Sakhalin Energy Investment Company Ltd.
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Sakhalin Energy Assets

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MARINE MAMMAL OBSERVER PROGRAMME 2018 CLOSE-OUT REPORT

ПРОГРАММА НАБЛЮДЕНИЯ ЗА МОРСКИМИ МЛЕКОПИТАЮЩИМИ В 2018 ГОДУ ЗАКЛЮЧИТЕЛЬНЫЙ ОТЧЕТ

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1 INTRODUCTION

Sakhalin Energy Investment Company Ltd. (Sakhalin Energy) was established in 1994 to develop the Piltun-Astokhskoye and Lunskoye oil and gas fields on the north-east shelf of Sakhalin Island, in the Sea of Okhotsk. 23 species of marine mammals, including 17 cetacean species (whales, dolphins and porpoises) and 6 pinniped species, can be observed in the coastal waters of the Sea of Okhotsk in the Sakhalin-2 project area. 7 of these species are listed in the Red Book of the Russian Federation: Okhotsk-Korean (western) gray whale (WGW), bowhead whale, pacific right whale, fin whale, Cuvier's beaked whale, harbour porpoise, and Steller's sea lion.

Sakhalin Energy has identified the protection of marine mammals as a high-priority task for the whole period of its oil and gas field development. In particular, the Company has focused on the conservation of western gray whales (*Eschrichtius robustus*) which feed near offshore production facilities of Sakhalin Energy during the ice-free season. This species is listed under Category 1 in the Red Book of the Russian Federation (2012). High conservation status was applied due to the small population size and low number of reproductive females. According to international expert estimates, over recent years the population has been steadily increasing by 2–5 % per year, due to which in 2018 IUCN changed the status of western gray whales in the Red List from "critically endangered" (CR) to "endangered" (EN).

Although industrial whaling was thought to have caused extinction of the WGW population (Bowen, 1974), a small number of feeding whales was identified in 1983 (Blokhin et al., 1985) in the coastal waters of Sakhalin. In 1995 studies of the WGW started under the *Agreement on Cooperation in the Field of Environmental Protection* between Russia and the USA. In 1997 Sakhalin Energy began funding the studies, which to date have produced extremely valuable information on the ecology of these whales. Since the discovery of WGW offshore the north-eastern coast of Sakhalin in 1983, the total number of known WGW has been consistently increasing from approximately 20 to over 200. As of 2018 a total number of 297 individuals have been included in the Sakhalin WGW catalogue of the Institute of Marine Biology (IMB), the Far Eastern Branch of the Russian Academy of Sciences.

In 2010–2012 a programme of whales' satellite tagging was successfully conducted using satellite telemetry performed by the A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences (IEE RAS) and the Oregon State University (OSU) Marine Mammal Institute in collaboration with the U.S. National Marine Fisheries Service, Kronotsky State Nature Biosphere Reserve, and the Kamchatka Branch of the Pacific Institute of Geography. The research was contracted through the International Whaling Commission (IWC) and International Union for Conservation of Nature (IUCN) with funding from Exxon Neftegas Ltd. (ENL) and Sakhalin Energy Investment Company Ltd.

During the study period, several whales were tagged. In 2010, one gray whale known as Flex (Belokhvost—"White Tail") was tagged near the north-east coast of Sakhalin. According to the satellite data, after the summer the whale migrated to the North American coast and reached the coast of central Oregon. In 2011 tags remained on two out of six tagged whales by the time of migration; these two whales followed the same route made by Flex a year before. The most representative example was the migration of Varvara. After tagging and wintering near the coast of California, this whale returned to Sakhalin for feeding in 2012. The data gathered to date indicates that the whales feeding near the north-eastern coast of Sakhalin and the individuals observed near the North-American coast may represent one common Pacific population of gray whales consisting of 20,000 individuals.

Sakhalin Energy adheres to the requirements of the ***Marine Mammal Protection Plan (MMPP)***, first issued in 2003. The Plan was updated in 2018 in line with Russian and international requirements based on updated information on marine mammals and international best practices (Sakhalin Energy, 2018a). The Plan defines general measures for protection of gray whales and other species within the areas of the Company activities. In general, these measures include:

- identification of protected zones (Piltun and Offshore feeding areas, see below);
- establishment of vessel corridors (navigation, construction, etc.);
- regulation of the acceptable distance between mammals and vessels (minimum distance) depending on the types of activities and animals;

- limitation of the maximum vessel speed.

A crucial condition for implementation of the above measures is the Marine Mammal Observers Programme which has been executed by Sakhalin Energy since 2003. Marine Mammal Observers (MMO) who stay on board of main vessels employed on offshore operations:

- record all marine mammals' sightings and where possible identify the species, their location, numbers, and behaviour;
- give advice on practical measures to avoid collisions with marine mammals; and
- record the cases of any injured or dead animals and where possible identify the reasons for injury or death.

This information is used to assess the adequacy of protection measures and their adjustment.

1.1 GOALS AND OBJECTIVES

In order to minimise the risk of marine mammal collision during offshore activities, regular observation is carried out from Sakhalin Energy vessels. The results of the analysis of observations in 2018 are presented in this report.

The objectives of the report include presentation and discussion of the following issues:

- overview of mitigation measures employed by Sakhalin Energy and used by MMOs to reduce the risk of collision between vessels and marine mammals (Section 2);
- qualification and preparation of MMOs (Section 3);
- the list of Sakhalin Energy offshore activities during the year which required MMO support (Section 4);
- the analysis of the applied mitigation measures efficacy (Section 5); and
- overview of observation data and factors affecting the detectability of marine mammals (Section 6).

The report also separately presents the results of marine mammal observations by MMO from Polar Baikal and Polar Piltun vessels in transport corridors from the Kaigan Port to LUN-A, PA-A, and PA-B platforms in 2017-2018 and an assessment of the impact of increased vessel speeds on collision risk (Appendix 1).

2 OVERVIEW OF RISKS AND MITIGATION MEASURES

2.1 POTENTIAL RISKS

The main aspects of the Sakhalin-2 Project activities that can potentially impact marine mammals are: anthropogenic noise, accidental oil spills, and the risk of collisions with vessels. The document “Analysis of Risks for Western Gray Whales (*Eschrichtius robustus*) from Shipping Traffic Associated with the Sakhalin-2 Project” developed by Sakhalin Energy (Sakhalin Energy, 2006) builds the foundation for the Marine Mammal Protection Plan (MMPP) (Sakhalin Energy, 2018a). This describes the measures applied by Sakhalin Energy to mitigate the risk of collisions with whales and other marine mammals. A summary of these measures is presented below.

2.2 COLLISION MITIGATION MEASURES

Gray whale collision mitigation measures were developed according to the recent data on their migration, distribution in the coastal waters, and behaviours.

The number and distribution of gray whales in Sakhalin waters has been studied during the feeding, ice-free period, i.e. approximately from June until November, depending on the season. Two main feeding areas are known in the north-eastern coast of the island: a shallow coastal area adjacent to Piltun Bay (Piltun feeding area) and a deeper sea area adjacent to Chaivo Bay (Offshore feeding area), which are shown on the whale density map (Fig. 2.1). The Piltun feeding area is located in the immediate vicinity of the Sakhalin Energy license area, which places the whales close to industrial activities and vessel traffic.

Collision mitigation measures are described in Sakhalin Energy MMPP. In general, the risk of vessel-whale collisions can be effectively mitigated by:

- control of vessel routes;
- control of vessel speed;
- establishment of an exclusion zone for the vessels;
- setting the limitations for vessels operating in feeding areas;
- deployment of Marine Mammal Observers;
- development of the procedure for vessel response in case of the collision risk;
- briefing and training for vessel crews.

Although there is a low likelihood of a vessel-whale collision in the vicinity of the platforms, the pipeline routes, and along the designated vessel routes, the mitigation measures, included in the MMPP, continued to be employed in 2018 to further reduce this risk.

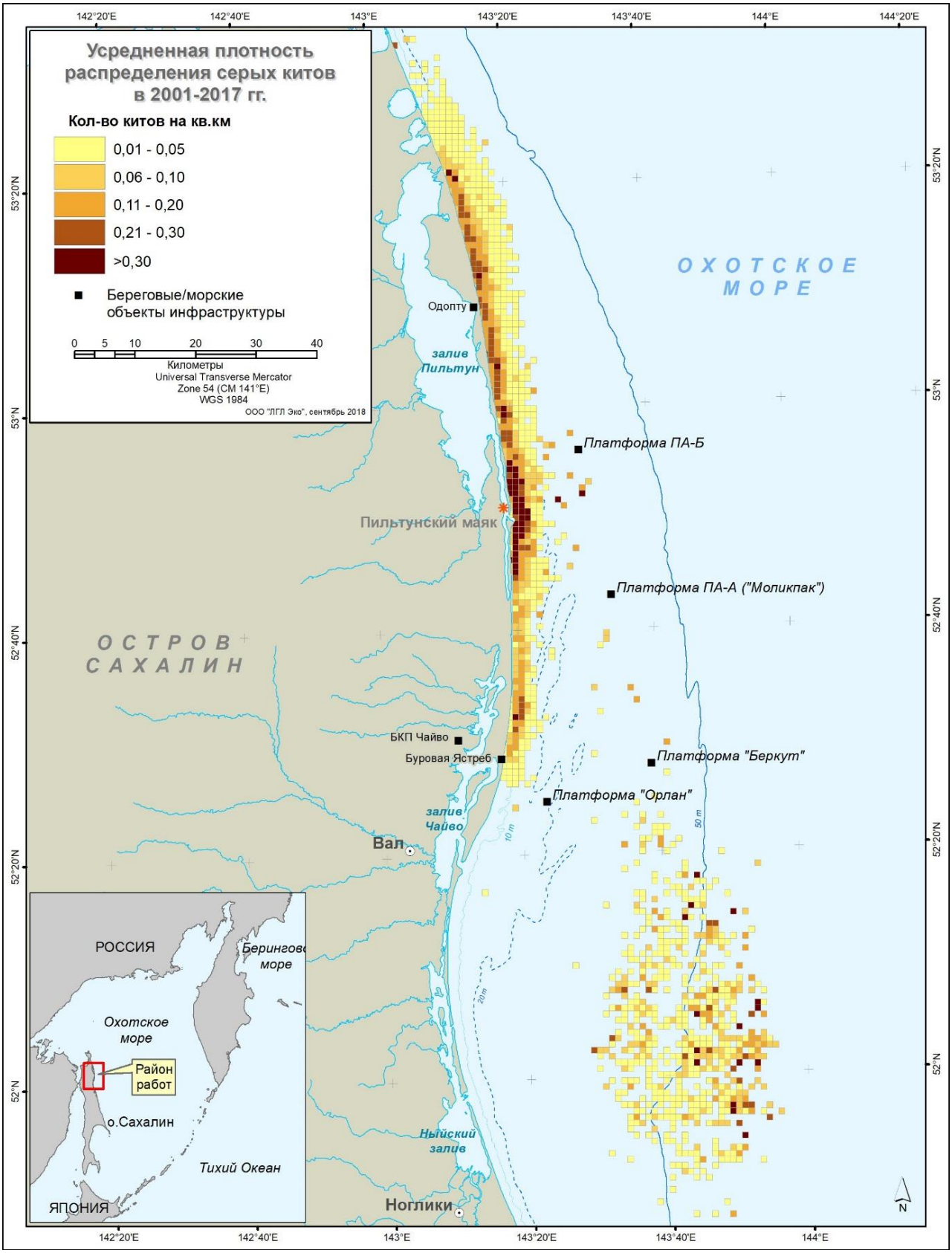


Fig. 2.1. Gray whale densities at the north-eastern coast of Sakhalin Island

2.2.1 Control of Vessel Routes

As in previous years, vessels were not allowed to enter the Piltun and Offshore feeding areas (Fig. 2.1) unless it was essential for safety, monitoring, or other purposes, subject to making a request and obtaining an authorisation.

Special vessel corridors have been established for all Sakhalin Energy vessel traffic along the eastern coast of Sakhalin Island. All Sakhalin Energy vessels were required to stay within the designated corridors, unless deviation from this course was essential for safety reasons or a special request and an authorisation were obtained.

The following corridors were determined:

- crew transfer corridors for crew change vessels travelling from the Kaigan Port to LUN-A, PA-A, or PA-B platforms (Fig. 2.2 and 2.3);
- navigation corridors for all vessels transiting from Kholmsk and Korsakov to Lunskoye and Piltun areas (Fig. 2.2 and 2.3); and
- pipeline inspection corridor for all vessels involved in offshore pipeline inspection and offshore environmental monitoring. For example, dynamic positioning vessels equipped with sonar systems and remotely operated vehicles (ROV) should follow the established navigation corridors while on transit and the pipeline inspection corridors during work execution. Other examples include research vessels that perform environmental monitoring (Fig. 2.3).

In addition to the above-mentioned corridors, a safety zone with a radius of 5 km has been established around all the three platforms. As a rule, supply and rescue vessels drift or are anchored in this area. Vessels without an affiliation with Sakhalin Energy are not allowed to enter this zone, which is guarded by emergency response and rescue vessels (Fig. 2.3).

2.2.2 Speed Limitation

The speed limitations established in 2018 are given in Table 2.1. Vessels are obliged to avoid sudden changes in speed and course (other than for safety reasons). In agreement with the Western Gray Whale Advisory Panel (WGWAP), a test speed increase from the previous 21 knots up to 35 knots was established within the transport corridors when the visibility was ≥ 1 km during daylight hours in the period of 2017–2018 for catamaran-type crew change vessels shuttling from the Kaigan Port to PA-A, PA-B, and LUN-A platforms. The following additional measures were applied on each of these vessels:

- A CCTV system (FullHD outdoor cameras with recording feature) was installed to monitor the sea surface.
- Purpose-built equipment has been installed for recording GPS, speed, and acceleration of the vessels.
- Observations were conducted by two Marine Mammals Observers (MMOs) simultaneously in all voyages.

Where necessary, an analysis was made of video materials and GPS records received from the installed equipment.

Table 2.1. Vessel speed limitation

Conditions	Crew transfer corridor	Within navigation corridors	Westward from corridors[1] and within inspection and PA-A/PA-B approach corridors
Daylight conditions and visibility ≥ 1 km	35[2] knots	17 knots	10 knots
Visibility < 1 km or at night	21 knots	17 knots	7 knots

2.2.3 Zonal Division of Eastern Sakhalin Coastal Waters

In order to compare different zones of marine mammal observations, Sakhalin Energy operational area was arbitrarily divided into four separate areas: Piltun, Lunskoye, Aniva Bay, and transit areas. Given the large size of the last area, it was divided into four observation areas: The North Transit area (between the Piltun and the Lunskoye areas), The Middle Transit area (from the Lunskoye area to the Terpeniya Bay), The South Transit area (from the Terpeniya Bay to the Aniva Bay) and the area south of Sakhalin (Fig. 2.4). In addition, observations in the coastal waters west of Sakhalin Island are grouped as belonging to a separate area west of Sakhalin.

Non-transiting[3] vessels should maintain course and speed unless there is an imminent risk of collision. If a whale is observed near the vessel and there is a risk of collision, the vessel is required to stop (if safe to do so), until the risk of collision with the whale has passed.

[1] Speed limits westward from the corridors (towards areas where encounters with WGW are more likely) are to be adhered to in all cases, unless the emergencies or safety considerations require otherwise.

[2] Test speed increase as agreed with the Western Gray Whale Advisory Panel (WGWAP) for the period of 2017–2018.

[3] Transiting vessels move between ports, usually Kaigan or Kholmsk, and the Sakhalin Energy offshore areas. Non-transiting vessels move between platforms within the Sakhalin Energy offshore areas.

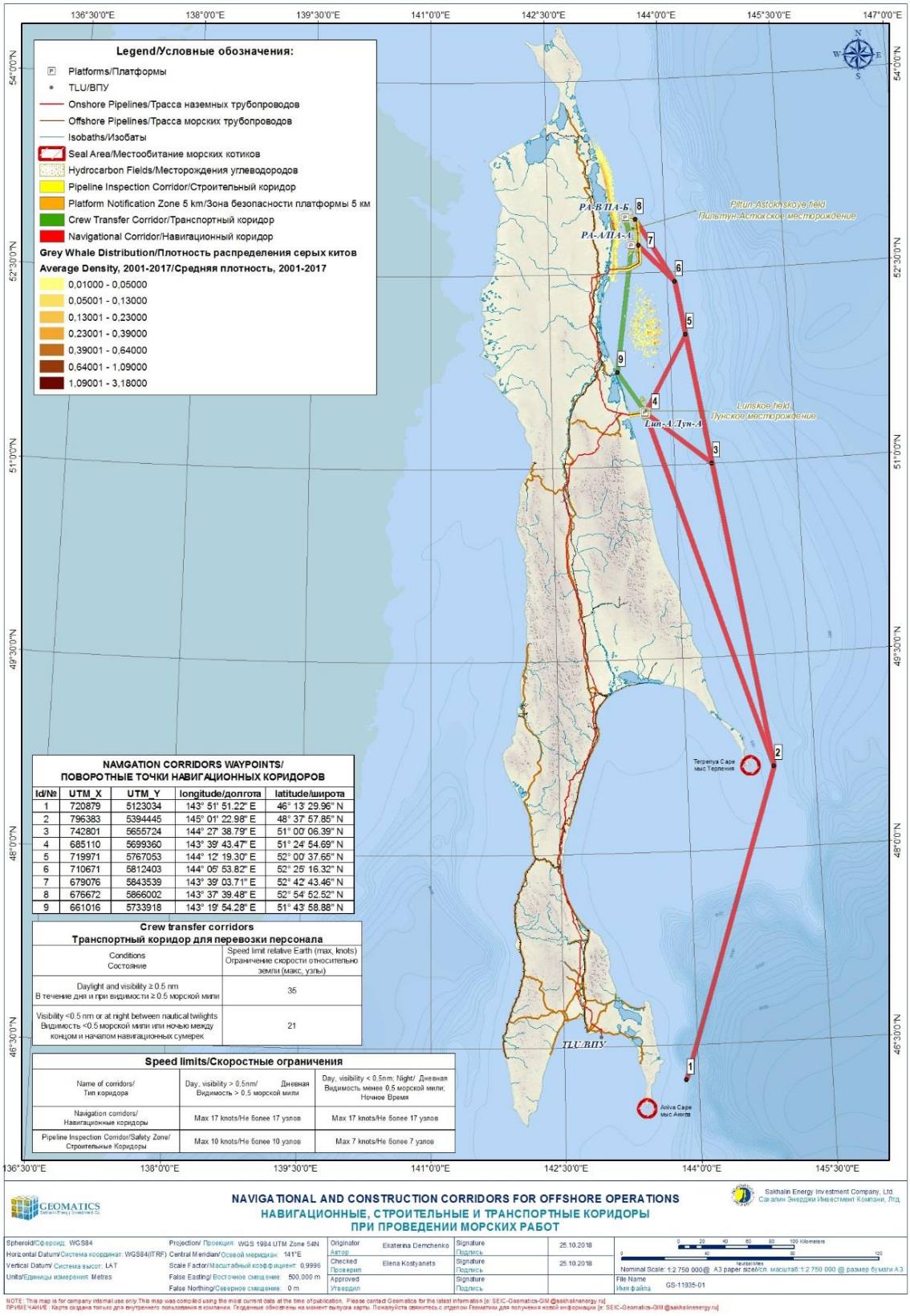


Fig. 2.2. Corridors for the vessels involved in offshore activities related to the Sakhalin-2 Project

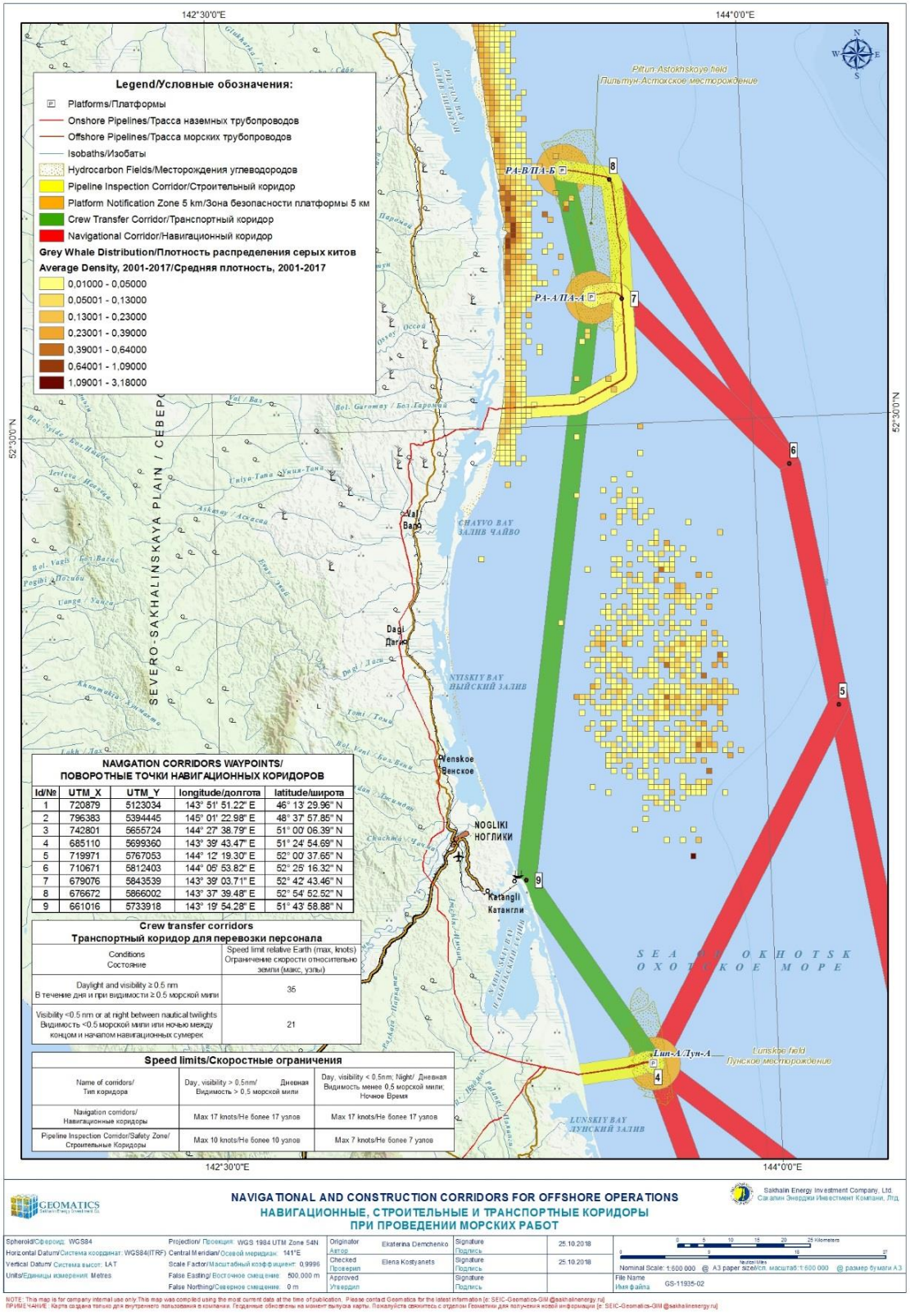


Fig. 2.3. Diagram of navigation, inspection, and crew transfer corridors in Piltun and Lunskoye areas

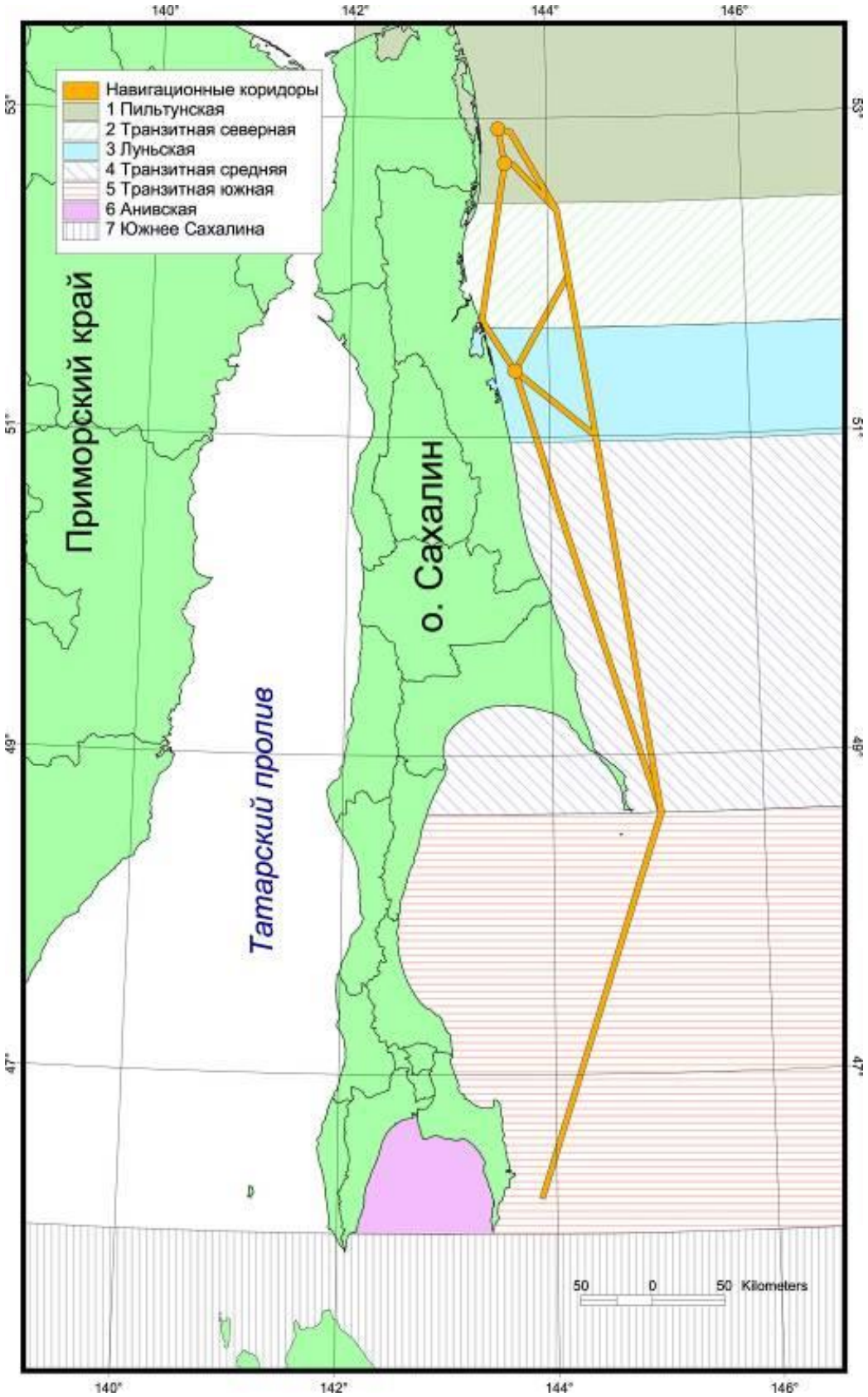


Fig. 2.4. Diagram of zonal division of eastern Sakhalin coastal waters

2.2.4 Marine Mammal Observers

Sakhalin Energy MMPP requires trained MMOs to be present on each of the main vessels[4] involved in offshore activities along the eastern coast of Sakhalin Island and to constantly watch for gray whales and other marine mammals. The number of MMOs assigned to each vessel depends mainly on duration and area of operations, as well as the type of activities conducted by the vessel.

MMO duties and scope of responsibilities are outlined below.

- Maintain diligent and systematic watch for marine mammals during daylight hours for the whole period of operational activities.
- Advise the Vessel Master (Sakhalin Energy representative) about practical measures that may be taken to avoid possible collision with a marine mammal sighted within insufficient safety distance[5]. This might include change of course, reduction of speed, or full stop of the vessel, if this can be done safely.
- Record location and number of marine mammals sighted, as well as their behaviour, where possible. This data may be used to improve mitigation measures. Upon detecting marine mammals, records shall be made on the standard data recording form. In addition, the records shall be made every 30 minutes, whether or not a marine mammal was sighted.
- Record all actions taken to mitigate the risk of collision and note the respective timings.
- Observe the area in the vicinity of the vessel for 30 minutes prior to start of noisy operations.
- Immediately report collision between vessel and marine mammal to the Sakhalin Energy representative aboard and to the MMO Programme Coordinator, record the event in a Marine Mammal Mortality-Injury Report.
- Where necessary, remind the Vessel Master to adhere to navigation, inspection, and other established corridors, to comply with the speed limits, especially in night hours and under poor visibility conditions, and not to traverse known feeding areas of gray whales unless it is essential for safety reasons, subject to making a request and obtaining an authorisation.
- Before anchoring, the MMO shall conduct a visual search of the area to make sure that this operation will not endanger any marine mammal.

Protocols

MMOs perform continuous observation of gray whales and other marine mammals during daylight hours. The observation is conducted when the Beaufort Sea State is 5 or less[6]. Since continuous observation is an exhausting task under often adverse weather conditions, its duration is restricted to four hours, after which the MMO takes a break for a minimum of two hours.

If the MMO needs to leave the post, he/she warns the bridge staff about his/her absence. If marine mammals are detected during this time, the MMO is required to continue observation; the MMO can only leave if another MMO replaces him/her. If several marine mammals are present in the area, all MMOs aboard the vessel shall be called on for observation.

The MMO shall be stationed on the highest observation post available on the vessel. Observations of a 180° sector of the sea surface shall be made mostly by naked eye, alternated with binocular scans[7] at regular intervals. When a marine mammal is detected, binoculars shall be used to confirm the sighting and to identify the species, its distance from the vessel, and direction of movement. Where whales are

[4] "Main vessel" is defined as a vessel that has a high probability of a whale encounter or that provides the most appropriate base for marine mammal observations during the planned activity.
[5] Safety distance of 1 km is used for endangered whale species (WGW, bowhead whale, North Pacific right whale, fin whale); safety distance of 0.5 km is set for other whales, dolphins, and porpoises; although safety distances are not specified for pinnipeds, vessels are required to proceed with caution.
[6] The Beaufort scale defines force 5 as 17–21 knots wind speed, 1.8 to 2.8 m waves, many white caps, and some spray.
[7] The binoculars in use are Fujinon 7X50 FMTRC-SX or similar types.

sighted in front of the vessel, the MMO immediately informs the bridge and advises on precautions to avoid collision.

The MMO records the observation results every 30 minutes regardless of whether marine mammals have been sighted. Records are made using data codes describing the vessel operations and speed, coordinates and course, time, sea state, visibility, species and number of marine mammals, their movements and activities, and if relevant, the distance between the vessel and the animals.

At the end of each day of observation, the MMO enters the data from the paper data recording forms into a Microsoft Access database. A daily report is then sent to the Sakhalin Energy MMO Programme Coordinator. The daily report summarises the data on marine mammal species detected, their number and distance from the vessel, time of day, location, and the vessel speed. It also describes all collision mitigation measures that were applied. Weekly reports are also sent to the MMO Programme Coordinator.

In addition, the MMO records the GPS track of the vessel in one-minute intervals using a hand-held GPS navigator.

Upon the voyage completion, MMOs receive a de-briefing by the MMO Coordinator and submit all paper data forms, electronic databases, and a brief summary of observations during the voyage in a close-out report.

Further details on protocols are included in the MMO Manual (Sakhalin Energy, 2018b), in the MMPP (Sakhalin Energy, 2018a), and in the Marine Operating Procedures and Methodical Recommendations (Sakhalin Energy, 2010).

2.2.5 Control of Vessel Movements

Transiting vessels are required to maintain, where possible, a minimum distance of 1,000 m from the detected whales belonging to endangered species (western gray whale, bowhead, Northern right whale, and fin whale); in addition, they should maintain a distance of 500 m from other non-endangered marine mammals. No minimum separation distance is established for pinnipeds, but vessels shall proceed with appropriate caution if pinnipeds are sighted close to the vessel.

If a whale surfaces in the vicinity of the vessel or moves towards it, the vessel is required to take all possible precautions to avoid collision until the collision risk has passed.

The MMPP forbids any vessel to pursue, intercept, encircle whales, or separate groups of whales.

Vessels are also required to avoid proceeding directly in front of moving or stationary whales, and when moving parallel to whales, vessels should maintain constant speed and course.

3 MARINE MAMMAL OBSERVERS

3.1 QUALIFICATION OF MARINE MAMMAL OBSERVERS

In 2018, six Marine Mammal Observers (MMOs) were employed within routine activities on the vessels engaged in Sakhalin Energy offshore operations in the license areas and during transits to these areas. All MMOs had relevant experience, either gained on Sakhalin Energy vessels or doing other activities related to marine mammal observations in this region. All MMOs have a university degree in biology, and two MMOs hold a Ph.D. degree in biology.

3.2 TRAINING PROGRAMME

The MMO's roles and responsibilities are described in the MMO Manual (Sakhalin Energy, 2018b). This manual is a working document and amended annually to reflect changes to the Sakhalin Energy MMPP and in response to comments and proposals put forward by MMOs and other stakeholders with regard to the implementation of the MMO Programme. The main objectives of the MMO Manual are to:

- serve as a training manual for the MMO Programme;
- provide guidance and reference information to the trained MMOs participating in Sakhalin Energy offshore activities;
- provide information to vessel operators and vessel crews with regard to the Marine Mammal Observer roles and responsibilities.

The following documents were provided to MMOs and used during the field season:

- Marine Mammal Observers Manual;
- Database Instruction Manual (2009);
- brief guidance for identification of marine mammals in Sakhalin waters;
- data code table; and
- data recording forms.

3.3 ORGANISATION AND METHODS

This document provides no detailed description of the MMO work arrangement, monitoring protocols, communication or reporting structure. The detailed description is provided in the Marine Mammal Observers Manual (Sakhalin Energy, 2018b).

4 OBSERVATION PROGRAMME

4.1 OFFSHORE OPERATIONS

In 2018, Sakhalin Energy performed offshore activities in the Piltun-Astokhskoye and Lunskoye areas. Activities which required vessel support and could potentially pose a risk of marine mammals' collision are described below.

Piltun-Astokhskoye Area

The operations in the Piltun-Astokhskoye area included hydrocarbon production using platforms PA-B and PA-A. These activities were also supported by supply vessels shuttling between Kholmsk and the platforms, emergency response and rescue vessels (ERR) and oil spill response (OSR) standby vessels located between PA-A and PA-B platforms. (In accordance with the MMPP mandatory presence of marine mammal observers (MMOs) on these vessels during routine works is not required). Crew change vessels shuttled between the Kaigan Port and the platforms. Gennady Nevelskoy vessel was involved in environmental monitoring around the offshore pipeline and platforms.

In addition to routine operations in 2018, a 4D seismic survey was carried out in the Piltun-Astokhskoye license area with the involvement of a main geophysical vessel and support vessels.

Lunskoye Area

As a part of the production programme, supply vessels, ERR and OSR vessels worked in the Lunskoye area. Environmental monitoring was conducted around the offshore pipeline and the platform. Crew change vessels shuttled between the Kaigan Port and the platform. In addition to routine operations in 2018, a 4D seismic survey was also carried out in the Lunskoye license area.

The results of marine mammal observations carried out onboard the seismic vessels are provided in a separate report.

Aniva Bay

Aniva Bay was used as a transit area on vessel routes to the Sakhalin Energy license areas on the north-eastern coast of Sakhalin. Activities in Aniva Bay included tanker traffic to and from TLU through La Perouse Straight, as well as traffic of tug and line boats, OSR vessel, and survey vessel. In accordance with the MMPP mandatory presence of marine mammal observers (MMOs) on these vessels is not required.

4.2 VESSEL AND MMO DEPLOYMENT

The SCF Endurance, SCF Endeavour, SCF Enterprise, and Gennady Nevelskoy supply vessels alternately made voyages between Kholmsk and the Sakhalin Energy license areas. The vessels were ordered to strictly follow the navigation corridors.

Polar Piltun and Polar Baikal platform crew change vessels made voyages between the Kaigan Port and PA-A, PA-B, and LUN-A platforms.

Fyodor Ushakov, Stepan Makarov and Evgeny Primakov standby vessels performing the OSR functions and providing support and accommodation to crews were permanently stationed between PA-A and PA-B platforms.

Gennady Nevelskoy vessel was involved in sampling for environmental monitoring.

In accordance with the Marine Mammals Monitoring Programme (MMMP), observers were present and conducted regular monitoring from two crew change vessels, as well as Gennady Nevelskoy vessel operating near the feeding areas of gray whales (for the implementation of the Environmental Monitoring Programme).

In the navigation period of 2018, observation was carried out from three vessels. In total, the observation of marine mammals lasted 111 vessel days (27 to 42 days on different vessels). The number of working days per month is given in Table 4.1.

Table 4.1. The total number of working days by MMOs in 2018

Vessel	May	June	July	August	September	October	November	Total
Gennady Nevelskoy						15	12	27
Polar Baikal		3	16	15	4	4		42
Polar Piltun		2	17	14	6	3		42
Total days:	0	5	33	29	10	22	12	111
Share:	0.00	4.50	29.73	26.13	9.01	19.82	10.81	100

In general, over the entire period of operations, the average number of working days per month on all vessels was 18.5 days. This value differed significantly from month to month: from 5 days in June to 33 days in July. During this period observations were conducted from Polar Baikal and Polar Piltun vessels. The difference in number of working days was due to weather conditions. There were difficult ice conditions on the north-eastern coast of Sakhalin and in the navigational routes area until the end of June. The work duration of MMOs (in hours) on these vessels is given in Table 4.2.

Table 4.2. Total number of observation hours in 2018

Vessel	Time, hours		
	Sightings	Breaks in observations	
		Hours	Share, %
Gennady Nevelskoy	255:15	0:0	0
Polar Baikal	201:28	11:45	5.83
Polar Piltun	276:14	4:25	1.60
Total:	732:57	16:10	2.21

Within the reporting period, the observations have lasted 733 hours. The total duration of breaks in the observations was approximately 16 hours (about 2 % of the total time). These were mainly due to specific distribution and abundance observations of gray whales in the offshore feeding area (a component of the Joint Program scope of work), the results of which are presented in a separate report. Types of vessel activities and MMOs' schedules of work are given in Table 4.3.

Table 4.3. Vessel activities and the list of Marine Mammal Observers, 2018

Vessel	Area and type of activity	Names of MMOs	Date of commencement	Date of completion
Gennady Nevelskoy	Piltun/Lunskoye/: environmental monitoring	D. Nam, A. Doroshenko	17.10.	12.11.
Polar Baikal	Piltun/Lunskoye: crew change	V. Kavun, I. Timokhin, A. Pogonyshev, V. Romancheev	20.06.	12.10.
Polar Piltun	Piltun/Lunskoye: crew change		19.06.	07.10.

Four MMOs were engaged in the observations from the Polar Piltun and Polar Baikal vessels. In total, Polar Piltun and Polar Baikal made 31 voyages from Kaigan Port to LUN-A and back; 27 voyages from Kaigan Port to PA-A and back; and 26 voyages from Kaigan Port to PA-B and back (Table 4.4).

Table 4.4. Number of voyages for crew change vessels, 2018

Area	Number of voyages		
	Polar Baikal	Polar Piltun	Total
Kaigan–LUN-A–Kaigan	5	26	31
Kaigan–PA-A–Kaigan	16	11	27
Kaigan–PA-B–Kaigan	21	5	26
Total	42	42	84

For each area, the number of observation hours was counted depending on the weather conditions (no observations were conducted during storm) and the daylight hours (Table 4.5).

Table 4.5. Number of observation hours in 2018

Area of operations	Observations (hours)							
	May	June	July	August	September	October	November	Total
Area 0—West of Sakhalin						13.50	1.75	15.25
Area 1—Piltun		13.00	60.87	51.00	11.50	56.50	61.75	254.62
Area 2—North Transit		21.78	103.63	88.32	28.20	18.92	8.50	269.35
Area 3—Lunskoye		4.00	28.17	24.10	9.72	27.50	4.67	98.15
Area 4—Middle Transit						13.50	21.33	34.83
Area 5—South Transit						22.00	10.75	32.75
Area 6—Aniva						20.50		20.50
Area 7—South of Sakhalin						7.50		7.50
Total:	0.00	38.78	192.67	163.42	49.42	179.92	108.75	732.96

Most of the total observation time was in the North Transit area (37 %), Piltun area (35 %), and Lunskoye area (13 %). In general, the observation time in these three areas accounted for 85 %. The remaining five areas accounted for 1 to 5 %.

5 COLLISION MITIGATION MEASURES

The responsibility for marine mammals' collision mitigation measures was assigned to the MMOs, the Sakhalin Energy representatives, the masters and the crew members of the vessels leased by Sakhalin Energy. The Vessel Masters were obliged to follow the Sakhalin Energy Marine Operating Procedures and Methodical Recommendations (Sakhalin Energy, 2010) including the mitigation measures from the Marine Mammal Protection Plan.

The main role of MMOs was to inform the Vessel Master on the presence of marine mammals and to advise on actions to be taken if marine mammals were sighted within insufficient safety distance. These mitigation measures can include speed reduction, course change, or full stop of the vessel. The effectiveness of these measures depends on the reliability, the coordination and the responsiveness of the MMOs and the team as well as their ability to identify the animals and determine their species.

5.1 ADHERENCE TO VESSEL CORRIDORS

In 2018, MMOs were on board of 3 vessels (Table 4.1). MMOs took the records of the vessel position every 30 minutes or whenever a marine mammal was sighted. In total, MMOs have recorded over 1,800 vessel coordinates, which were used to map the voyage tracks. Using these records, the MMO Programme Coordinator checked the compliance of vessel movement with the designated corridors. Routes and coordinates were mapped for a daily report to check the compliance with the designated routes within the corridors.

In addition, observers on each vessel were equipped with GPS navigators (Garmin GPSMAP 60CSx). GPS tracks were recorded with one-minute intervals. After each voyage, MMOs downloaded the recorded tracks from the GPS to a computer and sent them to the MMO Coordinator. This GPS data was used when more thorough analysis of possible deviations from corridors was required.

Whenever the deviations were identified, the MMO Programme Coordinator had to initiate investigations to determine the reason for these deviations.

In general, the compliance of movement within the corridors, unless the vessel mission required otherwise, is considered satisfactory. Most of the vessel tracks were inside the platform crew change corridors and navigation corridors (Fig. 5.1–5.3).

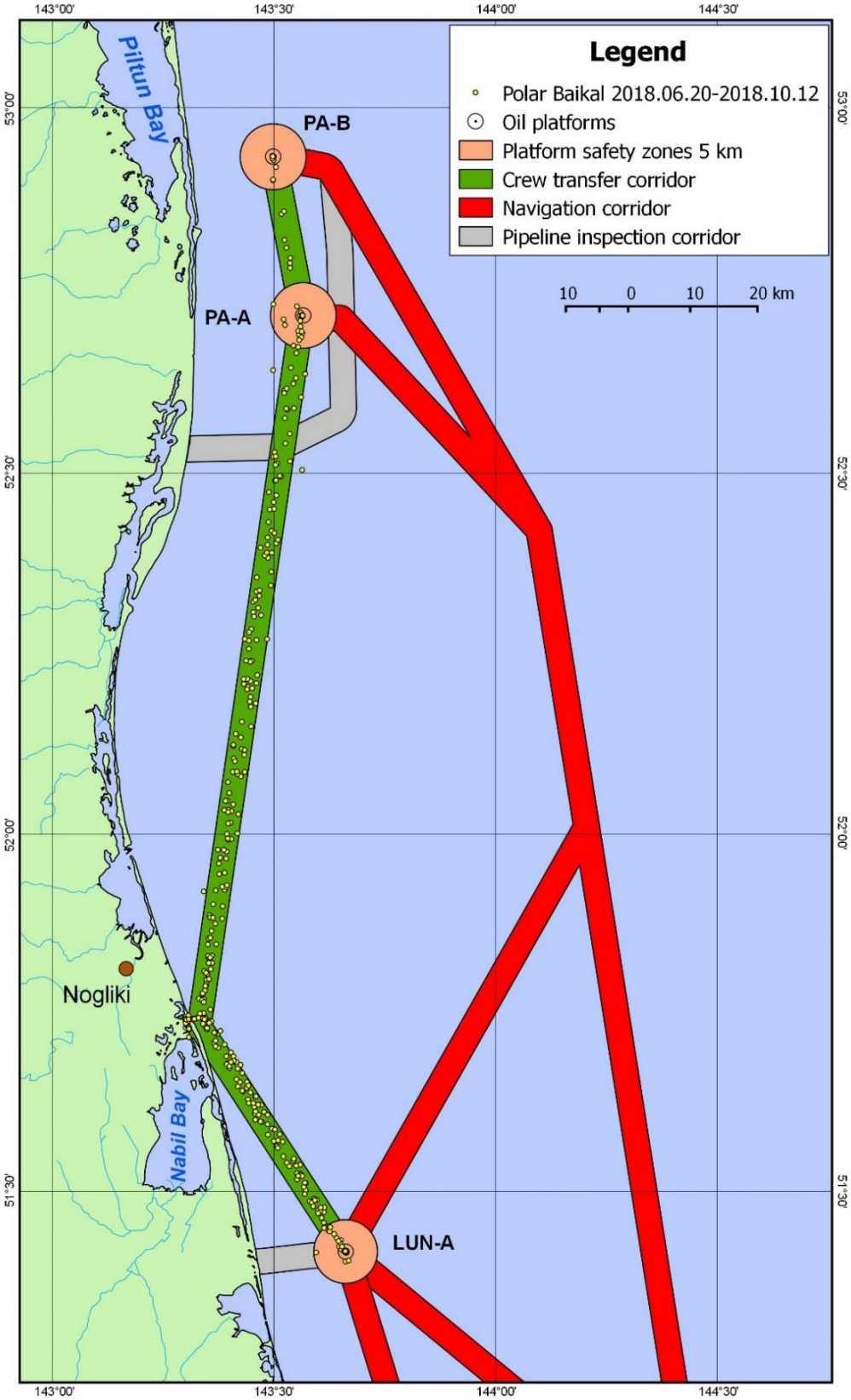


Fig. 5.1. Routes of Polar Baikal crew change vessel

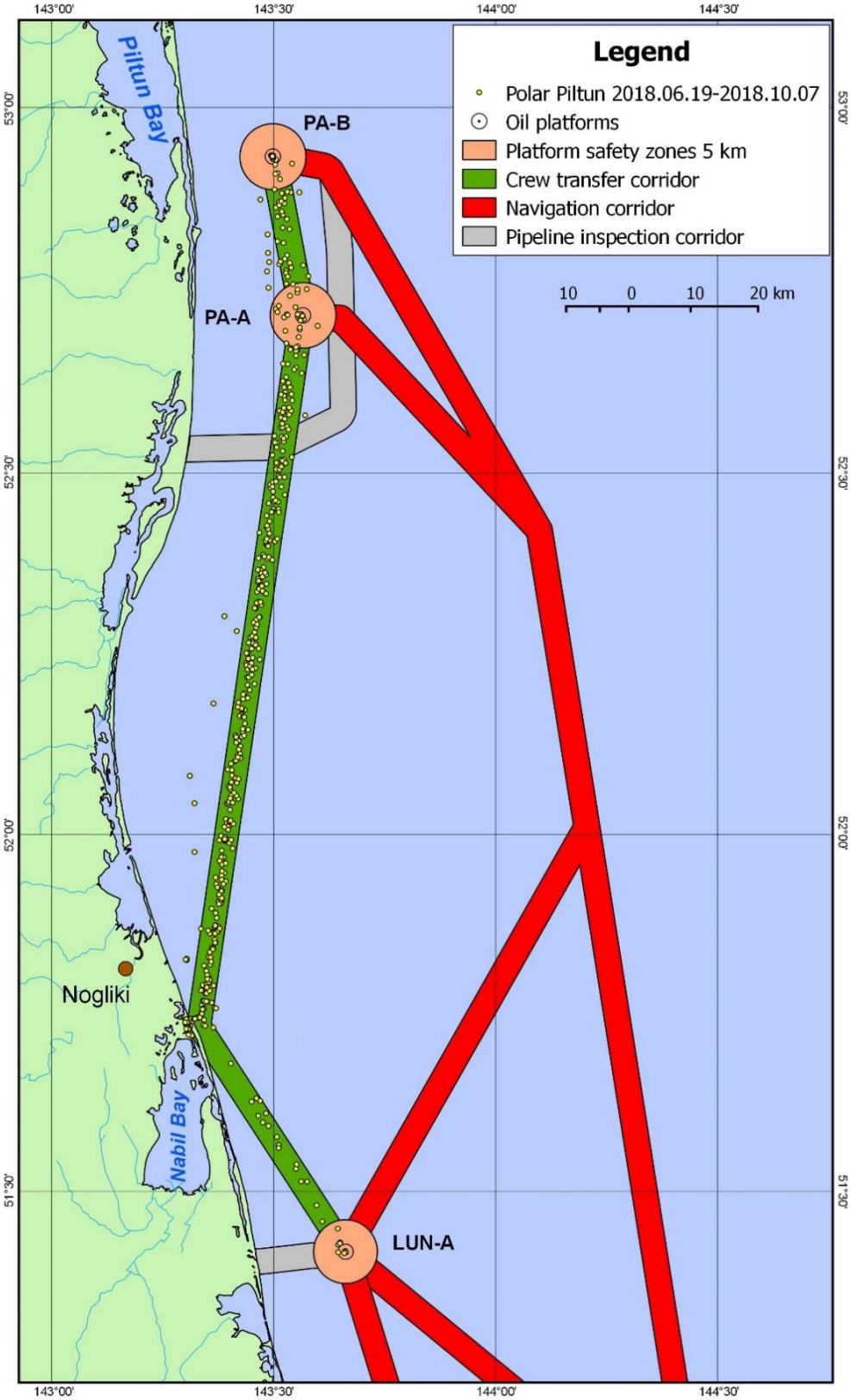


Fig. 5.2. Routes of Polar Piltun crew change vessel

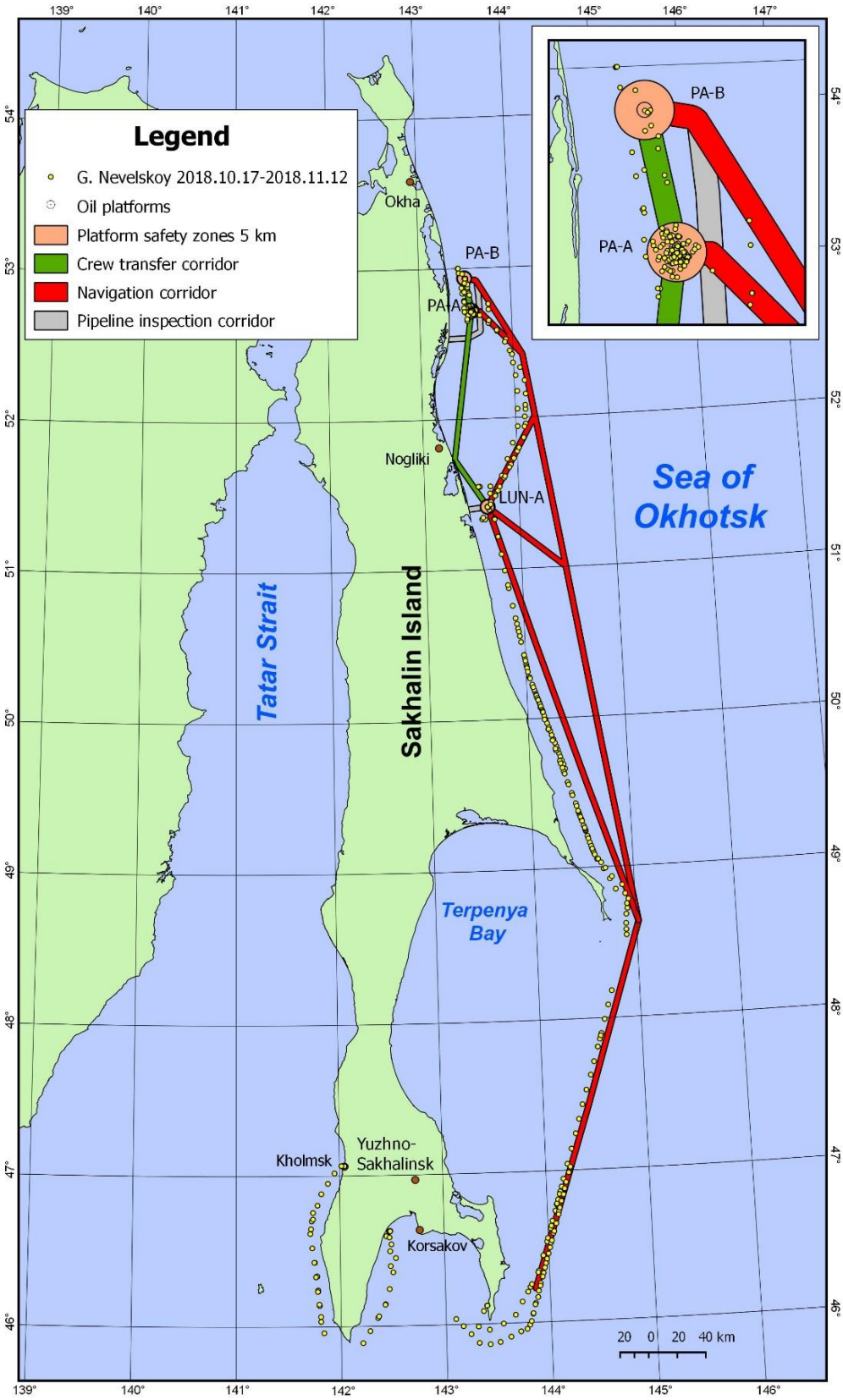


Fig. 5.3. Routes of Gennady Nevelskoy research vessel, environmental monitoring operations

Duration of vessels deviation from the designated corridors is given in Table 5.1.

Table 5.1. Duration of deviations from corridors in 2018

Vessel	Total time of observations	Duration of deviation from the corridor	Share of total time, %
Gennady Nevelskoy	255:15	122:42	48.07
Polar Baikal	201:28	4:28	2.22
Polar Piltun	276:14	13:0	4.71
Total:	732:57	140:10	19.12

The vessels stayed outside the corridors for 140 hours or one-fifth of the total observation period.

The contributions of the vessels to the total time spent outside corridors varied significantly. Gennady Nevelskoy vessel stayed outside the corridors over 48 % of the total time. This was due to the fact that this vessel carried out environmental monitoring with related operation areas and sampling locations being located outside the established corridors. Part of the deviations from the corridors was also due to navigation safety reasons during adverse weather conditions, since voyage of the vessel took place during autumn storms.

On average, Polar Baikal and Polar Piltun high-speed vessels deviated from the corridors for 3.8% of their total observation time. The total time of staying outside the corridors was less than 5 % for Polar Piltun and 2.2 % for Polar Baikal. Their deviations from the corridors were related to the navigation rules for avoiding a collision with third parties' vessels, special monitoring of gray whales whose aggregation areas are located outside the corridors (Offshore feeding area), as well as emergency response and personnel evacuation training (joint actions with helicopters).

5.2 COMPLIANCE WITH THE SPEED LIMITS

No cases of exceeding speed limits were recorded during the entire observation period in 2018.

5.3 OBSERVATION RESULTS AND MEASURES TAKEN

5.3.1 Gray Whales

In 2018, during the Sakhalin Energy offshore operations, 25 encounters with gray whales were recorded from the vessels with MMO's onboard, with a total of 40 individuals identified (Tables 5.2, 5.3, fig. 5.4).

Encounters with gray whales have been reported by MMOs onboard all the three vessels. More than 80 % of gray whale encounters were reported during three months: in July (20 %), August (44 %) and September (20 %). The largest number of records (13 out of 25, or 52 %) were made from Polar Piltun vessel and 8 records (32 %) were made from Polar Baikal vessel, which was due to the fact that observations from these vessels were conducted during the entire ice-free navigation season, from June through October (Table 5.2). 4 records of gray whales were made from Gennady Nevelskoy vessel. All these encounters occurred not in traditional feeding areas off the north-eastern coast. Gray whales were observed on 11 November 2018 on the way back from the operation area to Kholmsk Port (Southern Sakhalin) during navigation in the corridor from Terpeniya Bay to Aniva Bay.

Table 5.2. Gray whales' sightings by months, 2018

Vessel	Sightings by months							
	May	June	July	August	September	October	November	Total
Gennadiy Nevelskoy							4	4
Polar Baikal			1	4	3			8
Polar Piltun			4	7	2			13
Total:	0	0	5	11	5	0	4	25

The distance of whales sighted by MMOs varied within 0.2–8 km, with an average of 1.7 km. There were 15 encounters at a distance, which is equal to or less than the safe distance; in one case, the vessel was drifting, so there was no need to take measures to reduce impact (Table 5.3). In all other cases at the specified distances impact reducing measures were taken. In 11 cases, the vessel changed the course and in one case the vessel reduced the speed. In one case, when observing a gray whale straight ahead of the vessel at a distance of 0.3 km, MMOs initiated full stop of the vessel. During the entire ice-free navigation season there were no encounters with gray whales that posed a risk of collision. Thus, in 2018, presence of MMOs on the vessels allowed to take timely measures to minimise risk of collision or an adverse impact on gray whales.

Table 5.3. Gray whale encounters from the vessels during Sakhalin Energy offshore operations in 2018

							Coordinates						
Number of ind.	Date	Time	Vessel*	Angle (from the track line)	Distance (m)	Behaviour	Latitude			Longitude			Were any measures taken?
2	11.11	09:34	GN	30	5000	FD	144	35	55	47	53	2	No
3	11.11	09:42	GN	60	8000	FD	144	34	89	47	51	67	No
2	11.11	10:00	GN	60	4500	FD	144	33	48	47	48	60	No
1	11.11	10:00	GN	180	4500	FD	144	33	48	47	48	60	No
1	27.07	17:20	PB	120	1500	FD	143	21	21	51	47	88	No
1	3.08	09:35	PB	300	800	FD	143	33	83	51	31	30	Course change
1	3.08	09:54	PB	60	400	FD	143	27	57	51	38	2	Course change
1	4.08	10:35	PB	270	2000	FD	143	31	4	52	51	31	No
3	17.08	15:00	PB	300	1500	FD	143	33	50	52	42	96	No
1	12.09	12:37	PB	270	2000	FD	143	22	75	51	43	52	No
3	23.09	11:07	PB	90	600	FD	143	21	11	51	49	83	Course change
2	28.09	18:30	PB	180	2000	FD	143	20	47	51	44	90	No
1	8.07	13:14	PP	60	3000	FD	143	30	80	52	29	65	No
1	25.07	10:53	PP	330	700	BR	143	21	47	51	49	69	Deceleration
1	25.07	13:30	PP	30	300	FD	143	33	91	52	42	94	No
1	30.07	14:18	PP	0	700	FD	143	22	69	51	54	69	Course change
1	3.08	14:36	PP	300	1000	FD	143	20	20	51	46	94	Course change
1	14.08	10:39	PP	60	200	FD	143	20	78	51	46	69	Course change
3	18.08	09:17	PP	90	600	FD	143	31	90	52	46	17	Course change
3	27.08	16:42	PP	300	500	FD	143	31	79	52	50	88	Course change
1	27.08	16:45	PP	300	500	FD	143	31	46	52	52	16	Course change
1	27.08	17:00	PP	270	300	FD	143	29	84	52	56	5	Full stop of the vessel
3	27.08	17:57	PP	0	700	FD	143	31	23	52	50	17	Course change
1	24.09	18:44	PP	210	1000	FD	143	20	12	51	44	82	No
1	27.09	12:55	PP	270	300	FD	143	20	72	51	46	81	Course change

*Vessels; GN – Gennady Nevelskoy, PB - Polar Baikal, PP - Polar Piltun

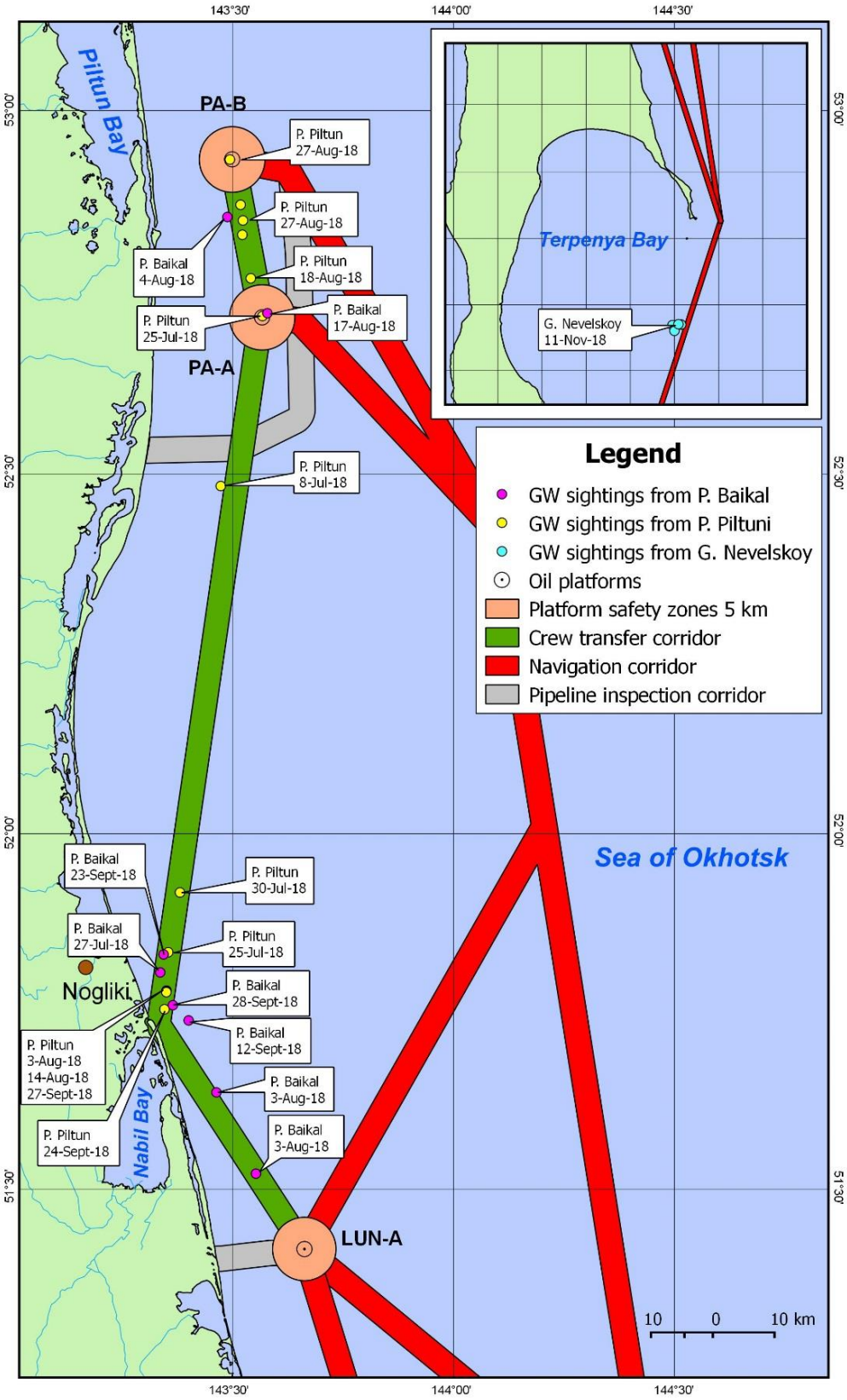


Fig. 5.4. Locations of gray whales sightings recorded by MMOs

5.3.2 Fin Whales

Over the entire period of observation in 2018 there were no encounters with fin whales.

5.3.3 Other Cetaceans

In 2018, four other species of cetaceans were recorded:

- Minke whale;
- Killer whale;
- Dall's porpoise;
- Harbour porpoise.

In 60% of the cases (48 out of 80), these cetacean species were observed at a distance of 500 m or less (i.e. equal to or less than the established safety distance). With this, a significant range of these values for different species was noticed. While the average encounter distance for all species was about 600 m, the average distance to the killer whales was about 2,300 m. Almost 70 % of porpoise encounters (harbour and Dall's) (24 out of 35) occurred at a distance of ≤ 500 m. This is quite typical for dolphins due to their high speed and lack of obvious avoidance of vessels, as well as their small sizes (it is more difficult for MMOs to notice these animals at a large distance).

Table 5.4 presents the statistics of marine mammals' movement observations. When considering the direction of movement of these species in relation to the vessel, two types of their movement were observed most often—away from the vessel (63.7%) and parallel to its course (33.7%). These types of movements are identified as the main ones and occurred in a total of 98 % of all the sightings.

Table 5.4. Cetaceans sightings from the vessels during Sakhalin Energy offshore operations in 2018

Species	Number of sightings	Number of sightings in a distance of ≤ 500 m	Visibility ≤ 500 m	Movement	Away from the vessel	Parallel to the vessel	Toward the vessel	Thrash	No movement	Unknown
Minke whale	43	24	0		26	16	1	0	0	0
Killer whale	2	0	0		1	1	0	0	0	0
Harbour porpoise	30	21	0		20	9	0	1	0	0
Dall's porpoise	5	3	0		4	1	0	0	0	0

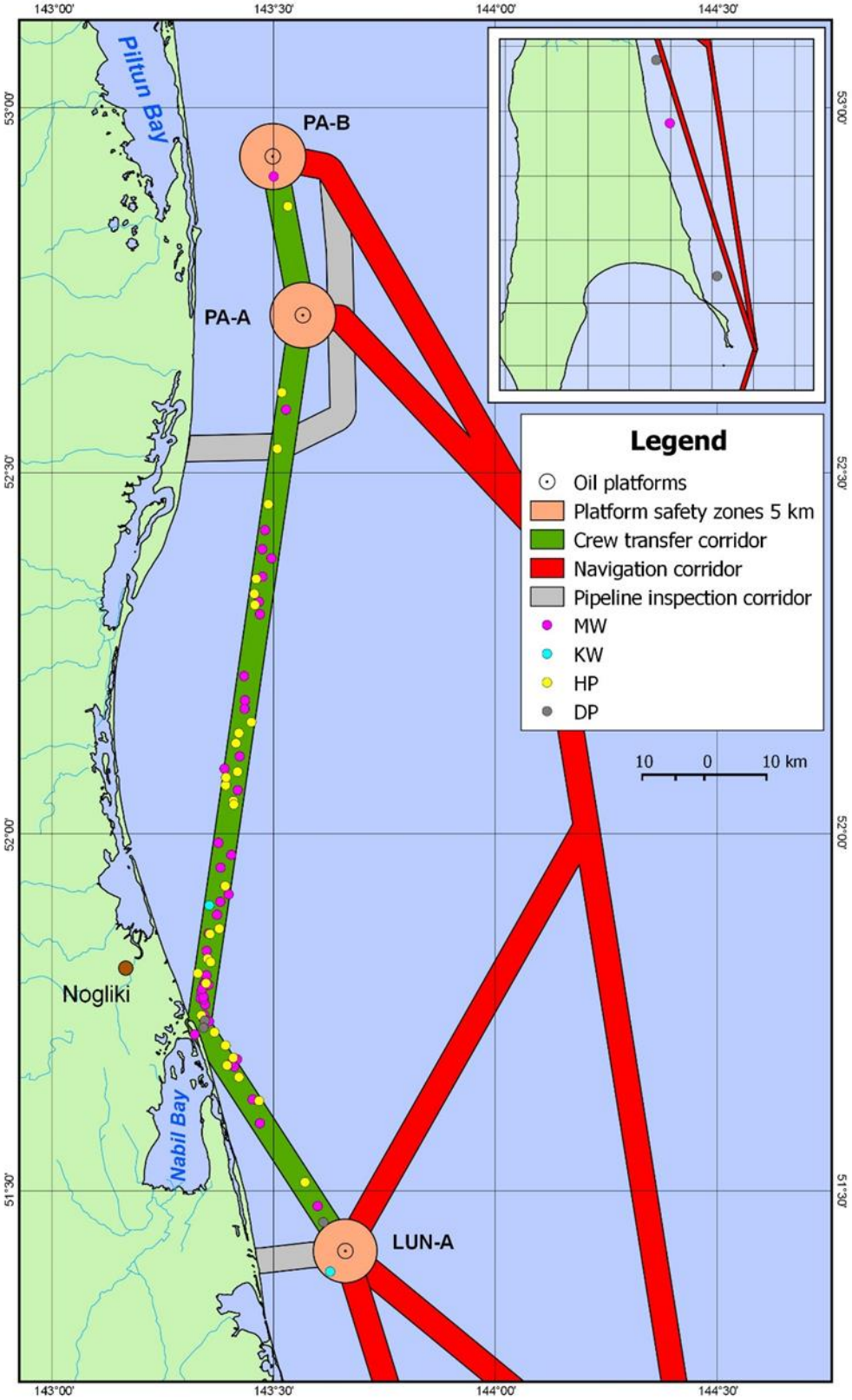


Fig. 5.5. Location of recorded cetaceans' sightings

Below is a description of measures taken, arranged by types of mitigating the impact on all marine mammals observed in 2018 (Table 5.5). MMOs have reported a total of 238 encounters with marine mammals, including gray whales. 105 observations out of them were of cetaceans. In some cases, no measures were required to avoid the collision as the animals were moving parallel to the vessel course or away from the vessel. Although no cases of near collision with marine mammals were recorded, in 61 cases measures for mitigation of impact were taken in order to avoid possible collision with whales and dolphins.

Full stop was used once for mitigating the impact on marine mammals in 2018. The deceleration measure was taken four times: in one case with a gray whale and in three cases during Minke whale encounters. In all other cases (56 out of 61), the vessels changed their course to mitigate the impact on marine mammals.

Table 5.5. Measures taken in 2018 to mitigate the impact on marine mammals

Species	Number of measures taken				
	Deceleration	Full stop of the vessel	Course change	Course change and deceleration	No mitigation measures were taken.
GW	1	1	11		12
MW	3		21		19
KW					2
HP			21		9
DP			3		2
SL					5
NF					49
SS					72
RS					7
TOTAL	4	1	56	0	177

Note. Species: GW—gray whale, MW—Minke whale, KW—killer whale, DP—Dall's porpoise, HP—Harbour porpoise, SL—Steller 's sea lion, NF—northern fur seal, RS—ringed seal, SS—spotted seal.

6 OBSERVATION PROGRAMME EFFICACY

The number of observations depends on various factors, the most significant being the number of animals present in coastal waters, observation effort determined by the number of vessels and MMOs (i.e. the total number of observation hours and the number of observations per time unit), and weather conditions.

6.1 GENERAL DESCRIPTION OF SIGHTING STATISTICS

During the field season from 19 June to 12 November 2018, a total of 238 marine mammal sightings were recorded by MMOs (total 1,572 animals), including 105 encounters with cetaceans and 133 encounters with pinnipeds. Table 6.1 provides a summary of the recorded marine mammals. Five species of cetaceans and four species of pinnipeds were recorded. The Minke whale, the gray whale and the harbour porpoise were the most frequently observed cetaceans; as regards to pinnipeds, the most frequently observed species were the spotted seal and the northern fur seal.

Table 6.1. Total number of marine mammal sightings and total number of marine mammals in 2018

English name	Latin name	Code	Number of sightings	Number of animals
Gray whale	*Eschrichtius robustus*	GW	25	40
Minke whale	*Balaenoptera acutorostrata*	MW	43	43
Killer whale	*Orcinus orca*	KW	2	8
Dall's porpoise	*Phocoenoides dalli*	DP	5	8
Harbour porpoise	*Phocoena phocoena*	HP	30	55
Steller's sea lion	*Eumetopias jubatus*	SL	5	5
Northern fur seal	*Callorhinus ursinus*	NF	49	74
Spotted seal	*Phoca largha*	SS	72	1332
Ringed seal	*Phoca hispida*	RS	7	7
Total			238	1572

Among the cetaceans recorded in 2018, two species are listed in the Red Book of the Russian Federation. Gray whale (*Eschrichtius robustus*) is listed under Category 1 (endangered species) and harbour porpoise (*Phocoena phocoena*) is listed under Category 4 (species with uncertain status)[8].

Among the pinnipeds recorded in 2018, the Steller's sea lion (*Eumetopias jubatus*) is listed under Category 2 in the Red Book of the Russian Federation. In total, 5 encounters with Steller's sea lions (5 individuals) were recorded (see Table 6.1); in the reporting period, the Steller's sea lion, as usual, was recorded in this region by observers less often than the northern fur seal (72 encounters and 1,332 individuals), which was often reported in accumulation of 10-30 species or more mostly at the mouth of Nabil Bay, at exit of personnel carrying vessels from the port of Kaigan.

6.2 NUMBER OF OBSERVATIONS BY MONTHS

Since the number of vessels with observers aboard and the duration of their activities varied per area and per month, the numbers of observed animals were compared by month and area (Table 6.2).

In 2018, spotted seal (0.098 encounter/hour), northern fur seal (0.067 encounter/hour), Minke whale (0.059 encounter/hour), harbour porpoise (0.041 encounter/hour), and gray whale (0.034 encounter/hour) were observed most frequently.

[8] See http://www.sevin.ru/redbook.

Table 6.2. Number of marine mammal sightings in relation to the observation period (number of sightings/total monthly hours of observation) in 2018

Species *	Area**	Total		May	June	July	August	September	October	November	Total
		sighting	hours								
DP	4	2	34.83	0.000	0.000	0.000	0.000	0.000	0.148	0.000	0.057
DP	2	2	269.35	0.000	0.000	0.010	0.011	0.000	0.000	0.000	0.007
DP	3	1	98.15	0.000	0.000	0.000	0.000	0.103	0.000	0.000	0.010
DP	Total:	5	732.950	0.000	0.000	0.005	0.006	0.020	0.011	0.000	0.007
GW	5	4	32.75	0.000	0.000	0.000	0.000	0.000	0.000	0.372	0.122
GW	3	2	98.15	0.000	0.000	0.000	0.083	0.000	0.000	0.000	0.020
GW	2	10	269.35	0.000	0.000	0.029	0.023	0.177	0.000	0.000	0.037
GW	1	9	254.62	0.000	0.000	0.033	0.137	0.000	0.000	0.000	0.035
GW	Total:	25	732.950	0.000	0.000	0.026	0.067	0.101	0.000	0.037	0.034
HP	3	4	98.15	0.000	0.000	0.036	0.083	0.103	0.000	0.000	0.041
HP	2	23	269.35	0.000	0.092	0.048	0.136	0.106	0.053	0.000	0.085
HP	1	3	254.62	0.000	0.000	0.016	0.020	0.000	0.000	0.016	0.012
HP	Total:	30	732.950	0.000	0.052	0.036	0.092	0.081	0.006	0.009	0.041
KW	3	1	98.15	0.000	0.000	0.000	0.000	0.103	0.000	0.000	0.010
KW	2	1	269.35	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.004
KW	Total:	2	732.950	0.000	0.000	0.000	0.006	0.020	0.000	0.000	0.003
MW	4	1	34.83	0.000	0.000	0.000	0.000	0.000	0.074	0.000	0.029
MW	3	6	98.15	0.000	0.000	0.071	0.000	0.206	0.073	0.000	0.061
MW	1	2	254.62	0.000	0.000	0.000	0.039	0.000	0.000	0.000	0.008
MW	2	34	269.35	0.000	0.000	0.096	0.215	0.142	0.053	0.000	0.126
MW	Total:	43	732.950	0.000	0.000	0.062	0.129	0.121	0.022	0.000	0.059
NF	2	1	269.35	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.004
NF	5	7	32.75	0.000	0.000	0.000	0.000	0.000	0.136	0.372	0.214
NF	4	39	34.83	0.000	0.000	0.000	0.000	0.000	2.889	0.000	1.120
NF	3	2	98.15	0.000	0.000	0.000	0.041	0.103	0.000	0.000	0.020
NF	Total:	49	732.950	0.000	0.000	0.005	0.006	0.020	0.233	0.037	0.067
RS	2	7	269.35	0.000	0.000	0.019	0.057	0.000	0.000	0.000	0.026
RS	Total:	7	732.950	0.000	0.000	0.010	0.031	0.000	0.000	0.000	0.010
SL	1	5	254.62	0.000	0.000	0.016	0.020	0.000	0.018	0.032	0.020
SL	Total:	5	732.950	0.000	0.000	0.005	0.006	0.000	0.006	0.018	0.007
SS	2	69	269.35	0.000	0.230	0.280	0.249	0.213	0.370	0.000	0.256
SS	4	1	34.83	0.000	0.000	0.000	0.000	0.000	0.000	0.047	0.029
SS	1	2	254.62	0.000	0.000	0.000	0.000	0.000	0.018	0.016	0.008
SS	Total:	72	732.950	0.000	0.129	0.151	0.135	0.121	0.044	0.018	0.098

* Table 6.1 shows the correspondence of the codes with marine mammal species names.

**Areas: Area 0—West of Sakhalin, Area 1—Piltun, Area 2—North Transit, Area 3—Lunskoye, Area 4—Middle Transit, Area 5—South Transit, Area 6—Aniva, Area 7—South of Sakhalin.

6.3 WEATHER CONDITIONS

Weather conditions play an important role in sighting marine mammals. Data were therefore grouped according to favourable and unfavourable weather conditions. Favourable weather conditions were defined as those where (a) visibility was ≥ 1 km, and (b) sea state was ≤ 3 on the Beaufort scale. Weather conditions that did not meet any of these criteria or their combination during the observation period were considered unfavourable.

During the reporting year, the observations were mostly performed in favourable visibility conditions (92.48%). The observations in unfavourable weather conditions constitute less than 10% of the total duration of observations (Table 6.3).

Table 6.3. Visibility conditions during observation in 2018, by areas of operations

Area of operations	Hours		Share, %	
	< 1 km	≥ 1 km	< 1 km	≥ 1 km
Area 0—West of Sakhalin	0.25	15.00	1.64	98.36
Area 1—Piltun	20.00	234.62	7.85	92.15
Area 2—North Transit	16.62	252.73	6.17	93.83
Area 3—Lunskoye	5.67	92.48	5.77	94.23
Area 4—Middle Transit	8.87	25.97	25.45	74.55
Area 5—South Transit	0.75	32.00	2.29	97.71
Area 6—Aniva	3.00	17.50	14.63	85.37
Area 7—South of Sakhalin		7.50		
Total:	55.15	677.80	7.52	92.48

The sea swell did not significantly affect the course of observation in 2018; the duration of observations during the sea swell considered favourable for observation (3 or less on the Beaufort scale) constituted 80 % (see Table 6.4).

The prevalence of favourable weather conditions during the monitoring period (visibility and sea state) is mainly because a decision to use Polar Baikal and Polar Piltun vessels for personnel transportation (observations from which provided most of the data obtained by MMOs in 2018) was only made in case of forecast favourable weather conditions, due to safety.

Table 6.4. Sea swell during observation in 2018, by areas of operations

Area of operations	Hours		Share, %	
	≤ 3	> 3	≤ 3	> 3
Area 0—West of Sakhalin	1.75	13.50	11.48	88.52
Area 1—Piltun	201.37	53.25	79.09	20.91
Area 2—North Transit	259.35	10.00	96.29	3.71
Area 3—Lunskoye	90.48	7.67	92.19	7.81
Area 4—Middle Transit	8.83	26.00	25.36	74.64
Area 5—South Transit	12.75	20.00	38.93	61.07
Area 6—Aniva	8.00	12.50	39.02	60.98
Area 7—South of Sakhalin	4.00	3.50	53.33	46.67

Total:	586.53	146.42	80.02	19.98

The ratio of records made in favourable and unfavourable weather conditions depends greatly on the area and the month (Fig. 6.1–6.8).

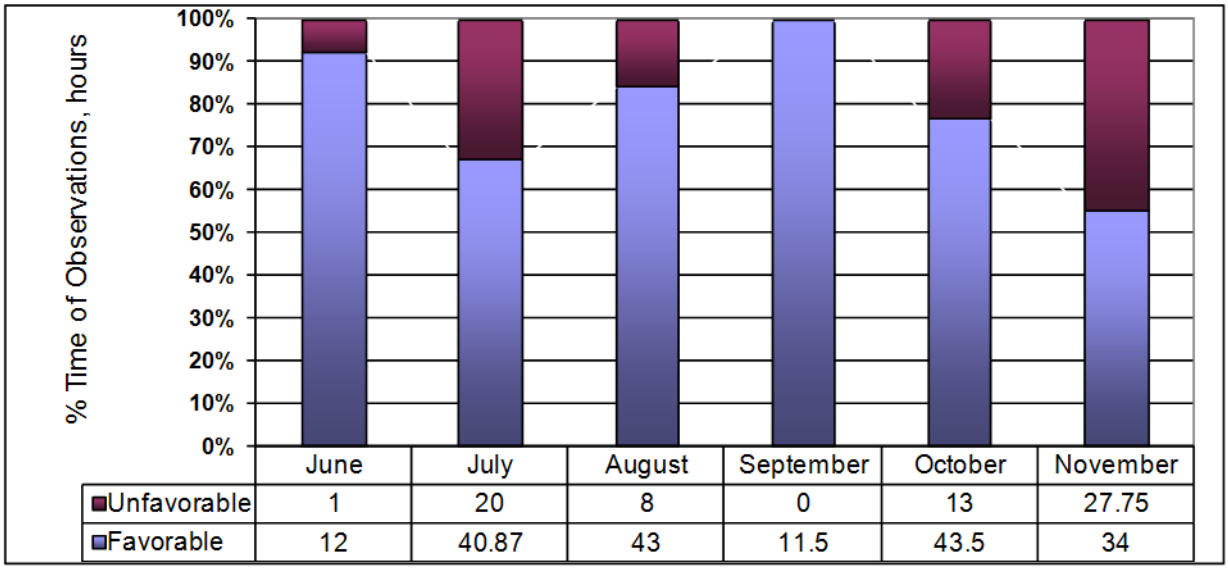


Fig. 6.1. Ratio of favourable and unfavourable weather conditions in area 1—the Piltun Area

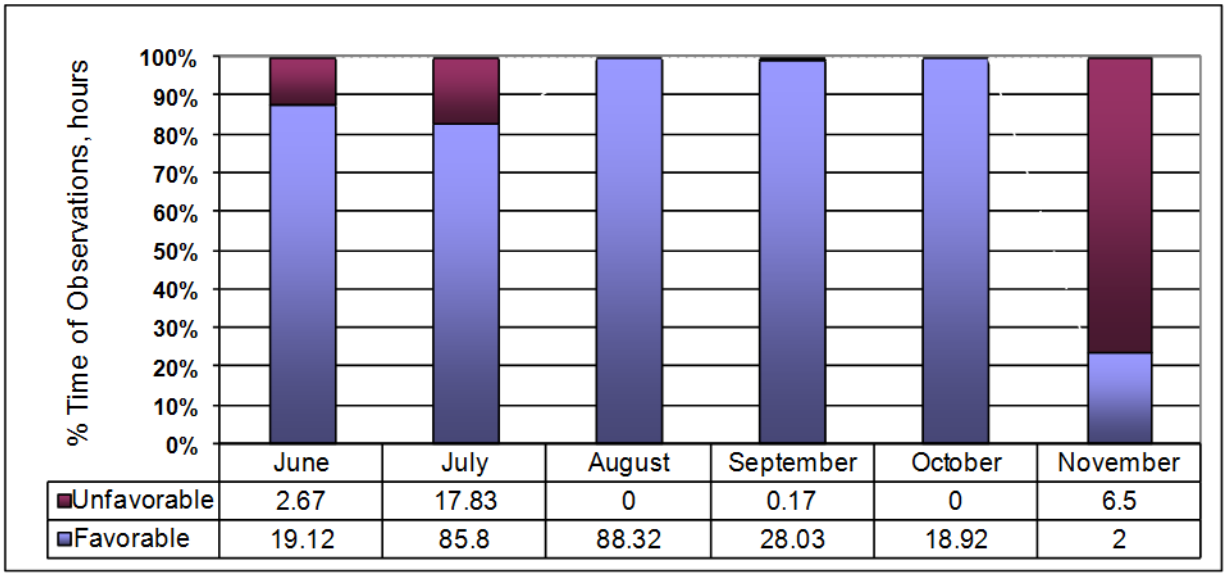


Fig. 6.2. Ratio of favourable and unfavourable weather conditions in area 2—the North Transit Area

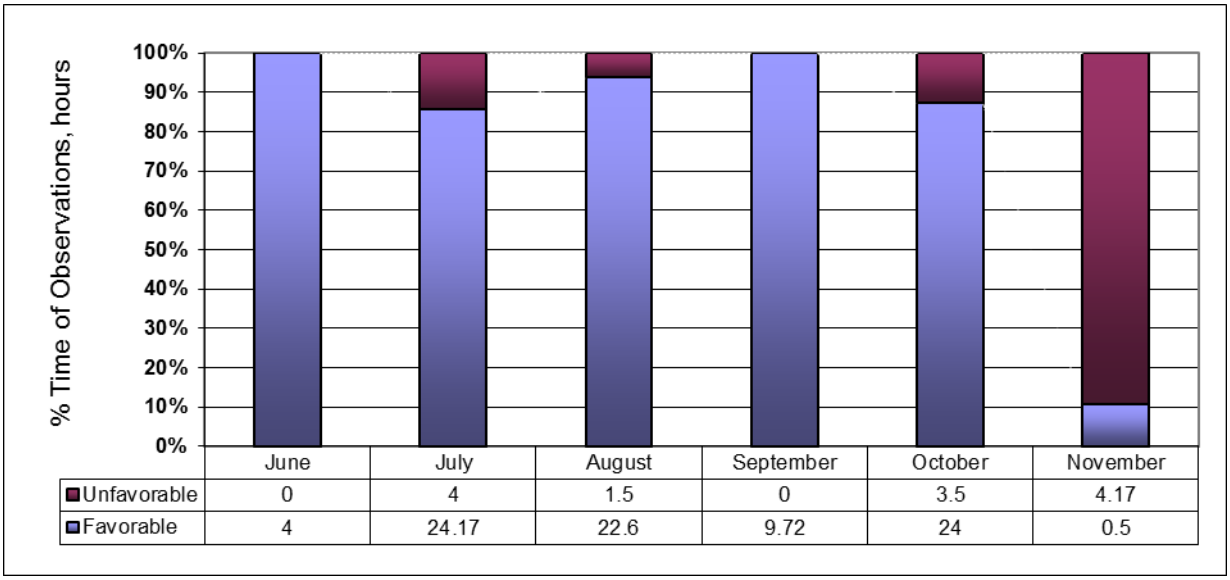


Fig. 6.3. Ratio of favourable and unfavourable weather conditions in area 3—the Lunskoye Area

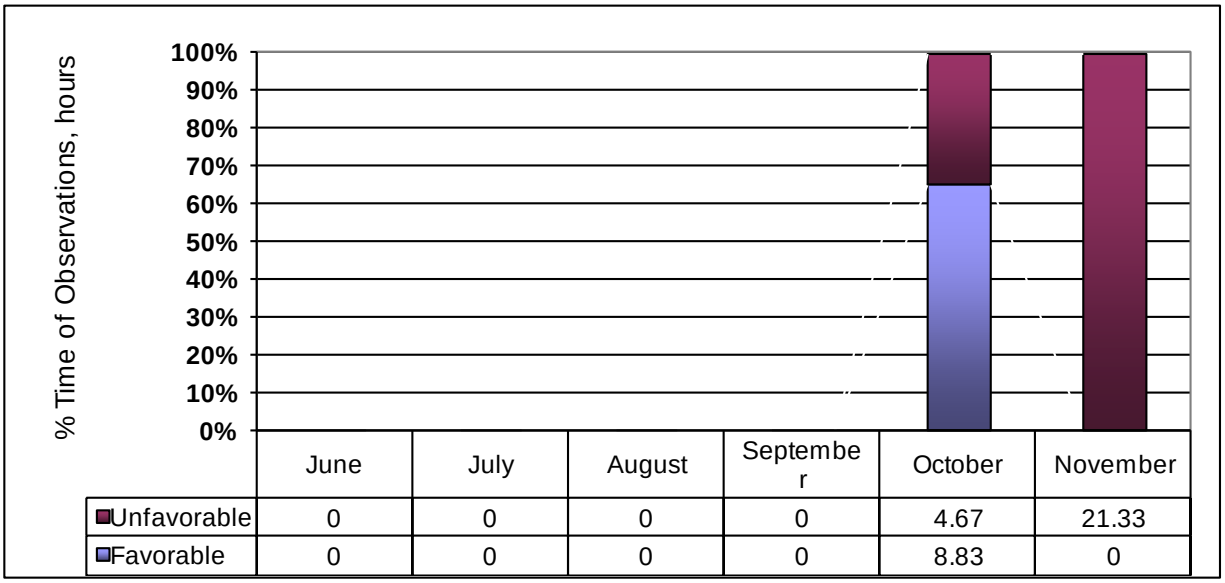
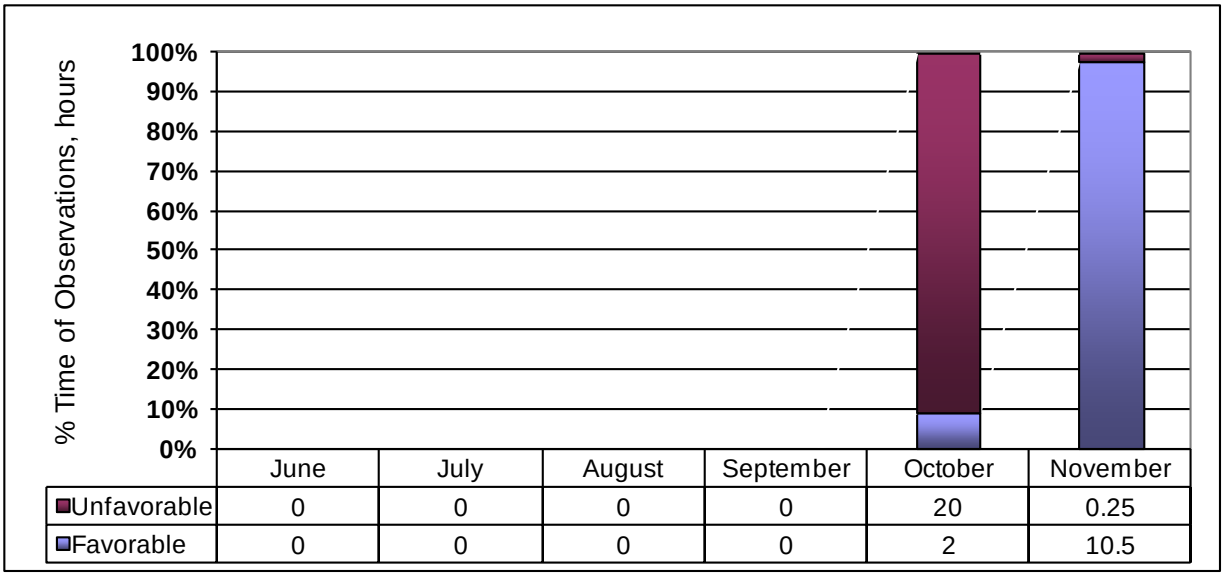
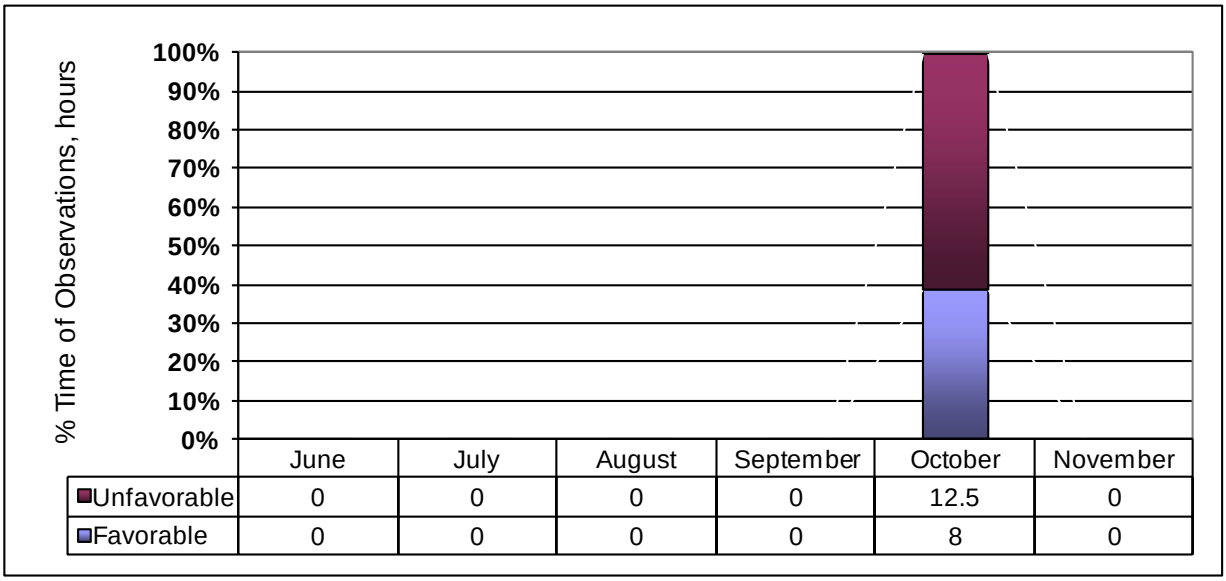


Fig. 6.4. Ratio of favourable and unfavourable weather conditions in area 4—the Middle Transit Area



	June	July	August	September	October	November
Unfavorable	0	0	0	0	20	0.25
Favorable	0	0	0	0	2	10.5

Fig. 6.5. Ratio of favourable and unfavourable weather conditions in area 5—the South Transit Area



	June	July	August	September	October	November
Unfavorable	0	0	0	0	12.5	0
Favorable	0	0	0	0	8	0

Fig. 6.6. Ratio of favourable and unfavourable weather conditions in area 6—the Aniva Area

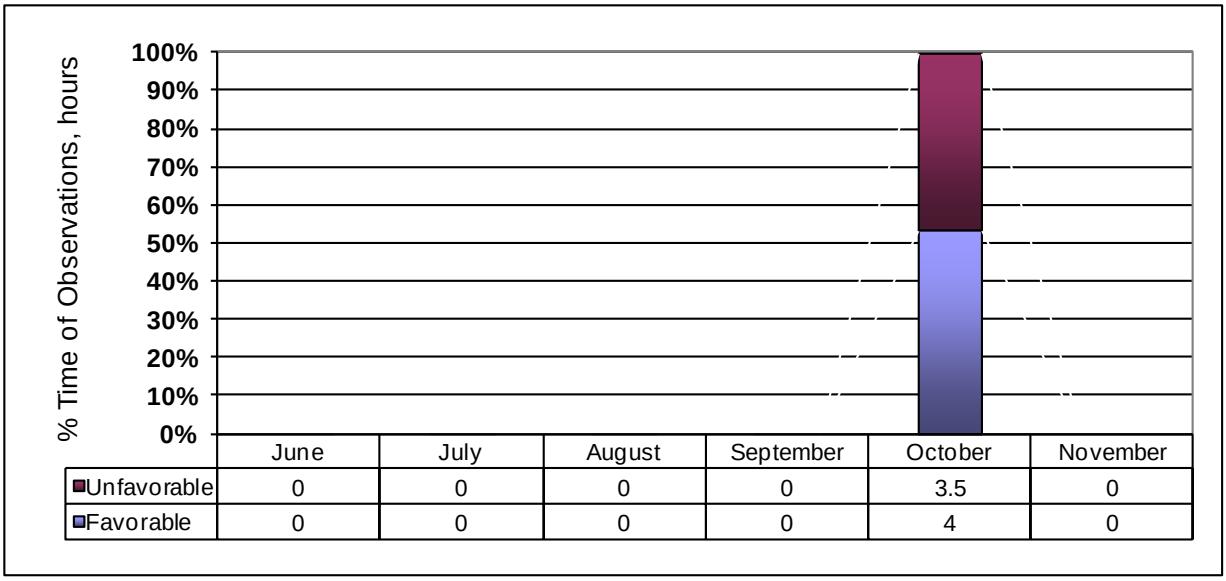


Fig. 6.7. Ratio of favourable and unfavourable weather conditions in area 7—South of Sakhalin

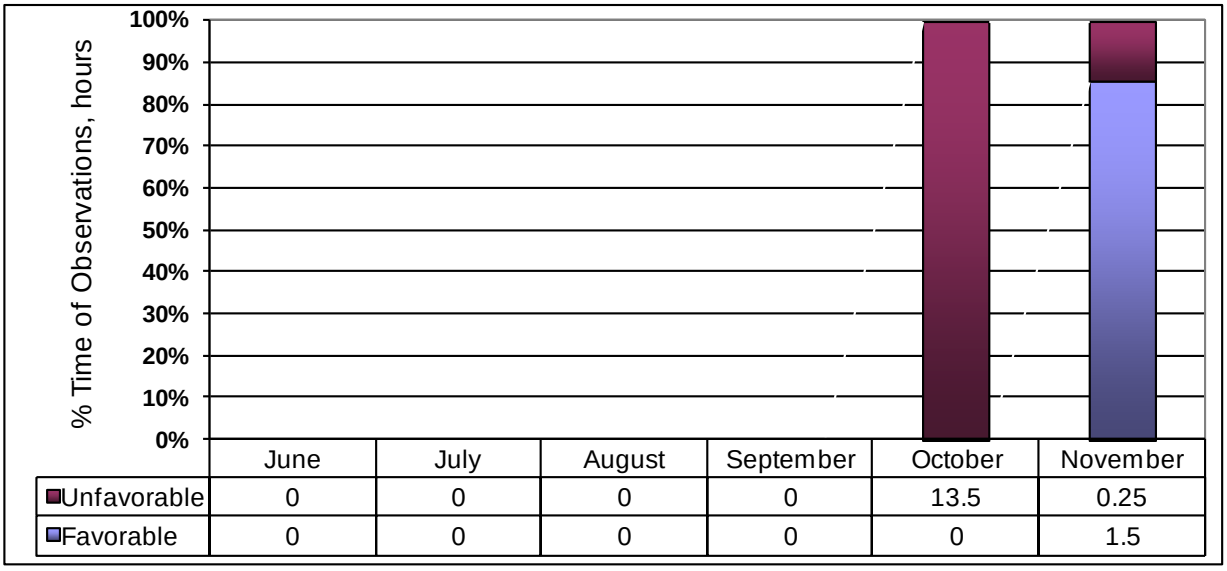


Fig. 6.8. Ratio of favourable and unfavourable weather conditions in area 0—West of Sakhalin

In general, favourable weather conditions considerably prevailed over unfavourable (75% and 25%, respectively) during the entire observation period (3-fold difference). October and November of 2018 were the least favourable months for observations; the most favourable conditions for observations were in June through September (see Fig. 6.9).

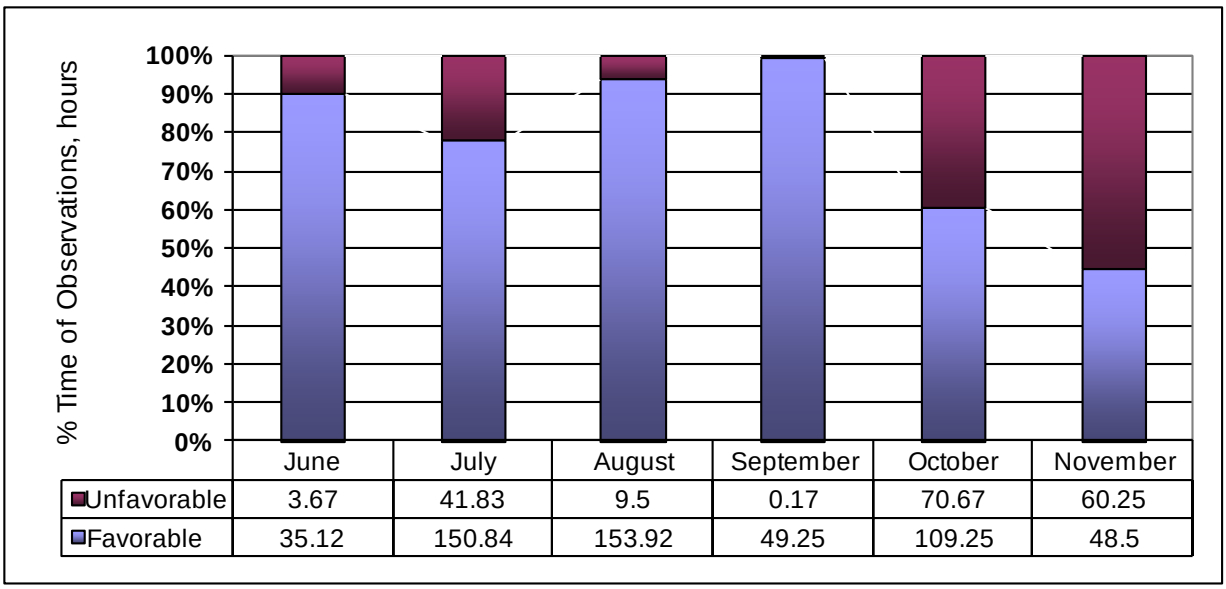


Fig. 6.9. Ratio of favourable and unfavourable weather conditions over the entire observation period

6.4 SIGHTING OF ANIMALS DEPENDING ON WEATHER CONDITIONS

Marine mammals sighting varies under changing weather conditions, differing between species according to their size and distance from the vessel. Behaviour of animals also matters; for example, some mammal species leave an area as a storm approaches.

During the MMO field season in 2018, 84.4 % of marine mammal encounters were recorded under favourable weather conditions (Table 6.5). The unfavourable observation conditions (visibility less than 1 km and/or sea state over 3) reduced the number of marine mammal encounters by six times on average.

Table 6.5. Number and frequencies of marine mammals sighted in favourable and unfavourable weather conditions in 2018

	Favourable conditions, 546,9		Unfavourable conditions, 186,1		Total	
Species	Sightings	Sightings/hour	Sightings	Sightings/hour	Sightings	Sightings/hour
GW	25	0.046		0,000	25	0.0341
MW	42	0.077	1	0.005	43	0.0587
KW	2	0.004		0,000	2	0.0027
DP	4	0.007	1	0.005	5	0.0068
HP	30	0.055		0,000	30	0.0409
SL	3	0.005	2	0.011	5	0.0068
NF	26	0.048	23	0.124	49	0.0669
SS	62	0.113	10	0.054	72	0.0982
RS	7	0.013		0,000	7	0.0096
Total:	201	0.368	37	0.199	238	0.3247

Note. Species: GW—gray whale, MW—Minke whale, KW—killer whale, DP—Dall's porpoise, HP—Harbour porpoise, SL—Steller 's sea lion, NF—northern fur seal, RS—ringed seal, SS—spotted seal.

7 CONCLUSION

In 2018 6 Marine Mammal Observers were employed on three vessels engaged in Sakhalin Energy offshore activities in Lunskoye and Piltun areas, and during transits to the operations areas. Observations began on 19 June and continued until 12 November. In 2018 the observations lasted a total of 733 hours during 111 vessel days. During the season, 5 species of cetaceans and 4 species of pinnipeds were encountered.

Gray whales were observed 25 times (40 animals in total). The average distance to them from all encounters was 1.7 km. There were 15 encounters at a distance equal to or less than the safe distance; in one case the vessel was drifting, so there was no need to take measures to avoid impact. In all other cases at the specified distances impact risk reduction measures were usually taken. In 11 cases, the vessel changed the course and in one case the vessel reduced the speed. In one case, when observing a gray whale straight ahead of the vessel at a distance of 0.3 km, MMOs initiated full stop of the vessel. During the entire ice-free navigation season there were no encounters with gray whales that posed a risk of collision. Thus, in 2018, presence of MMOs on the vessels allowed the vessels' crew to take timely measures to minimise risk of collision or an adverse impact on gray whales.

Over the entire period of observation within the marine mammal observation programme in 2018 there were no encounters with fin whales or pacific right whales.

In 2018 MMOs reported a total of 238 encounters with marine mammals. In addition to the encounters with gray whales, there were 80 cetaceans encounters. In 48 cases cetaceans were encountered at a distance equal to or less than the established safety distance (500 m). In some cases, no measures were required to avoid a collision as the animals were moving parallel to the vessel course or away from the vessel. Although no cases of near collision with marine mammals were recorded, in 61 cases preventive measures were taken in order to avoid possible collision with whales and dolphins.

Measures taken to protect gray whales and other marine mammals during 2018 can be considered successful; no cases of (near) collision with gray whales or other marine mammals were recorded.

The programme implemented conforms with environmental requirements and the Company commitments towards stakeholders; it adheres to WGWAP recommendations.

From the beginning of the Company's operations in coastal waters of the north-eastern Sakhalin, no collisions of vessels with marine mammals were recorded. Thanks to the risk mitigation measures, the possibility of vessel collision with marine mammals is estimated as low.

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APPENDIX 1: ANALYSIS OF THE INCREASE OF SPEED LIMITS FOR SAKHALIN ENERGY CATAMARAN-TYPE BOATS (CREW CHANGE VESSELS) DURING 2017–2018 NAVIGATION SEASONS

Introduction

In May 2013, at the Western Gray Whale Advisory Panel (WGWAP, Panel) 13th meeting, Sakhalin Energy Investment Company Ltd (Sakhalin Energy) presented to the Panel two proposals from its Marine Department (document WGWAP-13/20) for:

- a change of vessel navigation corridor;
- an increase in the speed limit for crew-change vessels in the transfer corridors only.

The second proposal was to change the speed limit of the crew-change vessels in the transfer corridors, based on health and safety issues. The welfare of the vessels' crews and passengers would be improved if the speed limit between Kaigan port and the Company's platforms was modified to its safe hydroplaning speed. Sakhalin Energy considered the risk of encountering a whale in a crew change catamaran travelling at this speed versus the previous lower speed limit was still acceptably low. Other stipulations, outlined in the Marine Mammal Protection Plan (MMPP) including the use of dedicated, trained Marine Mammal Observers (MMO), would remain unchanged. The Company argued that this change offered several operational and welfare advantages and appeared to pose minimal additional risk to gray whales (GW).

In the 16th meeting of the WGWAP (WGWAP-16) Sakhalin Energy presented to the Panel document "Gray whales and Sakhalin Energy activities: Impact assessment of proposed changes to vessel transit routes and crew transfer vessel speed" (WGWAP-16 report, document WGWAP-16/13) with the required risk analysis. With regard to the proposal to increase the allowed speed for crew change vessels from 21 knots to the design speed of the catamarans (30-35 knots), the Panel was sympathetic to the reasons given, but they did not consider the information presented sufficient to allow them to draw a conclusion about potential impacts on whales. The Panel asked for more details concerning the vessels and the conditions under which they operate. In order to estimate the specific ship strike risk from the crew change vessels, the following information was needed:

- a breakdown of vessel transit time by (a) day/night, (b) good/poor visibility and (c) calm/rough seas;
- angle and radial distance to each gray whale sighting (which together give perpendicular distance);
- width of vessel surface footprint (at planning and non-planning speeds, if noticeably different);
- an assessment of how much other high-speed traffic is expected in the area.

In November 2016 at the 17th meeting of the WGWAP Sakhalin Energy provided document "Gray whales and Sakhalin Energy activities: Crew-change vessel speed proposals" (WGWAP-17 report, document WGWAP-17/27). The main conclusions of this analysis were as follows:

- low frequency of GWs sighted in the transfer corridors;
- relatively large distances between the vessel and any sighted whales were recorded;
- vessel movements in bad weather/poor conditions (night, pure visibility, waves) were very limited;
- higher speeds would reduce the need for vessel movements at night (due to shorter juration of the journeys);
- the technical ability of the vessels to respond safely, based on high maneuverability and rapid stopping, was confirmed.

The MMOs and navigators on crew-change vessels were able to effectively and timely detect the whales

and apply measures to avoid collisions. The conclusion was that the risk of ship strikes to whales in the transfer corridors in case of crew-change vessel speed increase could be mitigated and managed efficiently.

Catamarans are highly maneuverable at operating speed and the water-jet propulsion allows for their speed to be reduced rapidly even from maximum to full stop. In addition, because the rate of deceleration is so rapid, the risk of collision/injury to a whale is already substantially reduced even in the moments prior to the vessel stopping.

Additionally, there would be benefits to the welfare and safety of the crews and passengers (notwithstanding the compliance with national and international law). There was therefore a reasonable case for the crew transfer vessels to operate at their design speeds.

Based on the above conclusions of the analysis provided by Sakhalin Energy, and that «*the origin and rationale for the current 21 knots speed limit is unclear, as it does not appear to be based on a recommendation of the Panel or its predecessors, or on local regulations*», the Panel advised «*that an increase in speed from 21 to 35 knots would be acceptable from a gray whale conservation point of view for a provisional period of 2 years, pending more refined estimation of the risk*» (WGWAP-17 report, item 8.2).

In order to provide data in the event of a ship strike, the Panel recommended that within the provisional 2-year period, consideration be given to installing dashcams on each vessel that would monitor the sea surface area in front of the bows. The Panel also recommended that accelerometers be installed with continuous recording, or selective recording of large accelerations.

According to the WGWAP recommendations, this report presents an analysis of a 2-year period of increasing speed limits for crew-change vessels.

Materials and Methods

Mitigation Measures to Avoid Collision and Reduce the Impact on Gray Whales and Other Marine Mammals Implemented Aboard Crew Change Vessels

A Marine Mammals Protection Plan (MMPP) was developed by Sakhalin Energy in cooperation with Western Gray Whale Advisory Panel (WGWAP) to ensure safety and mitigate the impact on gray whales and other marine mammals directly associated with the operation of crew change vessels. In accordance with this plan, the following requirements were established:

1) Vessel navigation within the established corridors from the port of Kaigan to LUN-A, PA-A (Molikpaq) and PA-B platforms (navigational corridors). Scenarios when the vessel may navigate outside the established corridors are:

- emergency aboard the vessel threatening the life or health of the crew (fire, accident, equipment malfunction, evacuation of a sick or injured person, etc.);
- adverse weather conditions making it impossible to keep the vessel within the boundaries of the established corridors;
- performance of works outside the corridors against a special permit, e.g. training, emergency drills, as well as when monitoring the distribution of gray whales within the feeding area as part of the Joint Monitoring Programme (JP).

2) Compliance with the speed limits. At day time, when visibility is greater than 1 km — not more than 35 knots. At night time as well as when visibility is less than 1 km during the day — not more than 21 knots.

3) Compliance with the established safe distances to marine mammals specified in the MMPP.

4) Annual mandatory training for the vessels' crew on measures to avoid collision and mitigate the impact on marine mammals.

5) The presence of a Marine Mammals Observer (MMO) aboard each crew change vessel. In

addition, with the increase in the speed limit to 35 knots, the Company decided to engage two MMOs at a time aboard the crew change vessels as an extra precautionary measure to reduce the risk of collision.

MMO role aboard the vessel:

- to ensure continuous monitoring of marine mammals and record all sightings;
- to advise the vessel crew so they can take measures to avoid collision and mitigate the impact on marine mammals, including a smooth change of the vessel's course to stay clear of the whales, a reduction in speed or initiation of a complete stop of the vessel;
- monitoring of the vessel's path within the navigational corridors and speed limits depending on the visibility;
- checking video from installed outdoor cameras, in case of suspicion of possible incidents with marine mammals.

The comparative analysis presented in this document used the gray whale sighting data generated by MMOs aboard crew change vessels in 2009–2018 (Tab. 1).

Table 1. Number of voyages for crew change vessels in 2009–2018

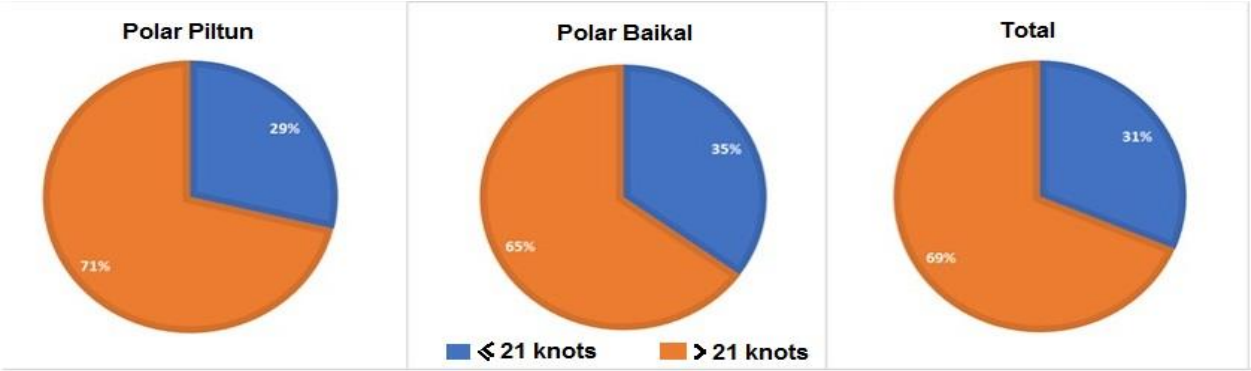
Year	Number of routes		
	"Polar Baikal"	"Polar Piltun"	Total
2009	47	67	114
2010	38	84	122
2011	51	77	128
2012	56	89	145
2013	41	70	111
2014	48	60	108
2015	46	45	91
2016	51	49	100
2017	48	49	97
2018	42	42	84

All MMOs positioned on crew change vessels in 2017–2018 had experience from previous years working aboard Sakhalin Energy vessels or from performing other marine mammals' observations in this area. All MMOs had a higher education with a degree in Biology, 2 MMOs hold a PhD in Biology.

Results and Discussion

Vessel speed

During 2017–2018 navigation season, the total travel time of Polar Piltun and Polar Baikal crew change vessels was approximately 804 hours. For 69% of this time the crew change vessels travelled with a speed above 21 knots. During the rest of the time the vessel speed was lowered due to adverse weather conditions (visibility of less than 1 km). (Fig. 1). The difference in the proportion of time spent in each speed regime between Polar Baikal and Polar Piltun is insignificant (Fig. 1a and 1b).



a) b) c)

Fig. 1. The proportion of crew change vessels' time spent above and below speed of 21 knots

The analysis of the speed records for these two boats showed that the maximum speed reached by Polar Baikal was 28 knots, and by Polar Piltun 34 knots (Fig. 2) and was below the maximum permitted (designed) speed 35 knots. The speed of the crew change vessels generally ranged from 19 knots to 25 knots for Polar Baikal and from 26 knots to 32 knots to Polar Piltun (Fig. 2).

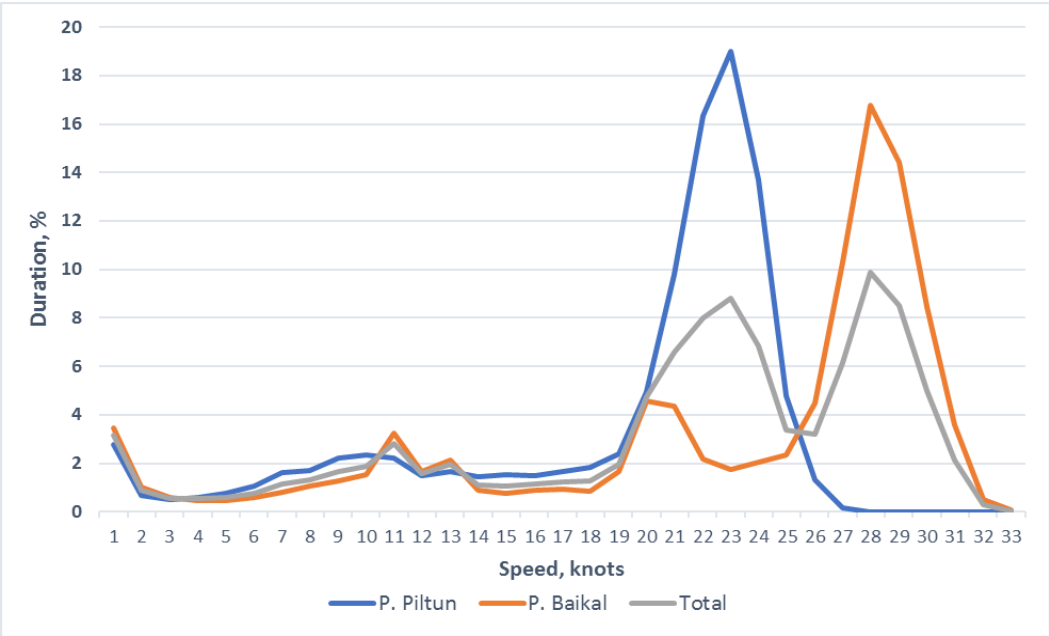


Fig. 2. Crew change vessels speed in 2017–2018 as a percentage of total navigation time.

Weather Conditions

Weather conditions are important for timely sighting of marine mammals. Favourable weather conditions are defined as those where (a) visibility is ≥ 1 km, and (b) sea state is ≤ 3 on the Beaufort scale. Weather conditions that did not meet any of these criteria or their combination during the observation period were considered unfavourable.

For a representative analysis, a time period with similar proportions of favourable and unfavourable weather conditions (2014-2016) was used for comparison with the 2017-2018 data. Refer "Gray whales

and Sakhalin Energy activities…" (WGWAP-17 report, document WGWAP-17/27).

Sea State

The operation time and speed limits of crew change vessels are directly linked to weather conditions. During 2017–2018, over 98% of the time the crew change vessels operated in a sea state up to and inclusive of 3 on the Beaufort scale (favourable conditions). During the remaining 2% of the time, the crew change vessels had to suspend operation while already at sea because of deteriorating weather conditions. The results obtained during the 2-year period are similar to the average figures obtained during 2014–2016 when vessels operated in a sea state up to 3 and below on the Beaufort scale during 98% of the time. For most of the time the crew change vessels operated in a sea state of 1–2 on the Beaufort scale, 53% and 29% of the total observation time, respectively. The percentage of time when the sea was calm (0 on the Beaufort scale) was 5% (Fig. 3).

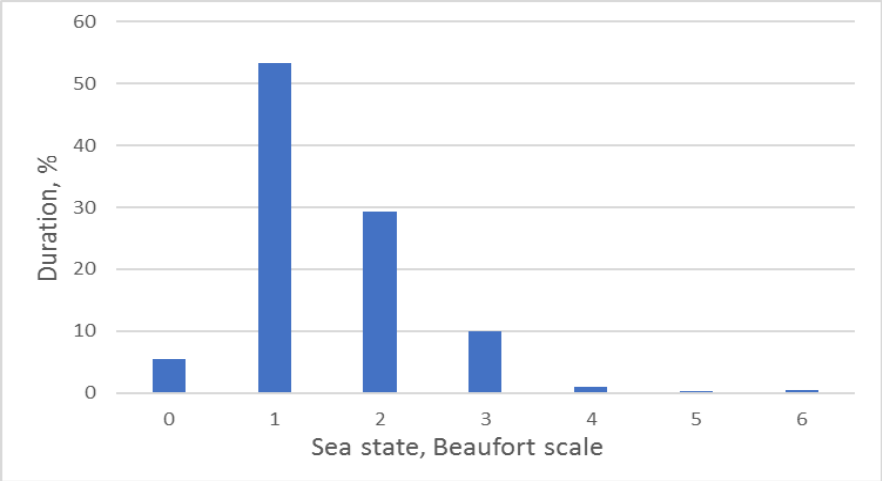
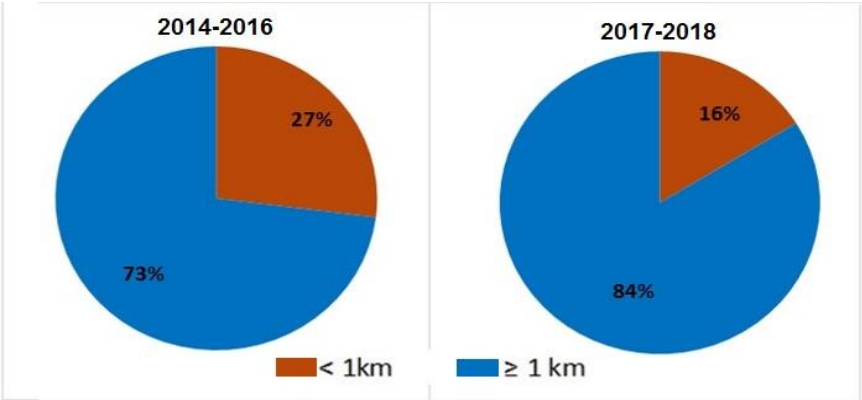


Fig. 3. The percentage of operating time in a different sea state during 2017–2018

Visibility

Visibility doesn't affect the vessels' operation as much as sea state, however, it impacts the potential sighing of marine mammals, therefore, in accordance with the MMPP Sakhalin Energy imposes a speed limits of 21 knots when the visibility is less than 1 km and for performance of works at night.

In the analysed period of 2017–2018, the crew change vessels navigated in low visibility conditions (less than 1 km) during 16% of the operation time. For comparison, in the period 2014–2016, the vessels navigated in low visibility conditions (less than 1 km) during 27% of the time (Fig. 4).



a) b)

Fig. 4. Visibility conditions for Polar Baikal and Polar Piltun in 2014–2018, %

The percentage of visibility at a distance of 1–5 km from the vessel amounted to 30% of the total navigation time; for over 53% of the operation time the vessels performed operations in visibility conditions greater than 5 km. The ratio of observation time in different visibility conditions is presented in Fig. 5.

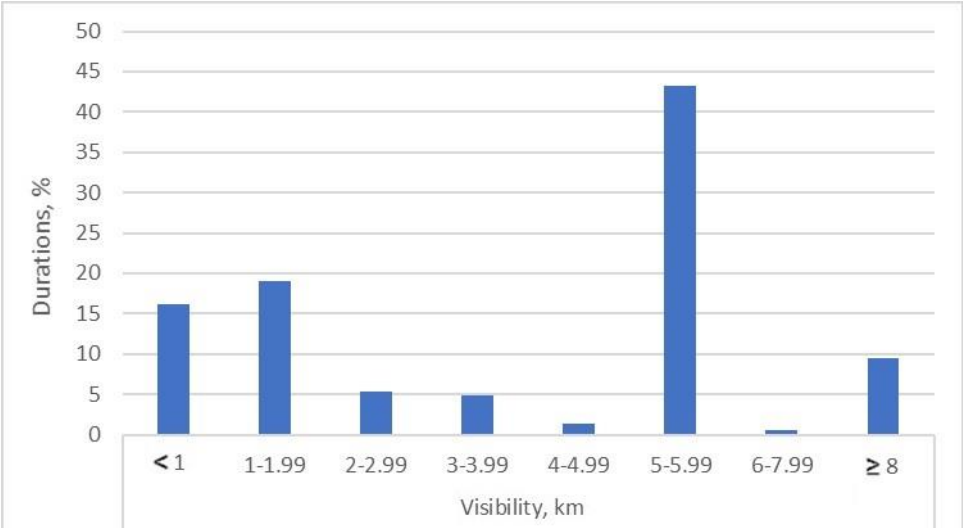


Fig. 5. The percentage of operating time with different visibility during 2017–2018

Travel during day time and at night

When planning crew change voyages, Sakhalin Energy tries to avoid travel at night. During 2014–2016, travel during night time amounted to 0.5% of the total travel time. During 2017–2018 the increase in speed limits enabled the duration of voyages to be reduced, and as a result, avoided the need for travel during night time. There were two cases of travel at night, which amounted to around 30 minutes in total or 0.05% of the total time, which is 10 times less than during the 2014–2016 navigation season. In the first case the vessel was not under power but drifted near the port of Kaigan (entrance to Nabil Bay) waiting for the high tide to enter the port. In the second case travel at night was caused by the need to leave the port early to perform comprehensive special monitoring of gray whales in the offshore feeding area. Thus, during the analysed period observations were possible in predominantly favourable visibility conditions.

Gray whale sightings

Registration of gray whale sightings by MMO aboard crew change vessels

The analysis uses the data provided by MMOs located aboard crew change vessels on the route from the port of Kaigan to LUN-A, PA-B and PA-A platforms. To compare the data, the analysis uses the entire observation period aboard Polar Piltun and Polar Baikal from 2009 through 2018, i.e. since their use for crew changes under the Sakhalin Energy Project.

It is worth noting that vessel-based recording of gray whales is performed primarily to prevent the risk of collision. This analysis only includes the gray whales encountered within the visibility limits when traveling within the navigation corridors. Such observations are limited by space and time and are performed in various weather conditions and thus do not allow for accurate identification of gray whale numbers or distribution in this area.

Over the period from 2009 through 2018, 100 sightings of gray whales were recorded by MMOs. In 2014 no sightings of gray whales along the vessel corridors were recorded. The maximum number of sightings (22) happened in 2010, while the minimum number of sightings (2) was registered in the subsequent year 2011. We can roughly distinguish 3 periods — 2009–2010, 2011–2013, and 2014–2018 during which the number of sightings increased from one year to the next, followed by a decline. Overall, the number of gray whales along the corridors fluctuated and does not have a pronounced trend to either increase or decrease (Fig. 6).

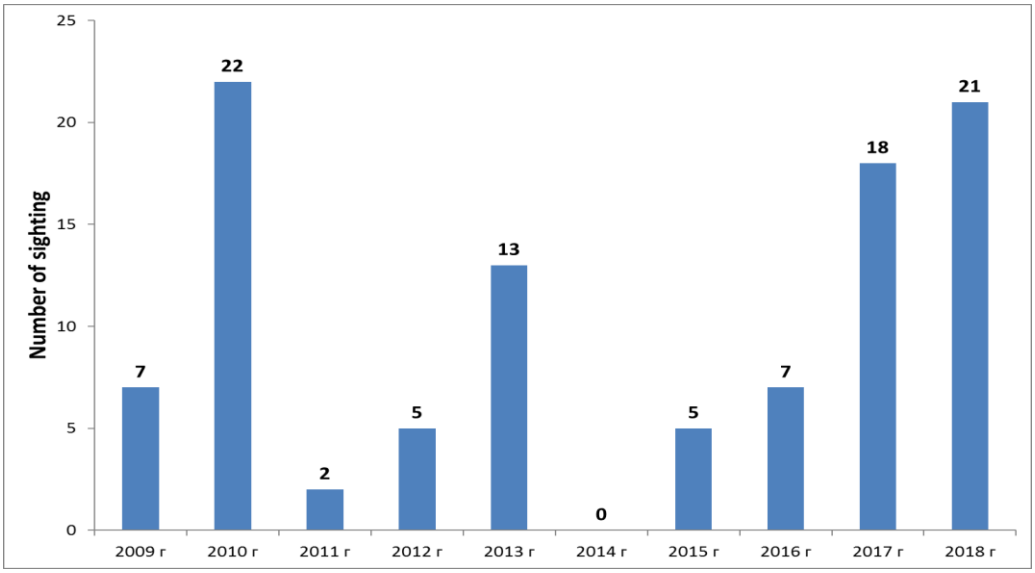


Fig. 6. The number of gray whales' sightings during crew change vessels voyages in 2009–2018

During 2009–2018, the majority of gray whale sightings happened in the area to the south of the PA-A platform. This area is a typical gray whale migration route (Fig. 6) between the Piltun and the Offshore feeding areas. Since 2013 gray whales have also been recorded outside of the known feeding areas in the coastal waters of Nabil Bay. A similar situation was observed in 2017–2018 when the majority of gray whales were sighted to the north and to the south of the port of Kaigan and along the route to the LUN-A platform, as well as in the northern part of the crew change vessel route between PA-A and PA-B platforms.

The analysis of all gray whale sightings during the crew change vessel voyages since 2009 through 2018 shows an uneven distribution of gray whale sightings during the voyages with MMOs on board and is probably associated with the general distribution of gray whales between the known feeding areas near the north-eastern coast of Sakhalin Island and the less-researched temporary local concentrations of gray whales in the coastal waters. (Fig. 7).

Gray whale sighting distance

The main concern associated with the increase in speed limits for crew change vessel was related to the potential failure to observe or untimely observance of gray whales at high speed. To mitigate this risk, the Company took a precautionary extra measure and in 2017 and 2018 two MMOs were allocated to each crew change vessel to simultaneously observe the water area during the voyage. In addition, there is also a marine watch on the bridge, who scans for any potential collision risk to the vessel, including marine mammals.

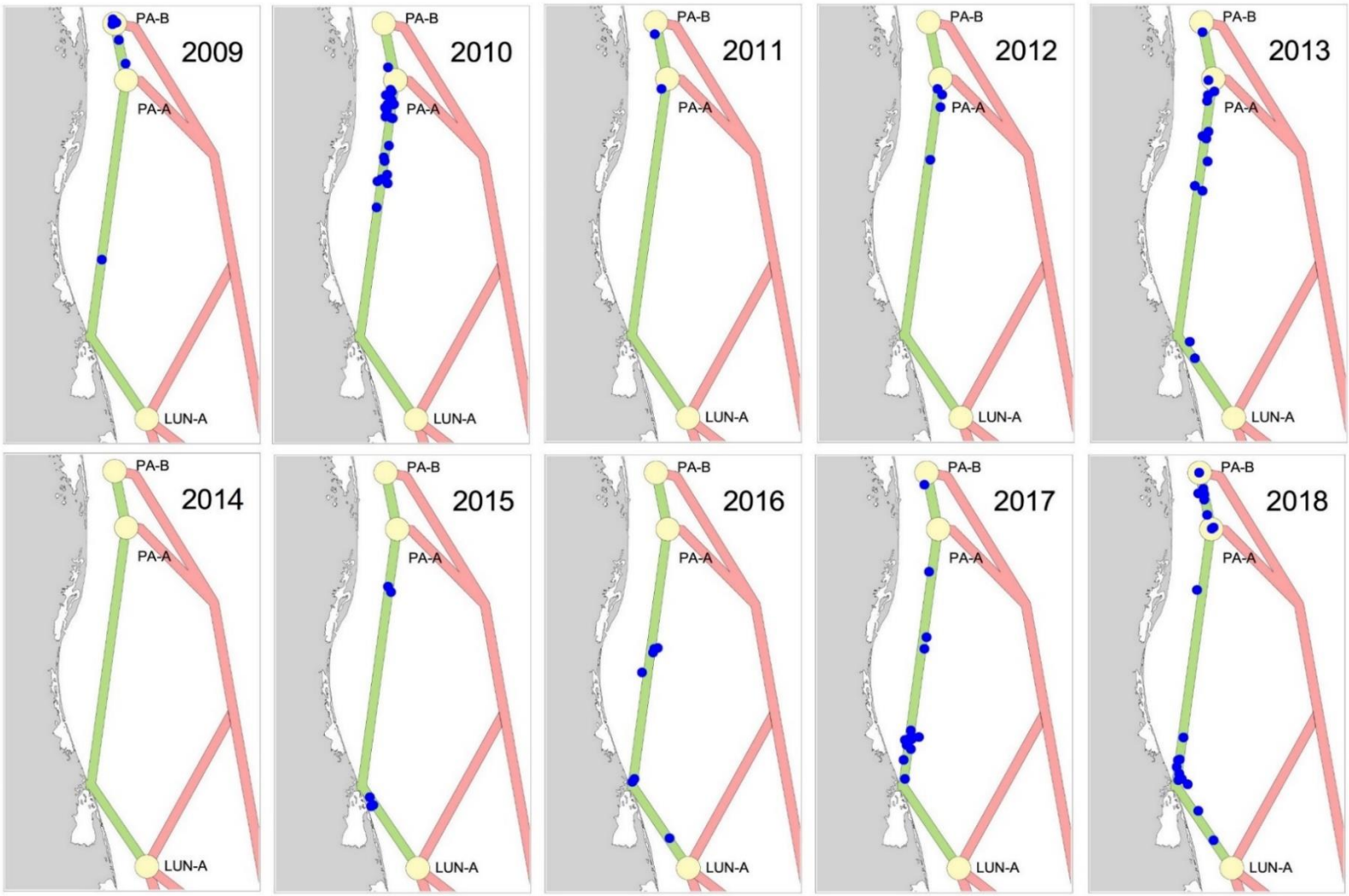


Fig. 7. Gray whales sighting in 2009-2018 (according to MMO observations from Polar Baikal and Polar Piltun)

The average distance at which gray whales were sighted over the entire observation period amounted to 1,505 m. The average distance for gray whale sighting in 2009–2016 amounted to 1,657 m, in 2017–2018 – 1,266 m. The values within the confidence interval remain similar (Fig. 8). The observed average distances indicate that gray whales have been sighted in advance, before the vessel approached them.

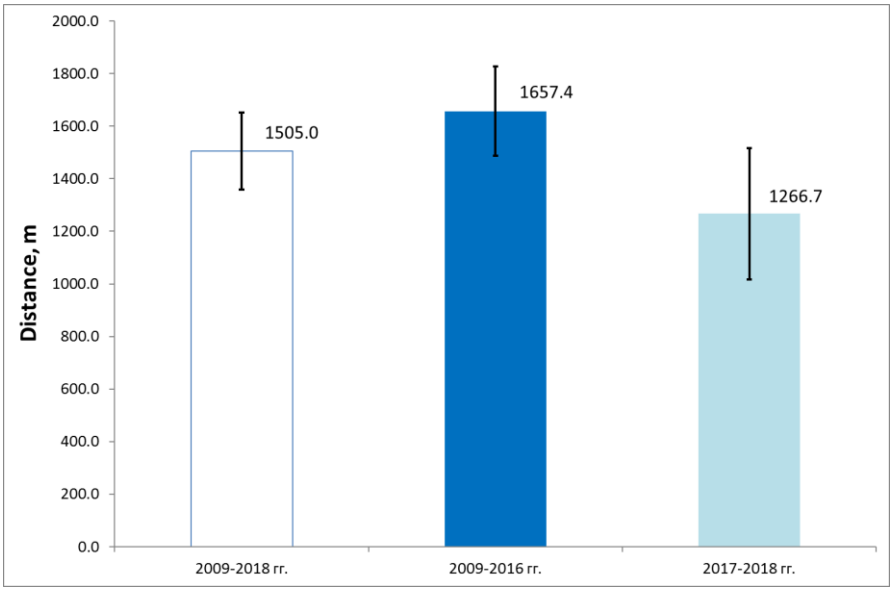


Fig. 8. Average sighting distance of gray whales

When comparing the average gray whale sighting distances by years, the lowest values were recorded in 2009, during which time the vessels moved with a speed of 21 knots. In 2017, with the established speed limit of 35 knots, the average gray whale sighting distance was 1,600 m, i.e. remained within the average for 2009–2016 (before the speed limit was increased) (Fig 9).

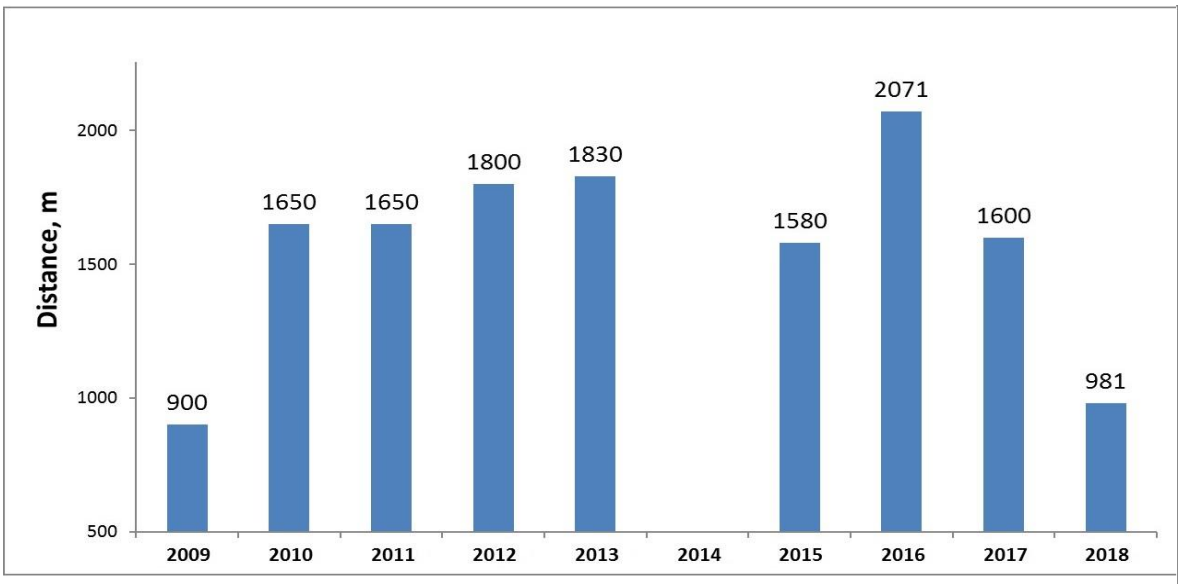


Fig. 9. Average sighting distance of gray whales in 2009–2018

In addition to the multi-year data, a comparison of average gray whale sighting distance was performed for the period of 2017–2018, when sightings were recorded at speeds of up to and above 21 knots. No statistically significant difference in gray whale sighting distance was identified when travelling above and below the previous speed limit, the average sighting distance amounted to 1,330 m and 1,244 m, respectively (Fig. 10).

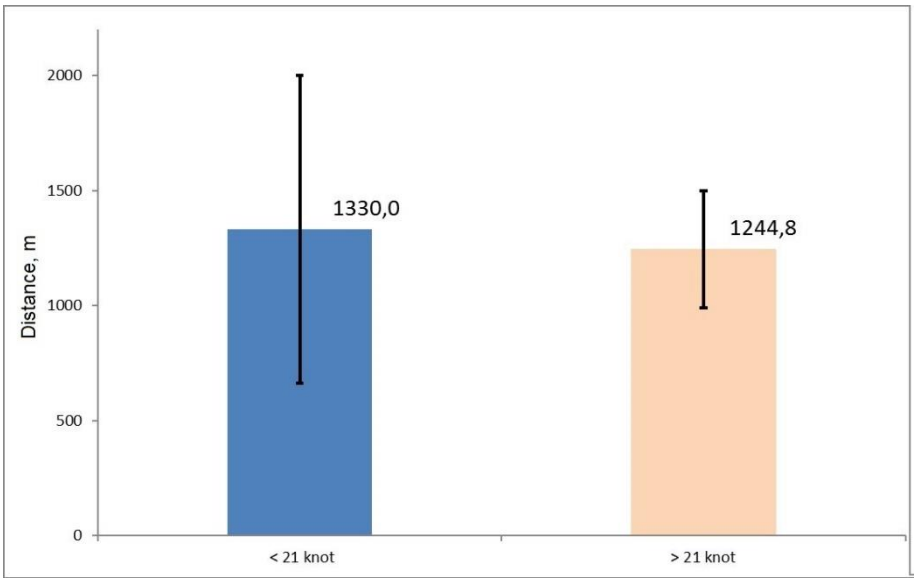


Fig. 10. Average sighting distance of gray whales in 2017–2018 at different speeds

The analysis of the average speed at which gray whales were sighted during 2009–2018 (Fig. 11) showed that despite the increase in speed of crew change vessels, the average speed at which gray whales were sighted didn't increase significantly.

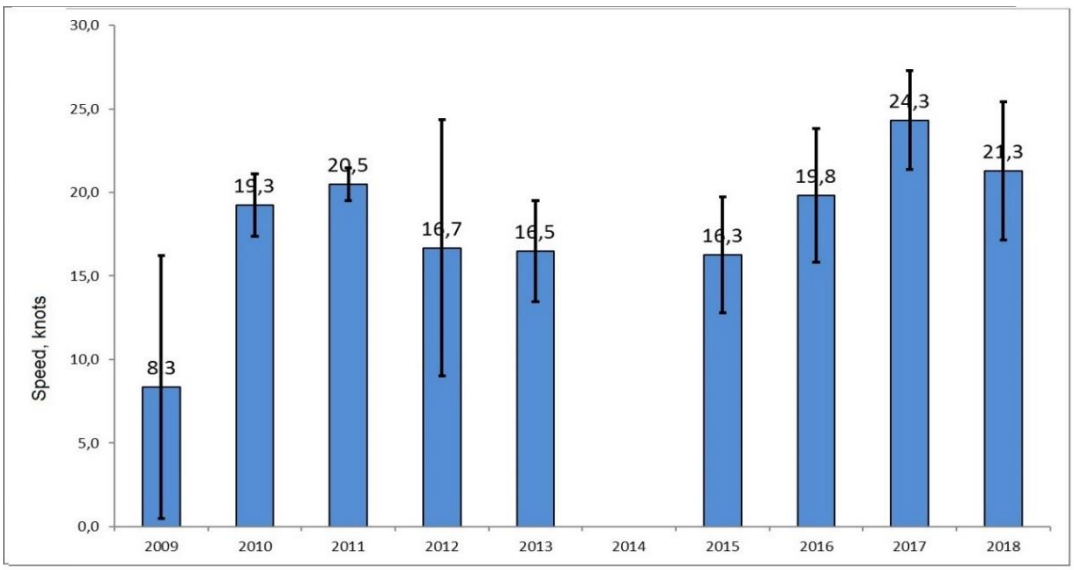


Fig. 11. Average speed and confidence intervals at gray whale sightings in 2009–2018

Implementation of Mitigation Measures

The main task of an MMO aboard a vessel is timely observance of marine mammals and, if required, notifying the crew to take measures to reduce the risk of collision. During 2017–2018, 39 sightings with gray whales were recorded from crew change vessels[9], and in 19 cases (48%) mitigation measures were taken, including 13 cases (34%) when gray whales were observed at a distance less than 1000 m (Tab. 2). It is important to note that in all cases mitigation measures were taken not to avoid an imminent risk of collision between the vessel and the whale, but as a preventive measure to keep or increase the distance to the whale to a minimum of 1,000 m in accordance with the MMPP. In most cases where the mitigation measures recommended by the observers were applied, the vessel adjusted the course, increasing the distance between the vessel and the sighted whales. In a few cases the vessel reduced speed to let the whale pass.

Table 2. The application of mitigation measures to reduce the impact on gray whales from Polar Baikal and Polar Piltun vessels in 2017–2018

#	Data	Time	Speed	Coordinates		Angle (from the trackline)	Distance to whale	Whale number	Measures
				Long	Lat				
1	08/07/2017	07:27	20	143.3378	51.75117	0	1000	1	Change course
2	26/09/2017	17:02	30	143.3767	51.89767	90	1000	1	Change course
5	14/10/2017	11:00	12.3	143.3658	51.87533	90	1000	2	Change course
3	15/10/2017	10:16	32	143.3927	51.90367	330	1000	2	Change course
4	15/10/2017	14:00	28	143.3757	51.90317	60	1000	2	Slowdown
6	03/08/2018	09:35	25.2	51.52167	143.5638	300	800	1	Change course
7	03/08/2018	09:54	24.4	51.63367	143.4595	60	400	1	Change course
8	23/09/2018	11:07	25.6	51.8305	143.3518	90	600	3	Change course
9	25/07/2018	10:53	20	51.82817	143.3578	330	700	1	Slowdown
10	25/07/2018	13:30	0.3	52.71567	143.5652	30	300	1	Drift, no need
11	30/07/2018	14:18	27.3	51.9115	143.3782	0	700	1	Change course
12	03/08/2018	14:36	30	51.78233	143.3367	300	1000	1	Change course
13	14/08/2018	10:39	27.2	51.77817	143.3463	60	200	1	Change course
14	18/08/2018	09:17	28.9	52.7695	143.5317	90	600	3	Change course
15	27/08/2018	16:42	30	52.848	143.5298	300	500	3	Change course
16	27/08/2018	16:45	29	52.86934	143.5243	300	500	1	Change course
17	27/08/2018	17:00	1.5	52.93417	143.4973	270	300	1	Stop
18	27/08/2018	17:57	24	52.83617	143.5205	0	700	3	Change course
19	27/09/2018	12:55	22.1	51.78017	143.3453	270	300	1	Change course

[9] see Tab. 5.2 on p. 31 of MMO report 2017 “Sakhalin Energy” doc no 1000-S-90-04-T-0910-00, and table 5.2, 5.3 current report

Technical control as additional mitigation measures in 2017–2018

To prevent collision with marine mammals, the Company implemented the following additional measures on crew change vessels:

1) As recommended by the Advisory Panel, each crew change vessel was equipped with an external video recording system with a 60° viewing range of the sea surface from each side of the boat and in front of the boat, allowing marine mammals within a distance of 400 m ahead of the boat to be recorded.
2) Each crew change vessel was equipped with a GPS receiver, independent from the vessel`s navigation system, with an automatic vessel coordinate mapping system (1 sec accuracy) when the vessel is in motion.

As mentioned earlier, the Company also used two observers aboard each crew change vessel.

Vessel Video Recording System

The video recording systems installed aboard the crew change vessels have good enough resolution to sight marine mammals at a distance up to 400 m ahead. If required, the videos can be reviewed upon completion of the voyage in case of any suspicion of a collision with marine mammals during the voyage. The video records are saved on a hard disc and sent to the Company at the end of the field season. In 2017–2018 no potential collision cases were registered.

Deceleration Recording System

Based on the Advisory Panel's recommendations, each crew change vessel was equipped with a deceleration recording system. Prior to installation, a market analysis was undertaken to find potential acceleration/deceleration systems, however no such offshore system was available. Therefore, an additional GPS system, independent from the vessel`s navigation system, was designed and installed. The system software can calculate acceleration/deceleration of vessel’s speed, record and transfer data with 1 sec accuracy when the vessel is in motion.

The system transfers data in the form of an electronic table with the vessel’s coordinates, course and speed. The data has been analysed for deceleration potentially indicative of a marine mammal strike. An example log is given in Table 3.

Table 3. A log sample from the GPS system representing deceleration.

Data	Time	Direction	Coordinates	Speed
25.06.18	8:12:02	9	51.987908 : 143.400224	19 n.m/h
25.06.18	8:12:03	11	51.987988 : 143.400240	21 n.m/h
25.06.18	8:12:04	6	51.988080 : 143.400256	19 n.m/h
25.06.18	8:12:05	5	51.988152 : 143.400288	19 n.m/h
25.06.18	8:12:06	7	51.988240 : 143.400304	20 n.m/h
25.06.18	8:12:07	12	51.988316 : 143.400336	19 n.m/h
25.06.18	8:12:08	11	51.988396 : 143.400352	20 n.m/h
25.06.18	8:12:09	6	51.988476 : 143.400368	20 n.m/h
25.06.18	8:12:10	7	51.988560 : 143.400384	19 n.m/h

The criteria for a potential collision with marine mammals were provided in the final report at the WGWAP meeting (WGWAP 17). Based on simulation, a deceleration with a value of 3.6 m/sec for Polar Piltun and 4.9 m/sec for Polar Baikal may be regarded as a potential collision with a marine mammal. To corroborate

for any potential collision, the video records and the observations of observers present aboard the vessel during the voyage were compared.

The installed system proved its operability and ability to record the required parameters. The analysis of the generated data showed that the system installed aboard crew change vessels records crew change vessel decelerations with a duration of 1 second. All recorded deceleration cases with values greater than the threshold deceleration values were associated with navigation in high sea state conditions (4–6 on the Beaufort scale), when vessels were moving against the wave, which was confirmed by marine mammal observers and video recording systems.

Conclusions

This report used the data collected by MMOs aboard crew change vessels in 2017–2018 in comparison with 2009–2016.

- The vessels' speed in 2017–2018 mostly ranged between 19 and 25 knots for Polar Baikal and 26–32 knots for Polar Piltun. That was 68% and 58% of the total time of movement of each vessel, respectively. The maximum speed each vessel attained was below the maximum permitted; 28 knots for Polar Baikal and 34 knots for Polar Piltun.
- In 2017–2018 the observations were predominantly performed in favourable weather conditions. The increase in speed limits enabled the total duration of voyages have been reduced, and as a result, avoid travel during night time.
- In 2009–2018, the observers recorded 100 sightings of gray whales; the maximum number of sightings, 22, was recorded in 2010, the minimum number of sightings, 2, was recorded in 2011. In 2014 no gray whales were sighted along the vessel corridors. The number of gray whales sighted along the corridors fluctuated throughout the years and does not show a pronounced trend to either increase or decrease.
- An analysis of those gray whale sightings along the corridors in 2009–2018 shows their uneven annual distribution and is associated with the general distribution of gray whales between the known feeding areas and temporary local gray whale concentrations in the coastal waters.
- The average distance at which gray whales were sighted over the entire observation period was 1,505 m. The average distance for gray whale sighting in 2009–2016 was 1,657 m, in 2017–2018 it was 1,266 m. The values within the confidence interval remain similar.
- In 2017–2018 there was no statistically significant difference of Gray whales sighting distance during navigation. Sighting distance to Gray whales with a speed up to 21 knots amounted 1,330 m, above 21 knots - 1,244 m.
- During 2017–2018 39 sightings with gray whales were recorded by MMOs from crew change vessels, and in 19 cases (48%) the vessel crew took mitigation measures. In all cases preventive measures were taken to keep or increase the buffer distance to the whales (1,000 m) and were not required to prevent an imminent risk of collision.
- The video recording system and the acceleration/deceleration recording system installed aboard crew change vessels proved their operability and ability to record the required parameters. All vessel speed alteration cases were associated with vessels travelling in a high sea state of 4–6 on the Beaufort scale.

In conclusion, the results of 2-year period of speed limits increase, indicates on lack of evidence of a significant increase in the risk of collision of vessels with Gray whales. Complex of mitigation measures, allows to provide a safety for Gray whales, during crew-change vessels navigations with current speed limits on a permanent basis.