted with any certainty during the survey work. This species was observed during the surveys in July (13 in total; all records were of individuals or small groups (up to six) swimming close to shore near Piltun lagoon); September

Author	Title	Summary of Survey / Notes
		(1 off Piltun lagoon), October (five swimming north of Nogliki; five including mother and calf, south of Piltun lagoon). Unidentified dolphins were sighted on two occasions in September (three in total, all offshore of Chaivo lagoon).
Sobolevsky, 2001	Marine mammal studies offshore north-east Sakhalin, 2000.	Aerial surveys with Helicopter MI-8MTV on June 23 and 24; July 19, 20 and 24; August 25, 26 and 30; September 6, 7 and 22; October 11, 13 and 14; November 19 and 20. Study area: Okha to Lunsky Bay. Notations include: • Date and time of observation • Species (seals are noted as seals unless certain determination could be made) • Position • Number of animals and description of behaviour. Maps with sightings of gray whales and seals are included in the report. Information on seal distribution and haul out sites at Piltun, Chaivo, Nabil and Nyisky Bays. Killer whale and beluga whale were the only non-WGW cetaceans noted during the survey work. Killer whale was observed during the surveys in July (group of 25-30 observed 10km off Piltun lagoon; group of six surrounding a gray whale, just south of Piltun lagoon). A group of five beluga were seen off north-west Sakhalin in November.
DVNIGMI, 1999	Environmental monitoring report - Piltun-Astokhskoye Field Area	Ship-based observations undertaken 19-27 June and 8-18 October 1998 pre- and post- drilling and installation of the Molikpaq platform. Dedicated marine mammal observations were carried out during daylight hours for the full survey period. Observations made from bridge of vessel using 7x50 field binoculars. Data recorded included: species, numbers, time, coordinates, weather conditions and

Author	Title	Summary of Survey / Notes
		behaviour. Russian and international identification guides were used. June survey log records sightings of sea lions (on three occasions, with two sightings of two individuals) and one sighting of a killer whale. During the October monitoring period, ringed seal was observed (singleton on several occasions) and minke whale (3 records of singletons).
Sakhydromet, 2000	Environmental monitoring report - Piltun-Astokhskoye Field Area	Ship-based observations undertaken 3-10 October 1999. Dedicated marine mammal observations were carried out during daylight hours for the full survey period. Observations made from bridge of vessel using 8x30 field binoculars. Data recorded included: species, numbers, time, coordinates, weather conditions and behaviour. Russian and international identification guides were used. Two species of mammal were recorded close to the Molikpaq platform – two sightings of Steller's sea lion (1 individual in each case) and two groups (comprising 3 individuals) of Dall's porpoise.
SakhNIRO, 1999	Baseline studies of the Piltun-Astokhskoye and Lunskoye Oil and Gas Fields, Subsea Pipeline Routes and Aniva Bay (final)	Ship-based surveys for a range of parameters conducted 1-17 September, 1998 (3-4 Sep. - Lunskoye pipeline area; 5-9 Sep. observations in the Piltun-Astokhskoye area; 2 and 12 Sep. – Terpeniya Bay (*en route*); 10-11 Sep. – observations in Lunskoye licence area and 13-16 Sep. – Aniva Bay). Dedicated marine mammal observations were carried out during daylight hours from about 06.30 – 20.00 for the full survey period. 8x30 field binoculars were used. Small boats were used for surveys in Piltun and Lunsky bays. Shore landings were undertaken, as necessary, to count seals and birds. Data recorded included: time, coordinates, weather conditions, species and number. No specific comments on behaviour provided. Russian and international identification guides were used. Eight species of cetaceans were noted including, minke whale, fin whale (three on 12 Sep. in Eastern part of Terpeniya Bay), killer whale, pacific white-sided dolphin, short-beaked (common) dolphin, bottlenose dolphin, Dall's porpoise and harbour porpoise. Five species of pinniped observed – largha seal, bearded seal, ringed seal, Steller's sea lion and northern fur seal.
DVNIGMI, 2001a	Environmental monitoring report - Piltun-Astokhskoye Field Area	Ship-based and drilling-rig observations undertaken 9-10 July, 8-20 August (during drilling operations) and 5-13 October 2000. Dedicated marine mammal observations were carried out during daylight hours for the full survey period. Observations made from bridge of vessel

Author	Title	Summary of Survey / Notes
		using 8x30 field binoculars. Data recorded included: species, numbers, time, coordinates, weather conditions and behaviour. Russian and international identification guides were used. Two species of mammal were recorded during the drilling operations - two Steller's sea lions (individual records) and three largha seals. A group of three unidentified whales were observed at a distance of 5km from the drilling rig. During the October survey period, three minke whales, one gray whale, three killer whales, one Steller's sea lion and five largha seals.
DVNIGMI, 2001b	Baseline environmental observations, 2001	Surveys conducted 18 June to July 10, 2001. Continual daytime observations using 7x50 binoculars. Study areas: Piltun-Astokh field, Lunskoye field, pipeline routes, Kholmsk port, Kaigon port, Poronaysk port and Aniva Bay. A total of five species of cetaceans were observed including: minke whale, killer whale, sei whale (3 records of individuals at the following locations, Lunskoye field, Poronaysk port and Aniva Bay), dolphins (Delphinidae sp.) and harbour porpoise. Four species of pinniped were observed (largha, northern fur seal, Steller's sea lion and ringed seal).
TINRO 2002	Vessel based surveys of north-east Sakhalin	Dedicated surveys from 3 September to 16 October primarily to record and observe western gray whales. Transects in Piltun Bay and offshore Chaivo Bay were used and observations also made during all vessel movements for other activities (*e.g.* benthic prey sampling). All marine mammals during the surveys recorded by MMOs aboard the vessel. Continual daylight observations from upper bridge using binoculars. Information on date, time, sighting, weather, species, vessel position and heading, distance to vessel and general behaviour were made. Five species of cetacean (western gray whale, minke whale, killer whale, harbour porpoise and Dall's porpoise) and five species of pinniped (northern fur seal, Steller's sea lion, ringed seal, spotted seal and bearded seal) were observed during the survey work. Harbour porpoises were the most numerous species encountered (most observed in Aniva Bay en route to Piltun) followed by killer whale and minke whale. Sightings of fur seal were largely confined to the rookery around Terpeniya Point, with the remainder of the other pinnipeds being present in the Piltun area.

Author	Title	Summary of Survey / Notes
TINRO 2003	Vessel based surveys of north-east Sakhalin	Dedicated surveys 22 July 22 to 23 Sep. primarily to record and observe western gray whales. Predefined transects in Piltun Bay and offshore Chaivo Bay were used and observations made during all vessel movements for other activities (*e.g.* acoustic monitoring). All marine mammals during the surveys recorded by MMOs aboard the vessel. Continual daylight observations from upper bridge using binoculars. Information on date, time, sighting, weather, species, vessel position and heading, distance to vessel and general behaviour were made. Seven species of cetacean (western gray whale, minke whale, killer whale, beluga, harbour porpoise, Pacific white-sided dolphin and Dall's porpoise) and five species of pinniped (northern fur seal, Steller's sea lion, ringed seal, largha seal and bearded seal) were observed during the survey work. Harbour porpoises were the most numerous species encountered in the Piltun-Chaivo area, followed by killer whale and minke whale. The sighting en route to Piltun of a school of 49 Pacific white-sided dolphins (24 July) in La Perouse Strait in Aniva Bay was notable.
Perlov A.S., Vladimirov V, Reviakina Z.V., 1996	Review of literature/information regarding marine mammals in the vicinity of Sakhalin Island, Okhotsk Sea	Literature review of historical data. Method for pinnipeds: Mainly aerial surveys for counting seals on ice, altitude 100-200m weather dependent, survey transects 200m wide, two observers. Timing of surveys during pupping and moulting period. If weather allowed surveys were made by boat travelling parallel to the coast. Detailed counts of seals near the coast and on rookeries were made by putting an observer on land with a spotting scope. Method for cetaceans: Aerial surveys. Prior to 1979-fixed wing, after 1979 helicopters were used with speed 100-150km/h, altitude 100-200m. For detailed observations (*e.g.* behaviour) speed was reduced to 60-70km/h and helicopter hovered for extended periods above whales. Additionally vessel surveys were made when visibility was > 8km. Width of survey line was eight miles and the speed 20 km/h. Once whales were detected, ship slowly approached them for identification and counting. Additional data on marine mammal sightings was collected from local fisherman, lighthouse keepers, pilots, residents of coastal settlements and sailors. Sightings of Baird's beaked

Author	Title	Summary of Survey / Notes
		whales were made in 1993.
Kasuya T & Miyashita, 1997	Distribution of Baird's Beaked whales off Japan. (IWC report comm. 47)	Whale sighting cruises conducted during 1982-1994 covering 11 months of the year. Surveys were conducted along predetermined tracklines. Species identification by researchers or captain of the vessel. Most vessels were whale hunting boats or whale sighting cruises. This study confirms the distribution of Baird's beaked whale in late spring/early summer in the northern latitudes (which could extend to southern Sakhalin). Article contains some maps with sightings of this species south and south east of Sakhalin coast in August and September).
Loughlin, Perlov, Vladimirov, 1992	Extensive survey of range of Steller's sea lion and estimation of total population in 1989	Steller's sea lions were counted on rookeries and haul out sites throughout their distribution range during the breeding period in June and July. Methods used, dependent on rookery accessibility, included aerial surveys, vessels or observations from land. Publication shows a map of Steller sea lion rookeries and haul outs in Okhotsk Sea (Sakhalin: Robben island and Opastnostly Rock; Kuriles: 14 rookeries and haul outs; Kamchatka: one rookery).

5.3 PINNIPEDS

Pinnipeds comprise seals, sea lions and walruses. Six species of pinniped inhabit the Sea of Okhotsk. Four of these species, ringed seals (*Phoca hispida*), largha seals (*Phoca largha*), ribbon seals (*Histriphoca fasciata*) and bearded seals (*Erignathus barbatus*) are "true" or "ice" seals. These species establish ice haul outs during the winter months and breed, nurse young and moult between March and May. When the sea ice retreats, ringed, largha and bearded seals may establish coastal haul outs, whilst some ribbon seals move out into the open ocean. These four species are all relatively abundant in the Sea of Okhotsk and are regularly hunted.

The northern fur seal (*Callorhinus ursinus*) and Steller's sea lion (*Eumetopias jubatus*) are the other two pinniped species that inhabit the Sea of Okhotsk. These eared seals do not establish coastal haul outs, coming ashore only for short periods. The Steller's sea lion is usually observed in the open sea during the summer months. In contrast, northern fur seals migrate through the coastal waters of Sakhalin Island during the spring (between May and June) and autumn (October, November and December) migrations between Tyulenii Island to the south of Sakhalin Island, and wintering places in the Sea of Japan.

Figures 1.19 and 1.20 in Chapter 1, Volume 5 of the EIA can be referred to for additional details regarding the seasonal distribution of pinnipeds in Sakhalin Island waters.

5.3.1 Ringed Seals

Ringed seals are classified on the IUCN Red List as "Least Concern" in 1996 (see IUCN 2001 for definition of categories used throughout this Chapter) [1]. Ringed seal is not listed in the Red Book of the Russian Federation (2001). The species is abundant within the Sea of Okhotsk and is found along the entire eastern coast of Sakhalin Island (Fedoseev 2000). From aerial surveys undertaken between 1968 and 1990, it was estimated that the average population within the Sea of Okhotsk was approximately 750,000 individuals, with the waters of eastern Sakhalin Island supporting a multi-year average of approximately 130,000.

Whilst abundant along the eastern coast, ringed seals are not generally observed in the coastal waters of the south of the Island and Aniva Bay, with only occasional sightings of solitary or small groups of seals being observed during surveys conducted in Terpeniya Bay and Aniva Bay in recent years (LGL 2003).

To the north, the species has been observed regularly within Nyisky, Lunsky, Chaivo and Piltun Bays, predominantly at the mouths of estuaries, rivers,

1 Some species included in the 2002 IUCN *Red List of Threatened Species* were not reassessed by the organisation. In these cases they are referenced with the date of the last assessment *e.g.,* the status of ringed seals was assessed by the IUCN as being of *Least Concern* in 1996.

straits and channels connecting the north-eastern Sakhalin's lagoon habitats with the sea. Aggregations of between 20 and 70 individuals are often recorded.

The species main food source consists of euphausiid shrimps, walleye Pollock fry, Pacific herring, Asian smelt and sand lance. Shrimp and crabs represent a lesser constituent (Nikolaev and Skalkin (1975) in LGL 2003).

5.3.2 Largha Seals

Largha seals, also known as spotted seals, are classified as Least Concern on the IUCN Red List. This species is not listed in the Red Book of the Russian Federation. They are considered to be abundant within the Sea of Okhotsk and have been observed throughout the year along the north-eastern coast of Sakhalin Island. Based on ten years of aerial surveys conducted between 1968 and 1990, estimated numbers in the Sea of Okhotsk ranged from 180,000 to 240,000, with about 15 to 20% in the waters of eastern Sakhalin Island (Fedoseev 2000). Surveys have estimated that the numbers of largha seals off eastern Sakhalin Island have exceeded 40,000 (Trukhin 1999 in LGL 2003). A 'most likely average value' of 30,000 to 40,000 has been used by the Russian Federation to calculate total admissible catch for eastern Sakhalin Island (V. Vladimirov, *pers. comm*. 2004).

A breeding site between Sakhalin and Hokkaido Islands has also been established with 13,600 seals being observed in March and 6,500 in April 2002 (Mizuno *et. al*. 2002 in LGL 2003).

Largha seals are present along the entire eastern coast of Sakhalin Island but during the winter months, they are concentrated along the northern third of the Island and in Terpeniya Bay. Pupping rookeries are generally located offshore on drift ice, especially on hummocked floes.

When the ice retreats, some seals migrate from the breeding region, whilst others remain in Sakhalin coastal waters forming many haul outs along the coast. Most of these haul outs are located at the mouths of salmon spawning rivers, especially at the inlet of Chaivo Bay, Cape Popova, Tyulenii Island and Aniva Bay (LGL 2003).

SakhNIRO has conducted baseline studies focused specifically on the Piltun, Lunsky and Aniva Bay areas (SakhNIRO 1999). In Piltun Bay, over 200 largha seals were observed. The majority of seals were encountered at the mouth to the bay, in the riptides and surf over the many sandbars. Beyond the bay mouth, the number of sightings diminished significantly and about 2km from the entry to the bay there were no seals at all. SakhNIRO have noted, however, that the observed reduction in numbers beyond the bay may have been due to the presence of fishermen in the area who were fixing dog salmon nets at the time of the studies. On the shore itself, the studies recorded that the bay was isolated due to the dense covering of dwarf cedar trees, alder and bushes. Access from the water was also reported as being restricted due to the high-energy wave environment over the sandbars. These conditions present access difficulties and therefore minimise human

disturbance, which may be contributing to the relatively high numbers of seals observed in Piltun Bay.

In Lunsky Bay, SakhNIRO reported similar observations to those made for Piltun Bay. Largha seals dominated sightings, with over 150 individuals being recorded. Animals were mainly concentrated at the bay mouth, in the surf zone, over the sandbars and along the shore. Seals were generally not aggregating into groups but being encountered singly. As in Piltun Bay, the number of seals decreased with increasing distance from the bay mouth. It was noted that the animals exhibited cautious avoidance behaviour, diving 50 to 100m away from the survey boats and leaving the open water area for the sandbars as soon as the vessels entered the bay. This behaviour may be a reaction to the local hunting of the seal by hunters and fishermen (SakhNIRO 1999).

In Aniva Bay, observed seal numbers were generally low, with only five largha seals being recorded (SakhNIRO 1999).

5.3.3 Ribbon Seals

The ribbon seal is classified as Least Concern in the IUCN Red List and is not included in the Red Book of the Russian Federation (2001). Average population estimates, based upon aerial survey data, are in the region of 350,000 to 450,000 for the Sea of Okhotsk and 110,000 for the waters off eastern Sakhalin (Fedoseev 2000 in LGL 2003).

During the winter and spring, the majority of animals are concentrated offshore on hummocked flows with open water areas along the north-eastern coast between Lunsky Bay and Chaivo Bay. Rookeries may be established 200 to 240km from the ice edge. In years where there is low ice cover or early ice retreat, the seals may move to coastal waters, where they establish moulting rookeries on drifting ice. Ribbon seals are not known to establish coastal rookeries. As the ice melts, the density of animals on the remaining ice cover increases. When the ice disappears altogether, the seals convert to a completely pelagic lifestyle, and are distributed across the entire Sea of Okhotsk.

In the southern part of the Sea of Okhotsk, ribbon seals have a higher abundance than ringed seals but are less abundant than largha seals. No ribbon seals were observed during surveys conducted in Terpeniya Bay and Aniva Bay by SakhNIRO in September 1998 or by DVNIGMI in July 2001. Ribbon seals feed predominantly on pelagic fish such as walleye pollock, Pacific cod and capelin, cephalopods and crustaceans (LGL 2003).

5.3.4 Bearded Seals

Bearded seal is classified as “Least Concern” on the IUCN Red List and is not listed in the Red Book of the Russian Federation (2001). There are estimated to be between 200,000 and 250,000 bearded seals in the Sea of Okhotsk, and approximately 60,000 to 75,000 in eastern Sakhalin waters.

Bearded seals are typically benthic feeders, feeding upon crustaceans, gastropods, bivalves, annelids and cephalopods. The seals also feed upon some fish species including walleye pollock, sand lance and plaice (Bukhtiyarov 1990 in LGL 2003). As benthic feeders, the distribution of bearded seals is restricted to depths of less than 200m (LGL 2003).

Bearded seals generally tend not to congregate on ice, but occur singly on the shear zone between shore-fast and drift ice (Nikolaev & Silishchev 1982, in LGL 2003). The main reproductive groups are observed between Cape Elizabeth, at the north of the island, and 50°N (approximately halfway down the island). During the summer months, animals are scattered along the north-eastern and western Sakhalin coasts in low numbers, occurring sometimes in small rookeries.

Aniva Bay falls within the geographic range of the bearded seal, but currently the size of the population is unknown. No individuals were recorded during surveys conducted in Terpeniya Bay and Aniva Bay by SakhNIRO in September 1998 or by DVNIGMI in July 2001.

5.3.5 Northern Fur Seals

Northern fur seal is classified as “Vulnerable” on the IUCN Red List but are not considered to be rare in the Sea of Okhotsk. It is not listed in the Red Book of the Russian Federation (2001). Populations are estimated to be as high as 120,000 (LGL 2003).

Northern fur seals migrate from the Sea of Japan to the Sea of Okhotsk in the spring, returning during the autumn. Up to 25,000 to 30,000 animals use that route annually (Kuzin 1999 in LGL 2003). The population spends summer mainly along the south-eastern coast of Sakhalin Island. Small numbers of animals have been recorded within Aniva Bay during the spring and autumn migrations and some sightings have been made between Lunsky and Piltun Bays (DVNIGMI 2001). During surveys by SakhNIRO in September 1998 and by DVNIGMI in July 2001, animals were only observed in Terpeniya Bay (including the Poronaysk Port area and Cape Terpeniya) where they were abundant. Approximately 75,000 to 80,000 individuals were observed at the rookery on Tyulenii Island, some 20km southeast of Cape Terpeniya, and in adjacent waters eastward of the Island (Vladimirov 2002 in LGL 2003).

Fur seals feed mainly on pelagic fish and cephalopods. Within the Sea of Okhotsk, this includes walleye pollock, salmon, Japanese anchovy and small squid (LGL 2003).

5.3.6 Steller’s Sea Lion

Steller’s sea lions are listed as “Endangered” within the IUCN Red List and the Red Book of the Russian Federation (2001). Steller’s sea lion is distributed around the North Pacific Ocean rim from northern Hokkaido, Japan through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, southern coast of Alaska and south to the Channel Islands, California. The world population of Steller’s sea lions includes two stocks divided at 144° W

longitude (Cape Suckling, just east of Prince William Sound, Alaska). The stock differentiation is based primarily on genetic differences, but also on differing population trends in the two regions.

Numbers within the Sea of Okhotsk are thought to be in the region of 9,500 to 10,000 (V. Vladimirov, *pers. comm.,* 2004). As reported in the EIA, Steller's sea lion populations have decreased significantly across large portions of their range from the mid-1970s to the mid-1980s. This is thought to be due primarily to a combination of habitat loss, habitat degradation, invasion by alien species and the effects of hunting. In 2002, more than 1,500 adult and 410 newborn animals were recorded at the only known breeding rookery on Sakhalin, located on Tyulenii Island (Kuzin and Naberezhnykh 2002 in LGL 2003). Two main bachelor haul outs have also been identified, on Kamen Opasnosti Rock in La Perouse Strait and Kuznetsova Cape on the south-western coast of Sakhalin Island. Kamen Opasnosti Rock is used throughout the year, with up to 700 animals congregating there. The haul out at Kuznetsova Cape is usually established between autumn and winter each year and approximately 350 to 500 animals have been observed at this location (LGL 2003). A smaller haul out is also present on the harbour breakwater at Nevelsk (on the western coast, 50km south of Kholmsk).

During the summer, animals may be seen along the entire eastern side of Sakhalin Island and across the northern section of Sakhalin Island into Amurskiy Bay. They are frequently sighted in Aniva Bay (Sobolevsky 2000; Kuzin, unpubl. data). During surveys conducted in Terpeniya Bay and Aniva Bay by SakhNIRO in September 1998 (SakhNIRO 1999; Sobolevsky 2000) and by DVNIGMI in July 2001, Steller's sea lions were found only in Aniva Bay in 1998 (six of 12 pinnipeds recorded). In winter, Steller's sea lions migrate from the freezing areas of the Okhotsk Sea to the south. Many of them spend the winter on southern Kurily, Hokkaido, and adjacent small islands (Mizuno *et al*. 2002). These migratory movements have been confirmed by satellite tracking (Kuzin and Naberezhnykh 1991; Kuzin 1996, 2002). Baba *et al*. (2000) used satellite transmitters to follow a yearling Steller's sea lion for five months from Hokkaido to Sakhalin and throughout the southern Okhotsk Sea. This data indicates that Steller's seals undertake significant transit trips (rather than shorter foraging trips from established haul out sites) and may be found throughout the southern Okhotsk Sea in suitable habitat. Individual Steller's seals marked in Hokkaido have also been observed at the haul out site at Nevelsk.

Steller's sea lions feed within shelf waters, mainly at night (Loughlin *et. al*. 1987). Their diet consists predominantly of fish and cephalopods including walleye pollock, atka mackerel, Pacific cod, capelin, Pacific herring, navaga (saffron cod), round goby, squid, octopus and cuttlefish.

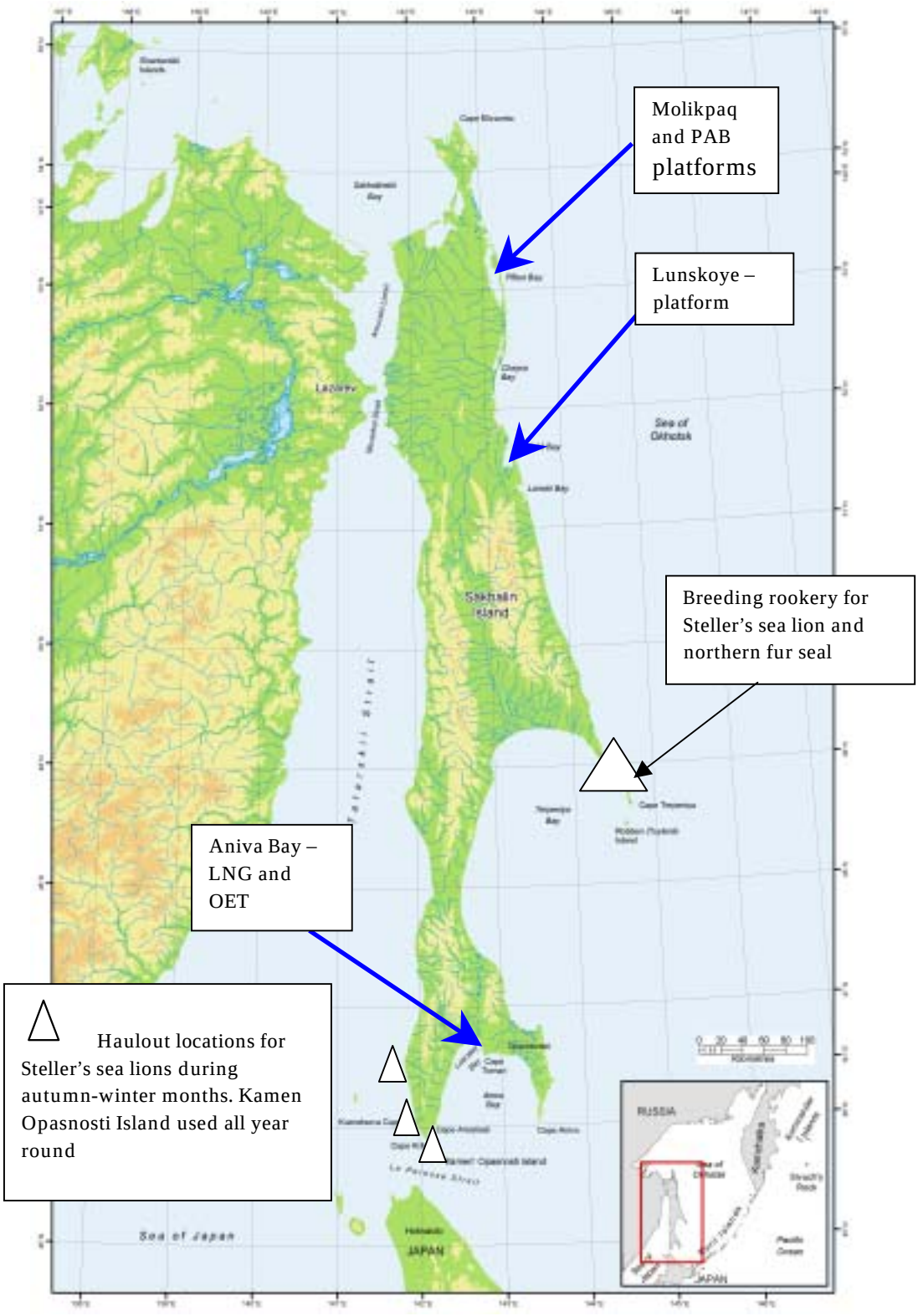

Figure 5.2 Map Showing Location of Key Sites for Steller's Sea Lions on Sakhalin Island (showing breeding rookery and haul out sites at Kamen Opasnosti, Kuznetsova Cape and Nevelsk)

5.4 CETACEANS

To the north-east of Sakhalin Island, seventeen species of cetaceans are known to occur:

- North Pacific right whale *(Eubalaena japonica)*
- Fin whale *(Balaenoptera physalus)*
- Minke whale *(Balaenoptera acutorostrata)*
- Western gray whale *(Eschrichtius robustus)*
- White whale *(Delphinapterus leucas)*
- Sperm whale *(Physeter macrocephalus)*
- Orca (killer whale) (*Orcinus orca)*
- Baird's beaked whale *(Berardius bairdii)*
- Cuvier's beaked whale *(Ziphius cavirostris)*
- Dall's porpoise *(Phocoenoides dalli)*
- Harbour porpoise *(Phocoena phocoena)*
- Pacific white-sided dolphin *(Lagenorhynchus obliquidens)*
- Short-beaked common dolphin *(Delphinus delphis)*
- Bottlenose dolphin *(Tursiops truncatus)*
- Short-finned pilot whale *(Globicephala macrorhynchus)*
- Northern right whale dolphin *(Lissodelphis borealis)*
- Bowhead whale *(Balaena mysticetus).*

Populations of four of these species, the bowhead whale, North Pacific right whale, fin whale and western gray whale have been greatly reduced through decades of mechanised and unregulated commercial whaling. Five species are currently listed in the Red Book of the Russian Federation, and six species are listed as Endangered, or Vulnerable in the IUCN Red List.

The cetacean species most likely to be encountered near the Lunskoye and PA Fields in summer-autumn are western gray whales, minke whales, killer whales, harbour porpoise, and common dolphin. Beluga whales are most likely to be seen during their spring migration.

No cetaceans are likely to be in the vicinity of the PA or Lunskoye Fields during the winter, with the possible exception of bowhead whales and beluga whales near the pack ice edge.

Cetacean species that have been observed to the south of Sakhalin Island from Terpeniya Point to Aniva Bay include:

- North Pacific right whale
- Fin whale

- Minke whale
- Sei whale (*Balaenoptera borealis*)
- Western gray whale
- Sperm whale
- Pygmy sperm whale *(Kogia breviceps)*
- Orca (killer whale)
- Baird's beaked whale
- Cuvier's beaked whale
- Dall's porpoise
- Harbour porpoise
- Pacific white-sided dolphin
- Short-beaked common dolphin
- Bottlenose dolphin
- Short-finned pilot whale
- Northern right whale dolphin

The sections below report additional information that has been reviewed or released since the EIA was published in early 2003. Volume 2, Chapter 1, Section 1.7.3 of the EIA should be referred to for a description of the original baseline information.

5.4.1 North Pacific Right Whale

North Pacific right whales (*Eubalaena japonica*) were formerly classified in the same species as North Atlantic right whales (*E. glacialis*). Recent genetic studies have resulted in recognition that the North Pacific form is a separate species (Rosenbaum *et. al*. 2000). North Pacific right whales are listed as "Endangered" (Category 1) in the Red Book of the Russian Federation, and Endangered by the IUCN (2002) [2].

Current population estimates for the species are largely speculative and range from 100 to the low thousands, however, most authorities tend to use the lower end of this range (Brownell *et. al*. 2001). It has been proposed that as many as 800 to 900 right whales inhabit the Sea of Okhotsk (Vladimirov 1994) and that 150 to 200 animals stay in waters off the east coast of Sakhalin Island during the summer and autumn.

As reported within the international EIA, sporadic sightings of North Pacific right whales indicate that they are sometimes present along the eastern coast of Sakhalin Island. Surveys conducted by SakhNIRO in September 1998 and DVNIGMI in July 2001, which took in the waters of La Perouse Strait, the

2 The IUCN still considers the species to be a N. Pacific stock of *E. glacialis.* It is expected that this designation will change with the reclassification of the North Pacific population as a separate species.

northern and open deep-water areas of Aniva Bay, and the waters at Cape Krilion and Cape Aniva did not reported the presence of the species (LGL 2003).

5.4.2 Fin Whale

Fin whales are listed as "Vulnerable" (Category 2) in the Red Book of the Russian Federation, and classified as Endangered by the IUCN (2002). It has been estimated that there are approximately 2,700 individuals in the Sea of Okhotsk, 400 to 600 of which inhabit the waters of eastern Sakhalin Island during the summer and autumn (Vladimirov 1994).

Although predominantly a pelagic species, individuals sometimes occur in shallow water, both along the coast and offshore (Perlov *et al*. 1996). In 1975, two groups of fin whales were sighted northeast of Aniva Bay, and in 1933, seven fin whales were noted at Cape Terpeniya (Shuntov 1994). Three individuals were sighted in southern Terpeniya Bay, about half way between Cape Terpeniya and Cape Aniva, on 12 September 1998, but none were seen in eastern Aniva Bay on 13 September (SakhNIRO 1999). Thus, fin whales are common in the southern Sea of Okhotsk, and their occurrence in Aniva Bay is possible.

5.4.3 Minke Whale

Minke whales are designated as "Near Threatened" by the IUCN, however they are the most numerous of the baleen whales remaining in the Sea of Okhotsk with approximately 19,000 individuals being reported (Buckland *et. al*. 1992).

Minke whales are found along the entire eastern coast of Sakhalin Island and have also been observed in Aniva Bay.

5.4.4 Western Gray Whale

Detailed information regarding the distribution of western gray whales in the offshore waters of north-east Sakhalin has been collected as part of an intensive survey programme undertaken by SEIC and others since 1997. This information can be accessed via the SEIC website:

http://www.sakhalinenergy.com/environment/env_whales_program.asp

5.4.5 White Whale

White whales (or beluga whales) are categorised as "Vulnerable" by the IUCN but are not considered to be rare within the Sea of Okhotsk. The population is estimated at 18,000-20,000 (IWC 2000), however, their distribution is not uniform. Beluga whales inhabit cold arctic waters and are typically observed close to the ice edge. Beluga do not permanently inhabit the waters off eastern Sakhalin, but are present in small numbers (400-500 individuals) in the north-eastern and northern parts of the Island only during spring migration. Historical data and surveys undertaken during the 1980s and 1990s suggest

that Nyisky Bay is likely to be the southern limit of the distribution of this species in the Okhotsk Sea (TINRO 1996).

5.4.6 Sperm Whale

The sperm whale is not considered to be endangered in the Sakhalin region but is listed as "Vulnerable" by the IUCN [3]. They occur throughout the eastern and southern regions of the Sea of Okhotsk but the waters offshore from the Kuril Islands appear to be the centre of distribution for this species. During the summer and autumn period, the total population of sperm whales within the Sea of Okhotsk is estimated to be between 1,000 and 3,000 individuals (Doroshenko 2002 in LGL 2003) with approximately 200 to 300 sperm whales inhabiting waters seasonally along the eastern Sakhalin Island coast.

Sperm whales are most frequently seen around Cape Terpeniya, Cape Aniva and adjacent waters. In the past Sperm whales were sighted regularly north of Hokkaido (Tomilin 1957 and Nishiwaki 1966) and were recorded in La Perouse Strait and Aniva Bay (Berzin and Rovnin 1966). However, they were not recorded during recent surveys conducted by SakhNIRO in September 1998 (SakhNIRO 1999), DVNIGMI in July 2001 or during surveys conducted in La Perouse Strait, the northern and open deep-water areas of Aniva Bay, and the waters at Cape Krilion and Cape Aniva (DVNIGMI 2001).

5.4.7 Orca (Killer Whale)

Orca are categorised by the IUCN as being "Conservation Dependent" but are common within the Sea of Okhotsk with 2,000 to 3,000 animals being estimated to be present (LGL Ltd. 2003). An estimate of a population size as high as 10,000 has also been made (Doroshenko 2002).

Orcas have been observed along the entire eastern coast of Sakhalin Island, and were the only cetacean, other than the western gray whale, to be regularly recorded during aerial surveys conducted in 1999 and 2000 (Sobolevsky 2000). Most of the sightings were of individual whales, but a large group of 25 to 30 animals was observed approximately 10km from the coast in water depths of between 40 and 45m. This aggregation was thought to be associated with the beginning of the pink salmon run. Other survey data have shown the species to be present within Terpeniya Bay, Aniva Bay, La Perouse Strait, Cape Aniva and Cape Krilion.

5.4.8 Baird's Beaked Whale

Baird's beaked whales are categorised as "Conservation Dependent" by the IUCN but are not considered to be rare in the Sakhalin region. Approximately 1,000 to 1,500 animals occurring within the southern Sea of Okhotsk along the islands of the Kuril archipelago, the Kamchatka coast, the

3 The IUCN uses the name *Physalis catadon* for the sperm whale

south and east of Sakhalin Island and Shantarskie and Ion Islands (Perlov *et. al.* 1996).

The species is endemic to the North Pacific. Eastern and western Pacific populations are migratory, arriving at the continental shelf in summer and autumn. This species usually prefers deep continental shelf waters, but has been observed in shallower waters in the Sea of Okhotsk (Kasuya 2002).

Approximately 250 to 300 individuals have been estimated to visit southern Sakhalin, mainly in Aniva Bay and Cape Aniva (Berzin and Rovnin 1966). However, during recent surveys Baird's beaked whales were not observed in Terpeniya Bay and Aniva Bay (LGL Ltd. 2003).

5.4.9 Cuvier's Beaked Whale

Cuvier's beaked whales are listed as "Rare" (Category 3) species within the Red Book of the Russian Federation (Krasnaya Kniga 2001) and as Data Deficient by the IUCN (2002).

Beaked whales generally occur in non-continental shelf waters greater than 200m in depth. In areas where there is no continental shelf, they may occur close to shore, however, most sightings occur far from land. Most records of beaked whales come from the continental shelf edge and slope and around oceanic islands where the seabed shelves rapidly. Such areas appear to be important habitats for beaked whales. Beaked whale distribution is often recorded as being in association with areas of complex seabed topography, such as seamounts, escarpments, drop-offs and gullies.

It was reported within the international EIA that Cuvier's beaked whales had not been observed in the waters around Sakhalin Island and neither SakhNIRO's 1998 nor DVNIGMIs 2001 surveys recorded sightings. However, the species was observed in northern Aniva Bay during studies conducted in Aniva Bay, Cape Aniva and Cape Krilion between August and September 2001 (Vladimirov 2002). Its presence within Aniva Bay fits in with the observed preferred marine habitat of the species, as water depths rapidly drop off from 60m in the Bay to 2,000m at a distance of 50-100km to the east.

5.4.10 Dall's Porpoise

Dall's porpoise are categorised as "Conservation Dependent" by the IUCN (2002), but with an estimated population of between 20,000 and 25,000 individuals within the Sea of Okhotsk, the species is considered to be one of the most numerous cetaceans in the region.

Approximately 3,500 to 4,000 Dall's porpoises are thought to occur in eastern Sakhalin Island waters and surveys have recorded the presence of the species in La Perouse Strait, Terpeniya Bay, Aniva Bay and Cape Aniva. Observations indicate that the main distribution of the porpoises is between Terpeniya and Aniva Bays (*ibid.)*.

SakhNIRO's 1999 baseline studies recorded regular sightings of Dall's porpoise. The species was the most abundant cetacean in Terpeniya Bay, where the porpoises were actively feeding. SakhNIRO noted that the species was less commonly observed within Aniva Bay.

5.4.11 Harbour Porpoise

Harbour porpoise are categorised as "Vulnerable" by the IUCN but are not considered to be rare within the Sea of Okhotsk. They are usually observed in the waters of the inner continental shelf, along the western coast of Kamchatka, the eastern coast of Sakhalin Island and north of the Shantarskie Islands (TINRO 1996).

In Sakhalin Island waters, the harbour porpoise has been sighted frequently. During SakhNIRO's 1998 baseline studies, the species was the second most abundant cetacean recorded in Terpeniya and Aniva Bays (SakhNIRO 1999), and DVNIGMIs 2001 surveys recorded harbour porpoise in Poronaysk Port in Terpeniya Bay and within Aniva Bay. Surveys have also confirmed the presence of the species further north, with SEICs 2003 survey programme (TINRO 2003) reporting that the harbour porpoise was the most commonly observed species in the vicinity of Lunsky Bay during August (73 of 103 cetaceans) (LGL 2003). In the Piltun area, they were less frequently sighted by marine mammal observers in 2003 with five sightings out of 73.

5.4.12 Pacific White-Sided Dolphin

The Pacific white-sided dolphin is categorised as "Least Concern" by the IUCN. The species is considered to be one of the most numerous cetaceans in the north-western Pacific Ocean, being found in large aggregations averaging 90 individuals but also being observed in groups of up to 3,000 (Waerebeek & Wursig 2002 in LGL 2003). Within the Sea of Okhotsk, the dolphins appear to be concentrated towards the south with frequent sightings being recorded along the Kuril island arc, La Perouse Strait, Cape Aniva and Aniva Bay (LGL 2003).

Together with porpoises, SakhNIRO observed that Pacific white-sided dolphins were the most common cetaceans to be observed during baseline studies of Aniva Bay. The dolphins were actively feeding in the bay.

5.4.13 Short-Beaked Common Dolphin

Short-beaked common dolphins are categorised as "Least Concern" by the IUCN. The species is considered to be the most common dolphin in offshore waters (Perrin 2002 in LGL 2003) with a world population of several million. Within the Sea of Okhotsk, short-beaked common dolphins are mainly concentrated in the south along the Kuril island arc and along the west coast of Kamchatka. The species also inhabits the waters to the east of Sakhalin Island and to the north of the Shantarskie Islands (TINRO 1996).

Short-beaked common dolphins were the fourth most common species recorded during SakhNIRO's 1998 baseline studies conducted within Aniva Bay, with the dolphin accounting for 7% of cetacean observations. Studies conducted between August and September 2001 in La Perouse Strait, Aniva Bay, Cape Aniva and Cape Krilion reported the species as being the second most commonly observed cetacean, having a sighting rate of 16% (Vladimirov 2002).

5.4.14 Bottlenose Dolphin

The bottlenose dolphin is categorised as "Data Deficient" by the IUCN (2002). The species is uncommon in the Sea of Okhotsk, but surveys have observed the species in the waters around Sakhalin Island.

Baseline studies of Lunsky Bay and Aniva Bay conducted by SakhNIRO (1999) recorded the presence of bottlenose dolphin but the species was not observed in large numbers. Studies conducted between August and September 2001 in La Perouse Strait, Aniva Bay, Cape Aniva and Cape Krilion also noted the species, which accounted for 2% of cetacean observations.

5.4.15 Short-Finned Pilot Whale

Short-finned pilot whales are categorised as "Conservation Dependent" by the IUCN. The species migrates northwards during the spring and summer, and southwards in the autumn and winter following the migration of squid, which are their target prey. In the Sea of Okhotsk, the whales have been observed in the waters around the Kuril Islands, La Perouse Strait and Cape Aniva on the continental shelf break and inshore waters.

Short-finned pilot whales were not observed during the studies conducted by SakhNIRO in 1998, DVIGIMI in July 2001 or La Perouse Strait, Aniva Bay, Cape Aniva and Cape Krilion between August and September 2001.

5.4.16 Northern Right Whale Dolphin

Northern right whale dolphins are categorised by the IUCN as "Least Concern". They are generally observed in deep, temperate waters of the North Pacific, but they have been reported within the southern Sea of Okhotsk, including the waters around the Kuril Islands, the south-west coast of Kamchatka, La Perouse Strait, Cape Aniva and east of Terpeniya Bay (TINRO 1996).

Northern right whale dolphins were not observed during the studies conducted by SakhNIRO in 1998, DVIGIMI in July 2001 or La Perouse Strait, Aniva Bay, Cape Aniva and Cape Krilion between August and September 2001.

5.4.17 Bowhead Whale

Bowhead whales are listed as Category 1 "Endangered" in the Red Book of the Russian Federation. The IUCN categorises the species generally as

"Lower Risk-Conservation Dependent", but also designates distinct populations independently. The Sea of Okhotsk population is classed as Endangered.

As described in the EIA, bowhead whales occur in only two areas of the Sea of Okhotsk, in the north-east (Gizhiginskaya and Penzhinskaya bays), and the west (near Shantarskie Island and in Konstantin, Ulbanskii, and Tugurskii bays). During February and March, 50 to 100 bowhead whales may be present close to the ice edge along the north and east coasts of Sakhalin Island (Vladimirov 1994). The species has not, however, been recorded around the island outside of these months and has never been sighted in the waters around the island's south or south-eastern coasts.

5.4.18 Sei Whale

The sei whale is categorised as "Rare" (Category 3) in the Red Book of the Russian Federation and as Endangered by the IUCN.

Sei whales feed on planktonic crustaceans, small fish, and cephalopods. Sei whales have a wide distribution and can be found in the Atlantic, Indian and Pacific Oceans. Generally, they avoid the coldest areas close to ice and tend to prefer warmer waters than the fin whale for example. Sei whales occur in the open ocean and in coastal waters but usually remain beyond the 100m-depth contour. They are seldom encountered in shallow bays and estuaries. In summer, Sei whales penetrate into the southern and south-eastern Sea of Okhotsk through the various straits of the Kuril Islands. The estimated population in the Okhotsk Sea is 200-400 (TINRO 1996). Surveys carried out by DVNIGMI in 2001 recorded individual sei whales near Lunsky Bay, Poronaysk Port in Terpeniya Bay, and Aniva Bay. No detailed information was available as to the behaviour or activities exhibited by the sei whales during the surveys.

They were not observed in previous surveys in Terpeniya Bay and Aniva Bay between 1998 (SakhNIRO 1999 and Sobolevsky 2001) or in surveys in 2001 in La Perouse Strait, the northern and open deep-water areas of Aniva Bay and waters at Cape Krilion and Cape Aniva (Vladimirov 2002).

5.4.19 Pygmy Sperm Whale

Pygmy sperm whales were not covered in the EIA, as they were not reported as being present in Sakhalin waters at that time. However, as reported in LGL (2003), pygmy sperm whales have been sighted within the northern and open deep-water areas of Aniva Bay, La Perouse Strait, Cape Krilion and Cape Aniva (Vladimirov 2002 in LGL 2003).

The pygmy sperm whale is not included within the Red Book of the Russian Federation and is classified as "Least Concern" by the IUCN. The whales are thought to be oceanic species, preferring temperate and tropical offshore waters beyond the edge of the continental shelf (Rice 1998 in LGL 2003). Establishing the range of the genus has been problematic as it is rarely identified at sea but it is generally not thought to inhabit polar or sub-polar

seas (Gaskin 1982) and has previously only been recorded as far north as Hokkaido Island (Caldwell and Caldwell 1989).

5.5 SPECIFIC ISSUES AND CONCERNS

5.5.1 Impacts on Steller's Sea Lions

Concern has been expressed about the potential impact of the proposed project activities on the populations of Steller's sea lions that inhabit the coastal waters around Sakhalin, particularly with respect to their presence in Aniva Bay.

As reported in Section 5.3.6, Steller's sea lions can be found at a number of locations around the Island at differing times of the year (LGL 2003).

- The only breeding rookery is located at Robben (Tyulenii) Island, with animals being present there between May and December;
- Three haul out sites (bachelor seals) located in southern Sakhalin on the south-western fringe of Aniva Bay (see Figure 5.2) are established in autumn. Animals may be present all winter at these sites and there is evidence to indicate that some individuals move in to the haul outs from further afield (*e.g.* northern Hokkaido);
- Seals may be found during the summer months all along the east Sakhalin coast and in Aniva Bay. However, the large majority of sightings are of foraging individuals around the rookery site at Tyulenii Island.

In considering the potential impact of project activities a number of aspects must be considered in order to assess the likelihood and degree of disturbance or adverse impact occurring. These aspects can be summarised as follows:

- Proximity of main population centres to project activities, including the potential for exposure to oil spills;
- Nature of planned work and potential for causing disturbance to animals;
- Basic behavioural ecology of the Steller's sea lion and sensitivity to human presence/activity.

Potential disturbance resulting from project-based activity

As shown in Figure 5.2, the Steller's sea lion populations around Sakhalin are concentrated at a number of sites (Tyluenii Island and haul outs off the south-west coast). Information collected from marine mammal surveys (see *Table 5.3*) indicates that during the spring-early autumn, seal activity is concentrated in and around the rookery at Tyluenii. During the late autumn and winter, the focus of activity shifts to the haul out sites offshore of southern Sakhalin. Breeding and nursing females at the Tyluenii rookery may be found during the

summer months in coastal waters close to the rookery and further afield along the east coast on foraging trips. Males at Tyluenii do not feed and typically remain at the rookery defending territories.

The intensity of use of coastal waters around the rookery and haul out sites is not known, although individuals are regularly sighted in Aniva Bay. However, evidence of likely behaviour and likely level of use of surrounding waters comes from telemetry research undertaken elsewhere. The information from these studies provides a good indication of the potential for spatial overlap between critical sea lion habitat and planned project activities.

A number of telemetry studies have been undertaken to determine foraging behaviour and the nature of migratory transits between spring-summer sites and those used during the autumn-winter. The majority of these studies have involved the tagging of juvenile and female sea lions from colonies in Alaska and the west coast of the USA (NMFS 2001), although data have also been obtained for seals originating from the Kuril Islands and Hokkaido (e.g. Baba *et. al*. 2000). In the USA the data have been used in an effort to determine the interaction between nearshore fisheries and foraging activity by Steller's sea lion in order to shed light on the population decline in the western population of Steller's sea lion in the USA (NMFS 2001, Loughlin *et al* unpublished). The information gained from these studies is also useful in the context of assessing the potential level of interaction between Steller's sea lions and planned activities as part of the Sakhalin II project.

The telemetry work has been summarised by Loughlin *et al* (reported in NMFS 2001). The telemetry information clearly indicates that throughout the year, coastal waters up to 20km from shore are the most heavily used by Steller's sea lions (Table 5.2), and is the area in which pups and lactating females rely heavily on during the autumn and winter periods. Loughlin *et al* (unpublished) has pointed out that although the vast majority of trips are undertaken within the <18km zone, a number of these foraging trips may not be successful and the longer distance trips (18-36km and further offshore) may therefore be relatively more significant than the data suggests. This is more likely to be the case with adult sea lions during the winter. Even so, the available data strongly indicates that the zone up to 18km from key Steller's sea lions locations is of greatest significance in relation to foraging and general activity.

Table 5.2 Summary of Telemetry Data for Dives Undertaken by Steller's Sea Lions from Haul Outs and Rookery Sites in Alaska (figures given as % of total recorded dives)

	Summer (April-September)		**Winter (October-March)**	
Zone	**Juveniles**	**Adults**	**Juveniles**	**Adults**
0-3 nm (0-5.5km)	68.4	89.6	92.8	74.0
3-10 nm (5.5-18km)	6.0	6.0	6.3	5.2
10-20 nm (18-36km)	5.1	0	0.6	4.2
Beyond 20 nm (>36km)	20.4	4.5	0.4	16.7

Taking this data into account it is apparent that the majority of Steller's sea lion activity on Sakhalin is highly likely to take place at some distance away from project locations (see Figure 5.2). The main rookery at Tyluenii Island lies 400km to the south of project activities in the PA area and 250km south of Lunskoye. In Aniva Bay, the haul out sites are located between 100-150km from the LNG/TLU sites.

The potential for significant spatial overlap between project activities and critical habitat areas for Steller's sea lions is thus very limited. This is not to say that interaction and potential disturbance to individuals would not occur. Clearly, survey data collected during baseline/characterisation studies shows that Steller's sea lions are present in the Piltun area and have also been observed in the central part of Aniva Bay. Sea lions on longer foraging trips or on transit may encounter project related activity.

The likely response of individual sea lions encountering human activity is difficult to establish with any certainty. However, typical reactions are likely to be either avoidance of the source of potential disturbance or habituation to the activity. It is interesting to note that the Steller's haul out site at Nevelsk is located adjacent to the port and the area is subject to comparatively high levels of human activity in comparison to the vast majority of the Sakhalin coastal nearshore area. There is also no evidence to suggest that existing oil and gas development activities have adversely disturbed or influenced the behaviour of Steller's sea lions on the Island.

Calkins and Pitcher (1982) report that disturbance from aircraft and vessel traffic has extremely variable effects on hauled-out sea lions ranging from no reaction at all to complete and immediate departure from the haul out, for instance a stampede. Sea lions have temporarily abandoned some areas after repeated disturbance but in other situations they have continued using areas after repeated and severe disturbance (Thorsteinson and Lensink 1962).

Johnson *et al*. (1989) evaluated the potential vulnerability of various Steller's sea lion haul out sites and rookeries to noise and disturbance and also noted a variable effect on sea lions. A major sea lion rookery at Cape Sarichef, Unimak Island, Alaska was abandoned after the construction of a lighthouse at the site but the sea lions re-established the haul out after the lighthouse wasvacated.

During operation of the LNG plant and Tanker Loading Unit (TLU) in Aniva Bay, there will be an increase in shipping traffic (LNG and oil tankers) through La Perouse Strait. The main shipping channel is located well away from Steller's sea lion haul outs in the Aniva Bay area (approximately 110km to Nevelsk, 50km to Kuznetsova Cape and 15km to Kamen Opasnosti) and therefore ships would not approach close enough to these sites to cause any direct disturbance to sea lions.

The increase in underwater noise levels associated with increased vessel traffic and the potential effect that this may have on Steller's sea lions is, however, potentially an issue of concern. The distance of the main haul outs at Kuznetsova and Nevelsk from the main shipping channel immediately suggests that sea lions using these areas would not be adversely affected by any increase in vessel associated noise. However, the haul out at Kamen Opasnosti is potentially close enough to the main shipping channel that foraging individuals could encounter increased noise levels when vessels pass through La Perouse Strait.

There is very limited data on the underwater hearing capabilities and sensitivities of Steller's sea lions and typically available data on other eared seals (e.g. Californian sea lions) has been used in situations where assessment of potential impact due to underwater noise is required. Pinnipeds in the *Phocidea* family (e.g. fur seals) generally hear from 1 kilohertz to between 30 and 50 kilohertz, with thresholds between 60 and 85 dB re 1 µPa (Richardson et al. 1995). Sensitivity for most phocids remains good until approximately 60 kilohertz, after which sensitivity is poor (Richardson et al. 1995). Underwater sensitivity at the high- and low-frequency ends for pinnipeds in the *Otariidae* family (e.g. Steller's sea lion) is generally lower than that for phocids, but there is little difference in the middle frequencies (Richardson et al. 1995). The tolerance of pinnipeds to underwater noise levels is not well established and no definitive data for Steller's sea lion is available. However, on the basis of data from a range of studies, it is predicted that exposure to sound levels ~ 140 dB re 1µ Pa would cause temporary hearing loss in pinnipeds but it is doubtful if marine mammals (including seals) would remain in an area that was ensonified at 120 – 140 dB re 1µ Pa long enough to suffer any temporary, or possibly permanent hearing loss (LGL 2003, quoted in NPS 2003).

A useful analogy for the potential situation in La Perouse Strait is provided by work on the impact of underwater noise generated by cruise ships in Glacier Bay National Park in Alaska on Steller's sea lions and other marine mammals. This work was undertaken as part of an assessment into potential changes in vessel management (NPS 2003). Based on calculations using vessel signatures, cruise ships travelling at 10 knots projected noise at or above 130 decibels (the 130-decibel level was taken as the level where marine mammals might react to sound) for about 500 metres (LGL 2003, quoted in NPS 2003). Based on a sound sample of a cruise ship travelling at 19 knots (195 dB re 1 µPa @ 1m), LGL predicted that within Glacier Bay it would have projected noise at or above 130 decibels for up to 5,000 metres (radius from the ship). In comparison, large tankers typically generate underwater noise levels in the region of 175-195 dB re 1 µPa @ 1m (Richardson *et.al*. 1995 and Hildebrand 2004). Although not directly comparable, due to the different locational characteristics, it can be assumed that similar areas of ensonification would be likely for tankers moving through La Perouse Strait. It should also be borne in mind that for a stationary object a moving vessel does not constitute a constant noise source. Using data from the Glacier Bay studies it has been calculated that for a ship travelling at 19 knots, the estimated maximum time a stationary object would be exposed to 130 decibels or more is approximately

17 minutes (NPS 2003). These time periods are shorter than the 20 to 22 minute exposures that caused temporary reduced hearing sensitivity (temporary threshold shift) in a harbour seal, elephant seal, and California sea lion (Kastak et al. 1999).

Using these data (but taking into account the potential limitations of direct comparison) it is considered unlikely that underwater noise associated with vessel traffic through La Perouse Strait would reach levels at the haul out at Kamen Opanosti that would cause disturbance to Steller's sea lions. This haul out is approximately 15km away from the main shipping channel and, on the basis of data from the NPS (2003) study, and noise levels for large tankers, it is estimated that the haul out occupies a location that would be about 10km from any ensonified area (based on the 5km radius modelled prediction for vessels in Glacier Bay) in which noise levels could cause disturbance to Steller's sea lions.

The majority of Steller's sea lion activity would be likely to be concentrated within 10km of the haul out (see Table 5.2). Animals venturing beyond this area would be unlikely to enter areas of increased noise that would disturb them (i.e. during vessel passage). As vessel movements would be transitory, any ensonified area likely to cause disturbance (i.e. over 10km away from the haul out) would be temporary. There would also be long periods of time between vessel movements through the shipping channel during which animals could move across, or closer to the channel.

On this basis, it is therefore considered that while shipping traffic associated with project activities would lead to temporary, increased noise levels that could potentially cause harm, the affected area would be located some distance from the nearest Steller's sea lion haul out and the vast majority of area likely to be used by Steller's sea lion for feeding would remain unaffected by increased levels of underwater noise. Significant time windows during which Steller's sea lions would be able to move freely across the shipping channel without potential disturbance from increased noise levels would also occur.

Available information and research evidence suggests that the potential for disturbance to Steller's sea lions through project related activities is very low. This conclusion is based on the following factors:

- Haul out sites and the rookery at Tyluenii Island would not be directly impacted by project activities;
- Critical habitat, where the vast majority of Steller's sea lion activity takes place, is likely to lie within a <40km zone from haul out sites and the established rookery;
- The main centres of project activities are located between 100-400km from key locations for Steller's sea lion;
- Activities that cause significant disturbance to this species appear to be confined to direct interference at haul out areas and rookeries

through human presence and/or infrequent and noisy activity (*e.g.* aircraft overflight);

- Vessel passage through La Perouse Strait may lead to noise levels that would cause disturbance to Steller's sea lions. However, the nearest haul out is 15km from the shipping channel and potential noise disturbance would be temporary and confined to an area of approximately 5km radius from tankers.

Exposure to oil spills

Oil spills would be expected to adversely affect Steller's sea lions if oil came into contact with individual animals, haul outs, or rookeries when occupied, or large proportions of major prey populations. Potential adverse effects could include: exposure to oil including surface contact and coat (pelage) fouling, inhalation of contaminant vapour, and ingestion of oil or oil-contaminated prey.

The insulation of non-pup sea lions is provided by a thick fat layer, rather than pelage whose insulative value could be destroyed by fouling, therefore, oil contact would not be expected to cause death from hypothermia. Nevertheless, sensitive tissues (*e.g.* eyes, nasal passages, mouth, lungs) could be irritated or ulcerated by exposure to oil or hydrocarbon fumes. Such conditions can increase an individual's physiological stress and increase the likelihood of death of individuals that are highly contaminated or already weakened. Because they rely on their hair for thermal protection, sea lion pups are more vulnerable than are adults to oiling and could die if significantly oiled. Thus, a spill during peak pupping season could cause pup mortality if they were oiled through contact with the beach or from their mothers. However, available data do not indicate that such effects have typically occurred after previous spills or if they have, that large numbers of individuals were affected.

Oiled individuals would probably experience effects that may interfere with routine activities for a few hours to a few days although movement to clean water would be expected to relieve most symptoms. Females returning from feeding trips may transfer oil to pups, which probably are more sensitive to oil contact.

The extent to which sea lions avoid areas that have been oiled is not greatly known. Individuals observed in Prince William Sound and the Gulf of Alaska after the Exxon Valdez oil spill (1989) did not appear to avoid oiled areas (USMMS 2003). Sea lions were sighted swimming in or near oil slicks and oil was seen near numerous haul out sites and a number of rookeries. The Exxon *Valdez* spill was, by many measures, a worst-case scenario of an oil spill, in terms of the Steller sea lion, in that it was a very large volume spill covering a wide area within the range of the western stock, it persisted for long periods of time, reached important haul outs, and occurred during times when these animals were pupping and moulting. No rookery habitat was oiled though.

During the initial spill in March 1989, 12 sea lion carcasses were recovered from the beaches of Prince William Sound and an additional 16 sea lions collected from haul out sites in the vicinity of the Sound and the Kenai coast (Calkins *et. al*. 1994). The highest levels of Polycyclic Aromatic Hydrocarbon (PAH) compound were found in sea lions found dead following the oil spill. Sea lions collected seven months after the Exxon Valdez oil spill had levels of PAH metabolites in the bile consistent with exposure and metabolism of PAH compounds (Calkins *et. al.* 1994). However, since lesions associated with hydrocarbon contamination were not found in histological exams of any sea lion, there was no evidence of oil toxicity damage.

Statistical analysis of historic population data (adult and pups) and counts undertaken following the oil spill did not provide any firm evidence that there was an oil spill effect on Steller's sea lion at the population level. Potentially, this may have been due to limitations in the data collected from pre-spill counts, but significantly the data confirmed the continuation of the previously observed decline in the overall population.

Overall, the conclusion reached by Calkins et. al. (1994) was that no significant oil spill effect on Steller's sea lions could be detected. No conclusive evidence for the recorded deaths of the sea lions recovered following the Exxon Valdez spill could be provided. Although, through histological analysis, Calkins *et al* (1994) were able to determine that some sea lions were clearly exposed to oil, there was insufficient evidence to determine that the levels of toxic compounds were sufficient to cause contamination. Available evidence therefore suggests that the sensitivity of Steller's sea lion to oil spills, at the population level, even on the scale of the Exxon Valdez, is low. However, adverse harm to individual sea lions as a result of oil contamination (inhalation, contact and absorption and ingestion) cannot be ruled out.

If a spill did occur, the integrity of the haul out sites in Aniva Bay could be at risk. Food resources within nearshore waters could be adversely impacted but given the extensive foraging grounds available to sea lions, it is unlikely that overall food availability would be compromised. There is no evidence from studies following the Exxon Valdez spill that Steller's sea lions were adversely affected through impacts on their prey resource.

The probability, should an oil spill occur within Aniva Bay (from the TLU), of oil moving towards the haul out sites in the Bay is estimated at 6-14% (depending on the prevailing weather conditions and season). This estimate is based on oil spill trajectory modelling studies (FEHRI, 2004). The estimated frequency of a spill occurring is in the range of $5x10^{-5}$ - $5x10^{-6}$ per year (calculated frequency of a significant spill occurring in any one year) for the Offshore Export Terminal (including pipeline); TLU Oil Spill Response Plan – Preliminary Quantitative Risk Assessment (2004). Combining the results of the oil spill modelling studies with information on the behavioural characteristics and physiological response of Steller's sea lions to oil pollution suggests that:

- Although there is a possibility that an oil spill within Aniva Bay could lead to the oiling of Steller's sea lion haul out sites, the probability of such an event is very low;

- On the basis of data from the Exxon Valdez spill, as discussed above, if critical habitat (haul out sites) were affected, it is highly unlikely that adverse impact at the population level would occur, although there is the possibility that some individuals could be harmed.

The probability of adverse impact in the event of an oil spill could also be further reduced through the implementation of practical mitigation measures. Such measures will be set out in the Aniva Bay (TLU/OET) Oil Spill Response Plan, which will highlight areas of environmental sensitivity to oil spills and detail the response to prevent or reduce potential harm. Further information on oil spill response planning activities is presented in Chapter 2 of the EIA-A.

5.5.2 Noise disturbance to beaked whales and other cetaceans

Marine mammals are especially dependent upon hearing for navigation, communication, foraging and maintaining social structures. Therefore, change in the acoustic environment that may adversely affect their use of hearing in these activities is of particular concern.

The data available show that all marine mammals have a fundamentally mammalian ear that, through adaptation to the marine environment, has developed broader hearing ranges than are common in land mammals.

Available data indicates that there is considerable variation among marine mammals in both absolute hearing range and sensitivity, with the composite range spanning the ultra to infrasonic (10Hz – 200kHz, with best thresholds near 40-50 dB re 1 µPa). Modern cetaceans have three inner ear structural forms that coincide with acoustic groups: low to infrasonic Type M mysticetes, upper range ultrasonic Type I odontocetes, and lower range ultrasonic Type II odontocetes. Type I odontocetes have peak spectra above 100kHz and tend to be near-shore and riverine species that operate in relatively low-light, acoustically complex waters. Type II species are primarily delphinids, which are near and offshore animals that inhabit low object density environments, generally travel in large pods, are highly social and employ lower ultrasonic frequencies with longer wavelengths that are consistent with detecting larger objects over greater distances. Although relatively scarce, data on mysticete ears suggest they are adapted to sonic and infrasonic frequencies (Richardson *et. al*. 1995).

The consensus of the data is that virtually all marine mammal species are potentially impacted by sound sources with a frequency of 300Hz or higher. Any species can be impacted by exceptionally intense sound, and particularly by intense impulsive sounds. However, at increasing distance from a source, which is the realistic scenario as opposed to "at source", the effects are a composite of three aspects: intensity, frequency, and individual sensitivity.

Relatively few species are likely to receive significant impact for lower frequency sources (Hildebrand 2004).

In recent years, particular attention has focused on the role that intense sound sources have played in instances of whale strandings, as there is evidence to suggest that some strandings have been associated with the use of high-intensity sonar during naval operations and airguns during seismic reflection profiling.

Most of the recorded incidents have involved Cuvier's beaked whales, a species that has been recently recorded from Aniva Bay along with Baird's beaked whale. As a consequence, assessing the potential impact of project-related noise sources on these types of cetaceans has been raised as a particular issue.

A global list of beaked whale strandings involving two or more animals shows that, apart from two individuals in 1914, there are no records of multiple-animal strandings until 1963. However, from 1960 to 2000, three to ten multi-animal strandings have been recorded per decade (Hildebrand 2004). The increased incidence of multi-animal beaked whale stranding events since 1960 is coincidental with the advent and use of high-intensity sonar on a broad range of naval ships. Cuvier's beaked whales are by far the most common species involved in stranding events, making up 81 percent of the total number of stranded animals.

The reasons for the strandings are not clear although a combination of reasons are probably attributable. Potentially, Cuvier's beaked whale is more prone to injury from high-intensity sound than other species and its behavioural response to sound may make it more likely to strand. It is also likely to be the most abundant of the beaked whales and therefore the number of strandings involving this species (amongst beaked whales) tends to be greater.

The settings for stranding incidents are strikingly consistent: an island or archipelago with deep water nearby, appropriate for beaked whale foraging habitat. Exposure to high sound levels is known to lead to potential beaching of beaked whales. These animals die if they are not returned to the sea by human intervention. The fates of those animals that are returned to the sea are unknown (Hildebrand 2004).

Clearly, the available evidence indicates that potential harm to beaked whales, and Cuvier's beaked whale in particular, relates to the use of high intensity sound sources within the vicinity of their preferred habitat. The observation of the presence of two species of beaked whales in the waters of Aniva Bay shows that these whales are using the waters around southern Sakhalin, possibly for foraging, and therefore that the potential for harm exists. It is notable that these sightings correspond well with the maritime setting of the area and suggest that beaked whales may be regularly using the steep drop off area around south-eastern Sakhalin.

Assuming that beaked whales regularly visit the shallower waters of Aniva Bay, potential harm could arise through the generation of high intensity submarine noise during project activities. Harm and stranding of beaked whales, as discussed above, appears to be linked with low frequency, high-energy noise sources in the marine environment such as the use of low frequency sonar and air-gun arrays during seismic exploration. Such high intensity, low frequency noise generating activities will not occur during the planned works in Aniva Bay (*i.e.* construction of the LNG jetty and TLU). This therefore suggests that, based on previous coincidental evidence, the potential for this type of adverse noise associated impact on beaked whales does not exist.

It is also worth considering, however, whether other project-related noise generating activity could adversely impact upon beaked whales within Aniva Bay. Potential noise sources include piling works and dredging during construction of the LNG and TLU facilities and an increase in background noise produced through shipping activity.

Potentially, the noisiest activities that would take place would be sheet piling works for a temporary platform during construction of the LNG jetty and piling work for the Tanker Loading Unit (TLU) in Aniva Bay.

The sheet-piling work for the jetty would be undertaken by crane from the shore using a vibro-hammer (vibropiling). Similarly, the piles for the TLU would be emplaced using a vibro-hammer following drilling of slots in the seabed from a jack-up rig. In total, it is estimated that the piling and drilling works for the TLU would take approximately 2days.

Nedwell and Howell (2004) provide data from several studies of noise levels generated during piling operations and the documented effects on marine life. The reported results are interesting in that they indicate that piling noise can have diverse consequences for marine animals, such as avoidance and mortality. It is most likely that the significant factors, which affect the noise level, include the piling technique, pile diameter, local geology and bathymetry.

Nedwell et. al. (2003) reports on monitoring measurements of the waterborne noise resulting from impact piling and vibropiling at Town Quay, Southampton, UK, during construction of a ferry terminal. Underwater noise levels were monitored during the vibropiling operation at a location 417m from the actual site of piling. The recorded levels showed that there was no discernible increase in the background noise signal at this point during the vibropiling operation (with recorded background levels periodically reaching 150dB, but typically in the region of 110-120dB). However, it should be noted that background noise levels in Southampton Water, as a result of the high level of shipping traffic and other water-based activities, are likely to be significantly higher than levels in Aniva Bay.

Nedwell and Edwards (2002) report on underwater noise measurements obtained during vibropiling operations for a wharf extension at Littlehampton in

the UK. The recorded noise levels from a number of points showed a considerable degree of scatter indicating that the level of sound generated by the source varied. They attributed this variation to differing propagation conditions caused by variations in soil density near to the piles. The average (root mean square RMS) noise level for each measurement location varied between 132-152 dB/1 µPa at distances of 20-80m from the piling works. Noise spectra obtained for the piling shows that there was a strong signal in the region of 27Hz but with most of the signal being concentrated in the mid-frequencies (200Hz – 2KHz).

Nedwell et.al. (2003), measured underwater noise levels associated with seabed drilling operations (from a jack-up rig) into sandstone for the installation of piles for offshore wind turbines. Although a source noise level for the drilling could not be obtained, all of the measurements from 100m to 9km from the drilling location were below a level at which a significant behavioural effect (marine mammals and fish) might be expected to occur (Nedwell et.al. 2003).

Reported source levels for marine dredging operations range from 160 to 180 dB re 1µPa @ 1m for 1/3 octave bands with peak intensity between 50 and 500Hz (Greene and Moore 1995). In Aniva Bay, a bucket dredger for dredging works associated with the construction of the LNG jetty and the temporary Materials Offloading Facility (MOF) would be used. Work carried out by the United States Army Corps of Engineers in Cook Inlet, Alaska (Dickerson *et. al*. 2001) provides detailed records of the underwater noise generated by a bucket dredging operation. Measurements of the dredging in Cook Inlet, showed that the bucket striking coarse gravels on the seabed generated the most noise with a recorded peak of 124 dB re 1 µPa-m at 150m from the dredge site which attenuated by 30 dB re 1 µPa-m over a distance of 5km. The digging operation (bucket tearing into seabed sediment) was characterised by a grinding noise with a recorded peak of 113.2 dB re 1 µPa-m at 150m from the dredging site to 94.97 dB re 1 µPa-m, 5km away.

There is no available evidence to suggest that the types of noise signal associated with construction activities in the marine environment have such an impact on cetaceans to the extent that stranding and death result. However, it is generally considered that cetaceans are sensitive to the production of sound signals within the range used by them for communication and/or in situations where extremely loud noises occur. In the case of both vibropile driving and dredging, particularly dredging using a bucket dredger, the typical noise levels for these activities are significantly lower than the high intensity, mid-frequency signals associated with the use of sonar and air guns during seismic exploration and which are potentially linked to beaked whale strandings.

It is therefore considered highly unlikely that these activities pose an adverse risk to beaked whales that may be present within Aniva Bay. During the proposed works, (*i.e.* dredging and piling) the noise signals created may cause potential disturbance to any whales within relatively close proximity to the activity locations. The most likely behavioural cetacean response would

be avoidance of the area in which the noise signals reach a threshold at which discomfort or annoyance is reached. However, any noise disturbance, given the type of noise spectra and levels associated with bucket dredging and vibropiling, would be local to the area of the works and large acoustically undisturbed areas of the Bay would remain open to beaked whales if present within the Bay. It should also be borne in mind that the construction works are of a temporary nature and any disturbance and impact will be short-lived.

In the longer term, there would be an increase in vessel-generated noise associated with use of the LNG and TLU facilities in Aniva Bay and potentially ship-generated noise could have an impact upon cetaceans within the Bay.

At low frequencies (5 to 500Hz), commercial shipping is the major contributor to noise in the world's oceans. Distant ships contribute to the background noise over large geographic areas. The sounds of individual vessels are often spatially and temporally indistinguishable in distant vessel traffic noise. Ships generate noise primarily by propeller action, propulsion machinery and hydraulic flow over the hull. Overall, vessel noise covers a wide range of frequencies from 10Hz to 10kHz. A recent study of noise levels from small powerboats suggests peak spectral density levels in the 350-1,200Hz band of 145-150 dB re 1µPa^2/Hz @ 1m (Bartlett and Wilson 2002). Richardson *et. al*. (1995) report noise levels of 162dB at 630Hz (@ 1m) for a tug/barge travelling at 18km/hr, through to a large tanker with source level around 177dB (@ 1m) in the 100Hz third octave band.

Larger vessels have more powerful engines and slower-turning engines and propellers. Larger hull areas more effectively couple machinery sound from within to surrounding water. Therefore, as a rule-of-thumb, the bigger the ship, the higher the source level produced and the lower the dominant frequency range of the noise. In addition, for a given ship size and design, sound power level increases with speed.

Noise from ships may cause localised disturbance to cetaceans (and in some species act as an attractant) but direct evidence for any resulting adverse impact is difficult to determine. The increase in background noise levels in areas of high shipping activity may contribute to a reduction in the ability of some cetaceans to communicate effectively. However, the continued presence of cetaceans in many areas of high-use shipping channels suggests tolerance of and habituation to human activity and associated noise levels. For example:

- Mysticetes continue to use shipping lanes in the St. Laurence estuary and off Cape Cod, USA each year despite frequent exposure to heavy vessel traffic (Richardson *et. al*. 1995);
- Gray whales continue to migrate through heavily travelled shipping lanes and areas of seismic exploration along the West coast of North America twice a year (Richardson *et. al.* 1995);
- Baird's beaked whale is consistently sighted in the busy shipping lanes off the east coast of Japan (Kasuya and Miyashita 1997).

Existing data suggests that although present in Aniva Bay, beaked whales are unlikely to occur in significant numbers, their typical habitat being present to the east of the Bay in deeper waters. When coupled with available information on the response of cetaceans to vessel generated noise, and the intensity of such noise, it is considered highly unlikely that beaked whale populations or individuals would be adversely affected by the projected increase in vessel traffic within Aniva Bay.

Mitigation

While it is anticipated that the potential for adverse acoustic impacts to pinnipeds and cetaceans, in particular beaked whales, during construction work in Aniva Bay is very small, this potential risk can be further reduced through the implementation of appropriate mitigation measures, as set out in the SEIC 2005 Marine Mammal Protection Programme (MMPP), and in this instance would specifically include:

- The posting of Marine Mammal Observers (MMOs) on vessels, or on shore, in the construction area during dredging and piling operations. A visual watch of 30 minutes prior to the start of noise generating activities would be conducted to ensure that no cetaceans are within a pre-defined zone in which acoustic disturbance would be expected.

The implementation of relevant measures contained in the Marine Mammal Protection Plan and the use of MMOs would ensure that the potential for acoustic disturbance to cetaceans and pinnipeds, while not being completely eradicated, would be minimised using all practical and reasonable measures. Mitigation measures will be included in MMO guidelines and other specific mitigation plans, and will be listed as commitments in the Health, Safety, Environmental and Social Action Plan (HSESAP) under Offshore Biodiversity. The MMO guidance will be based on international guidelines, such as those of the International Whaling Commission (IWC) and the Joint Nature Conservation Committee, UK (JNCC), as well as international industry best practices applied elsewhere. Any additional mitigation measures that may arise from continued independent expert review and which are appropriate to the safeguard of non-Western gray whale marine mammals would be included in the SEIC Marine Mammal Protection Plan and implemented through the mechanisms set out in the Plan.

5.5.3 Cetacean Collision Risk

Certain cetacean species are susceptible to vessel collision, which is of particular concern where species are endangered and populations are at a critical level. In the project area, the two species (other than western gray whale) considered to be at potential risk from vessel collision are the North Pacific right whale and the bowhead whale. Both of these species exhibit behaviour (*e.g*. surface/skim feeding) that may make them less attentive to surrounding activity and noise and therefore more prone to collision risk (Laist *et. al*. 2001). Specific survey records for these species in the project area are sparse but right whales have been observed in the Terpeniya Bay area

(Shuntov 1994) and one was seen in this area during survey work in 2003. There are also occasional sightings of bowhead whale off northern Sakhalin and one recorded off the east Sakhalin coast. This latter species has not been sighted during survey effort associated with the project.

Laist *et al* (2001) provide a summary of historical whale collision data and note a number of general points that are pertinent to the estimation of risk.

- All sizes and types of vessels can hit whales;
- The most severe or lethal injuries are caused by ships 80m or longer;
- Whales are usually not seen beforehand or are seen too late to be avoided;
- Most severe or lethal injuries involve ships travelling 14 knots or faster.

Ship strikes can significantly affect small populations of whales, such as northern right whales in the western North Atlantic. Laist *et. al*. (2001), suggest that a crude measure of the importance of ship strikes on whale populations can be obtained by comparing data on ship strikes and the size and trend of affected whale populations. As an example they quote data for North Pacific gray whales and western Arctic bowhead whales, estimated to number 22,571 and 8,200, respectively, the populations of which have been increasing steadily for two decades or more (International Whaling Commission 1997). For gray whales, records of 12 collisions and six deaths off southern California between 1975 and 1980 are reported, while only seven of 489 gray whales stranded between Mexico and Alaska from 1975 to 1989 had apparent propeller injuries. For bowhead whales, no records were found of whales killed by ships and George *et al.* (1994) report propeller scars on only two of 236 (0.8%) carefully examined whales landed by Alaska Native whalers between1976 and 1992. Even if vessel-related deaths were several times greater than observed levels, it would therefore still only represent a small fraction of their total populations (Laist *et. al*. 2001).

Based on available data, the potential for whale-ship collisions exists within the project area. However, the level of risk is considered to be very low for those species under consideration for the following key reasons:

- The species typically involved in collisions with ships are only sporadically observed within the project area and appear to be confined to the eastern and north-eastern coasts of the Island;
- Following construction work, the majority of large vessel traffic (*i.e*. ships more likely to cause mortality) would largely be confined to routes in, and out of, Aniva Bay. The cetacean species recorded in this area would appear to be species that are not normally associated with collision risk.

Mitigation

Mitigation measures to further reduce the potential for vessel collision with cetaceans would also be employed. Such measures include the posting of Marine Mammal Observers (MMO) on vessels moving through waters in the project area where collision risk is greatest (notably in and around the north-east Sakhalin shelf) and reducing vessel speed in areas where cetaceans potentially at risk are present. Suitable mitigation measures will be included in MMO guidelines and other specific mitigation plans and will be included as commitments in the Health, Safety, Environmental and Social Action Plan (HSESAP). The implementation of these measures would ensure that the potential risk of collision, while not being completely eradicated would be minimised using all practical and reasonable measures.

5.6 SUMMARY

The potential environmental impacts of the Sakhalin II Project upon marine mammals in the waters around Sakhalin Island and the Sea of Okhotsk were assessed through a process of Environmental Impact Assessment (EIA) and reported in the *Environmental Impact Assessment Volume 2: Platforms, Offshore Pipelines and Landfalls and Volume 5: LNG & OET*. This supplementary chapter has presented additional detail to the baseline information supplied within the EIA, drawing from existing and recently published reports but also monitoring data that has become available since the EIA was published. A summary of the information presented within this chapter is included within Table 5.3, below.

Additional information has been assessed according to the criteria applied to the original EIA and is not regarded as having the potential to alter the conclusions of the original assessment or require additional mitigation and monitoring measures to be developed. It is therefore concluded that providing the mitigation measures proposed in the EIA Volume 2 are developed, incorporated into the Project's HSE management procedures and monitored to allow alterations to be made then there will be no major environmental impacts to non-WGW marine mammals and all moderate impacts will be reduced to as low as reasonably practicable levels.

Table 5.3 Marine Mammal Species, Population, Distribution, Status Information and Potential Relationship to Project Activities

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) [4]	IUCN Status [5]	Specific Sensitivities	Relation to Project Activities
Pinnipeds								
Phoca hispida ringed seal	Entire east coast. Observed regularly in Niysky, Lunsky, Chaivo and Piltun Bays but not generally within Aniva Bay	April–June	130,000	650,000-750,000		LR-lc (1996)	Cautious and considered to be easily disturbed by human activity	No specific sensitive haul out or breeding areas near to project activities
Phoca largha largha or spotted seal	Distributed along the entire east coast. Three main Sea of Okhotsk populations: • Northern: numbering approx. 215,000 • Terpeniya Bay: numbering approx. 55,000 • Kuril: numbering approx. 3,500.	January-June on ice; July–October on the coast. Concentrated in northern Sakhalin Island during the winter months	30,000-40,000	180,000-240,000		LR-lc (1996)	Sensitive to approaches by aircraft when hauled out on ice or land	No specific sensitive haul out or breeding areas near to project activities
Histriophoca fasciata ribbon seal	North-east coast with a peak from Lunsky Bay to Chaivo Bay. Ribbon seals are present within southern waters but have not generally been observed during surveys of Aniva and Terpeniya Bays	February–May	110,000	350,000-450,000		LR-lc (1996)	Considered to be easily approachable and not prone to disturbance	No specific sensitive haul out or breeding areas near to project activities

4 Status 1 = endangered and under threat of extinction; 2 = vulnerable; 3 = rare and numbers are declining; 4 = small population, numbers difficult to estimate, and/or species is at the limits of its range.

5 Codes for IUCN classifications: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; LR = Lower Risk (-cd = Conservation Dependent; -nt = Near Threatened; lc = Least Concern); DD = Data Deficient.

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) (4)	IUCN Status (5)	Specific Sensitivities	Relation to Project Activities
Erignathus barbatus bearded seal	Entire east coast. Main reproductive groups observed between Cape Elizabeth and 50°N (approx. half way down island)	February–May	60,000–75,000	200,000-250,000		LR-lc (1996)	Haul out close to the waters edge, diving immediately if disturbed	No specific sensitive haul out or breeding areas near to project activities
Callorhinus ursinus Northern fur seal	South-eastern coast of Sakhalin Island and Tyulenii Island. Small numbers observed in Aniva Bay and occasional sightings in Lunsky and Piltun Bays. Abundant at Cape Terpeniya	June–September	75,000-80,000	120,000		VU-A1b (2000)	Generally tolerant of short term disturbance associated with human activities	Breeding rookery at Terpeniya 250-400km from closest project activities
Eumetopias jubatus Steller's sea lion	Three bachelor haul outs at Kuznetsova Cape, Kamen Opasnosti Rock and Nevelsk. Breeding rookery at Tyulenii Island. Observed along the eastern and northern coasts of Sakhalin Island. Frequently observed in Aniva Bay but rarely sighted in Piltun and Lunsky Bays	March–November	>1,000	9,500-10,000	1	EN-A1b (2002)	Cautious and considered to be easily disturbed by human activity. Potentially sensitive to overflight by aircraft and helicopters. Does not tolerate repeated and intensive disturbance	Bachelor haul outs located 100-150km from activities in Aniva Bay. Rookery at Tyulenii Island located 250-400km from activities at Lunskoye and Piltun. Highly unlikely to be disturbed or adversely affected at such distances
Cetaceans								
Eubalaena japonica North Pacific right whale	East coast. Sporadic sightings, but not observed during surveys in La Perouse Strait, Aniva Bay, Cape Krilion or Cape Aniva in 1998 and	July–September	150–200	800-~900	1	EN-D (2002)	Particularly susceptible to vessel collision	No specific areas of distribution in close proximity to project activities

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) (4)	IUCN Status (5)	Specific Sensitivities	Relation to Project Activities
	2001							
Balaenoptera physalus fin whale	East coast. Potentially present in Aniva Bay, but unconfirmed to date	June–September	400–600	~2,700	2	EN-A1abd (2002)	May be susceptible to vessel collision	Potential for increased risk of collision with vessel traffic in Aniva Bay during operation of LNG/TLU
Balaenoptera acutorostrata minke whale	East coast and Aniva Bay	June–September	3 000–3 500	~19,000		LR-nt (2002)	Known to be curious which may increase the risk of collision	No specific areas of distribution in close proximity to project. However, potential for increased risk of collision with vessel traffic in Aniva Bay during operation of LNG/TLU
Eschrichtius robustus western gray whale	East coast, especially off Piltun and Chaivo Bays. Not observed within Aniva Bay	May–November	~100	~ 100-250	1	CR-D (2002)	Known to be curious which may increase the risk of collision	Feeding areas in Piltun, close to platform location and offshore pipeline construction
Delphinapterus leucas white whale	North-east coast north of Nikitski Bay. Not considered to be present within Aniva Bay	May–June	400–500	20,000–25,000		VU-A1abd (2002)	Sensitivity to disturbance (ships) in open water would be low, however, concentrations of whales along ice edges may have a higher sensitivity to shipping activity. Belugas' sensitivity to	Likely potential for disturbance is low due to presence in waters during winter months when activity levels in north-east are low. No specific areas of distribution in close proximity to project activities

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) (4)	IUCN Status (5)	Specific Sensitivities	Relation to Project Activities
							aircraft is considered to be higher in nearshore waters	
Physeter macrocephalus sperm whale	Cape Terpeniya and Cape Aniva. Rarely sighted	June–September	200–300	1,000-3,000		VU-A1bd (2002)	No specific sensitivities to shipping traffic or construction in the marine environment documented	No specific areas of distribution in close proximity to project activities
Orcinus orca orca (killer whale)	East coast, Terpeniya Bay, Aniva Bay, La Perouse Strait, Cape Aniva and Cape Krilion	June–October	300-400	2,500-3,000		LR-cd (2002)	Sensitive to short-term acoustic disturbance (*e.g.* sonar). Possible long term acoustic impacts (*e.g.* reduction in communication)	Potential short-term disturbance during construction in Piltun area, where majority of sightings are concentrated
Berardius bairdii Baird's beaked whale	Southern Sea of Okhotsk, Aniva Bay and Cape Aniva though not observed during recent surveys	June–October	250–300	1,000–1,500		LR-cd (2002)	Particular sensitivity to high intensity, mid-frequency sounds, exposure to which may lead to stranding and death	Noise associated with piling works (LNG) in Aniva Bay and increased shipping noise. However, levels and noise intensity associated with project activities unlikely to cause mortality or excessive disturbance
Ziphius	Observed during recent surveys	Summer	Not known	Not known	3	DD	Particular	Noise associated

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) [4]	IUCN Status [5]	Specific Sensitivities	Relation to Project Activities
cavirostris Cuvier's beaked whale	in northern Aniva Bay					(2002)	sensitivity to high intensity, mid-frequency sounds, exposure to which may lead to stranding and death	with piling works (LNG) in Aniva Bay and increased shipping noise. However, levels and noise intensity associated with project activities unlikely to cause mortality or excessive disturbance
Phocoenoides dalli Dall's porpoise	La Perouse Strait, Terpeniya Bay, Aniva Bay and Cape Aniva.	June–September	3,500–4,000	20,000–25,000		LR-cd (2002)	Sensitive to high intensity noise, but tolerate long term low-intensity signals. Tolerant of predictable or regular shipping activity. Probability of collision with vessels is low	Temporary exposure to increased noise levels during piling works and dredging works in Aniva Bay. Animals likely to avoid area during construction period
Phocoena phocoena harbour porpoise	East coast of Sakhalin Island, western coast of Kamchatka and north of the Shantarskie Islands	Summer	Common	Common		VU-A1cd (2002)	Sensitive to high intensity noise, but tolerate long term low-intensity signals. Generally wary of boat traffic. Probability of collision with vessels is low	Temporary exposure to increased noise levels during piling works and dredging works in Aniva Bay and construction activity in Piltun & Lunskoye areas. Animals likely to avoid areas of high acoustic energy

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) (4)	IUCN Status (5)	Specific Sensitivities	Relation to Project Activities
								during construction period
Lagenorhynchus obliquidens Pacific white-sided dolphin	Kuril Island arc, La Perouse Strait, Cape Aniva and Aniva Bay	Summer	Not known	>3,000		LR-lc (1996)	Known to be inquisitive. Sensitive to high intensity noise, but tolerant of long-term low-intensity signals. Tolerant of predictable or regular shipping activity. Probability of collision with vessels is low	Temporary exposure to increased noise levels during piling works and dredging works in Aniva Bay. Animals likely to avoid area during construction period
Delphinus delphis short-beaked common dolphin	East coast of Sakhalin Island, western coast of Kamchatka, north of the Shantarskie Islands, Aniva Bay, La Perouse Strait, Cape Aniva and Cape Krilion.	Summer	Not known	Not known		LR-lc (1996)	Sensitive to high intensity noise, but tolerant of long-term low-intensity signals. Tolerant of predictable or regular shipping activity. Probability of collision with vessels is low.	Temporary exposure to increased noise levels during piling works and dredging works in Aniva Bay and construction activity in Piltun & Lunskoye areas. Animals likely to avoid areas of high acoustic energy during construction period.
Tursiops truncatus bottlenose dolphin	Low numbers recorded in Lunsky and Aniva Bays	Summer	Not known	Not common		DD (2002)	Sensitive to high intensity noise, but tolerate long term low-intensity signals. Tolerant of	Temporary exposure to increased noise levels during piling works and dredging works in Aniva Bay. Animals likely to

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) (4)	IUCN Status (5)	Specific Sensitivities	Relation to Project Activities
							predictable or regular shipping activity. Probability of collision with vessels is low	avoid area during construction period
Globicephala macrorhynchus short-finned pilot whale	Not observed during recent surveys, but previously recorded around the Kuril Island arc, La Perouse Strait and Cape Aniva	Summer	Not known	Not known		LR-cd (2002)	Sensitive to high intensity noise, but tolerate long term low-intensity signals. Tolerant of predictable or regular shipping activity, but often shows avoidance behaviour. Probability of collision with vessels is low	No specific areas of distribution in close proximity to project activities
Lissodelphis borealis Northern right whale dolphin	Not observed during recent surveys, but previously recorded around the Kuril Island arc, southwest coast of Kamchatka, La Perouse Strait, Cape Aniva and east of Terpeniya Bay	Summer	Not known	Not known		LR-lc (1996)	Known to be susceptible to vessel collisions	No specific areas of distribution in close proximity to project activities
Balaena mystic etus bowhead whale	North and east coasts of Sakhalin Island, near the ice edge. Not recorded to the south of the island. Not known to be present outside of February and March	February–March	50-100	300–400	1	EN-D (2002)	Known to be susceptible to vessel collisions	Vessel activity in the north-east of the Island unlikely to increase significantly outside of construction period. Risk of collision

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) (4)	IUCN Status (5)	Specific Sensitivities	Relation to Project Activities
								considered very low due to presence of whale in Feb-March when shipping activity level will be low
Balaenoptera borealis sei whale	Observed close to Lunsky Bay, Poronaysk Port and Aniva Bay	Not known	Not Known	200-400	3	EN-D (2002)	Potentially prone to vessel collision. Likely to undertake avoidance action in response to approaching vessels or from harmful noise sources	No specific areas of distribution in close proximity to project activities
Kogia breviceps pygmy sperm whale	Aniva Bay, La Perouse Strait, Cape Krilion and Cape Aniva.	Not known	Not known	Not known		LR-lc (2002)	No particular sensitivities identified. However, species known to be approachable and generally sluggish at the surface. Therefore, potentially vulnerable to vessel collision. As with other small cetaceans may be sensitive to high intensity	Construction work (piling and dredging) in Aniva Bay may cause short-term disturbance

Taxon (Latin, Common Name)	Known Distribution in Sakhalin Waters and Project Area	Season of Maximum Abundance	Estimated Local Population	Estimated Population - Sea of Okhotsk	Russian RDB Status (2000) (4)	IUCN Status (5)	Specific Sensitivities	Relation to Project Activities
							sound levels	

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