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ABSTRACT

The cetacean survey was conducted in the central part of the Sea of Okhotsk in 2020. The vessel is a stern trawl type research vessel with a barrel for observation. The objective of the survey is to obtain information on distribution and abundance of large whales using the normal closing mode. The period of survey was from August 7 to September 7 (32 days), the northern and the southern boundaries are 57°40N and 50°00N, respectively and the western and the eastern boundaries are 147°00E and 152°00E, respectively. During the research distance of 1177,28 n.miles by closing mode for large cetaceans in the research area and 909,36 n.miles by passing mode during transit, the following species were sighted – common minke whale (19 schools – 24 animals), like minke whale (3-3), North Pacific right whale (9-13), sperm whale (1-1), fin whale (12-23), killer whale (6-23), white whale (2-49), Dalli type Dall's porpoise (16-45), truei-type Dall's porpoise (3-10), unidentified type Dall's porpoise (111-270), unidentified large cetacean (4-6), unidentified small cetacean (1-4),unidentified cetacean (4-7).
KEY WORD: SIGHTING SURVEY, SEA OF OKHOTSK, CETACEANS

INTRODUCTION

Research objectives

The plan of 2020 survey was submitted at the 68 B session of the IWC/SC meeting (Gushcherov *et al*., 2020). The survey was conducted in the central part of the Sea of Okhotsk by Russian scientists of Pacific branch of «VNIRO» («TINRO»).

The main objective of the survey was to record the information on distribution and abundance of cetaceans based on the IWC standard sighting survey method. Photo identification was tried if North Pacific right whale, humpback whale, gray whale, and killer whales were sighted. Distance and angle estimation training and experiment were conducted.

Research area and cruise track

The 2020 research area in the central part of the Sea of Okhotsk in coordinates to 57°40N - 50°00N and 147°00E - 152°00E (Figure 1). The vessel will enter the Sea of Okhotsk through Tatar Strait and leave through La Perouse Strait. The coordinates of way points for the pre-determined track line are given in Table 1 (WP1 – WP8). Track line was determined using Distance 7.3 Release 2 (Thomas *et al.* 2010).

SHORT INFORMATION ON THE CRUISE

Cruise itinerary

	Activity	Dates	Number of days
1	Preparation for the survey, embarking the equipment	3-4 Aug, 2020	2 days
2	Departing from Vladivostok and transit from Vladivostok to research area	7-12 Aug., 2020	6 days
3	Sighting survey in research area	13-29 Aug., 2020	17 days
4	Transit from the research area to the port of Vladivostok	29 Aug.-6 Sep., 2020	09 days
5	Arrival at the port of Vladivostok	7 Sep., 2020	-

Research vessel

The FSBSE «VNIRO» research vessel *ВЛАДИМИР САФОНОВ* (*VLADIMIR SAFONOV*) was used during the survey as same as the past surveys since 2015. It is equipped with a barrel (15,0 m from the sea level) where two observers can conduct searching. On the upper bridge (12,0 m from the sea level), scientists can also observe and record sighting, effort and weather information. The crew consisted of 24 members. Specification and photo of the vessel are shown in Appendix 1.

Attending scientists

Six scientists from Russia (Pacific branch of «VNIRO» («TINRO»)) participated in the cruise. All scientists have significant experience in the marine mammal research survey. Names and responsibilities are as follows:

1. Pavel S. Gushcherov (Pacific branch of «VNIRO» («TINRO»)) Cruise leader/Chief Scientist - sighting, photo-ID;
2. Igor A. Naberezhnykh (Pacific branch of «VNIRO» («TINRO»)) – sighting, senior researcher;
3. Petr A. Tiupeleev (Pacific branch of «VNIRO» («TINRO»)) – sighting;
4. Anton A. Novozhilov (Pacific branch of «VNIRO» («TINRO»)) – sighting;
5. Nikita O. Voloshanskiy (Pacific branch of «VNIRO» («TINRO»)) – sighting;
6. Michael A. Voronin (Pacific branch of «VNIRO» («TINRO»)) – sighting, meteo specialist, photo-ID.

Tomio Miyashita (T.M.) has acted as supervisor of IWC for oversight during the preparation and the survey by email communication.

Pre-cruise meeting

Due to the situation in the world caused by the COVID-19 infection, no pre-trip meeting was held this year. However, the readiness of the vessel, crew and scientific group was confirmed by T.M. via e-mail with the provision of photo and video materials.

Survey method

In the research area, the normal closing mode was primarily used for large cetaceans and killer whales, but the vessel passed for other small cetaceans. Two scientists conduct searching mainly by naked eye, sometimes using binoculars (15x50 with stabilizer or 7x50) as supplementary measures. Three observer teams with determined members operated in two hours shifts. The survey was conducted for a maximum of 14 hours per day (from 6 a.m. to 20 p.m.) when the weather conditions were suitable for observations: visibility better than 1.5 n.miles and the wind speed less than 15.5 knots (about 7.5 m/s) and Beaufort sea state less than 5. The vessel speed was about 9 knots with slight adjustment to avoid vibration of vessel, and about 10 knots while closing.

During the transit, the normal passing mode survey was conducted.

In general, research effort began from 6 a.m. and ended at 20 p.m. (maximum 14 hours), but considering the time of sunrise and sunset, the period was changed to keep enough brightness. Time-zone was kept the same as that of Vladivostok (GMT +10 hours) throughout the cruise.

When a sighting was made, the initial sighting information such as estimated distance and angle to the sightings, species and school size etc. was reported to a researcher on the upper bridge for record. The angle was estimated using the angle board in front of each researcher (Figure 2). The effort record was recorded by a researcher on the upper bridge. The hourly weather record was made by a scientist. Sea surface water temperature (SST) was measured from water drawn using a small bucket. Wind information was quoted from the sensor in the bridge.

When a sighted animal seemed to be large cetacean, one of the researchers on the barrel made instructions to the officer in the bridge about speed and/or course change using a transceiver. After the sighting was approached, the species, group size, estimated length, number of calves present and behavior were determined and recorded. All record sheets (sighting, effort and weather) were originally the same forms as those for IWC/POWER cruises.

Species identification

Guidelines of species identification were based on the IWC-POWER methods for classification of identification (Anon., 2014). Whale body, shape of blow, surfacing and other behavioral pattern were potential cues for species identification. Because of not closing to small cetaceans except for killer whales, it was difficult to identify color type of Dall's porpoises when it was observed at a long distance from the vessel and thus the proportion of unidentified type of the species became large.

School size estimation

Guidelines for school size estimation were also based on the IWC-POWER methods (Anon., 2014). For estimation of school size, a binocular was potentially used. School size was estimated after approaching within 1.0 n.miles for large cetaceans, but for small cetaceans it was estimated when the school was at the closest distance during passing. When it was difficult to determine the school size, especially for small cetaceans, the minimum, the maximum and the best estimate of school size were recorded.

Effort coverage and weather conditions

The overall length of accounting tracks passed in the survey area in normal closing mode with the observations was 1177,28 nautical miles (Table 2). In addition, 909,36 nautical miles were surveyed during passing mode.
Meteorological observations were made every hour. In total, 459 meteorological observations were carried out during 32 voyage days.
Some statistics on meteorological conditions during the period from August 7 to September 6, 2020 are shown in tables 3 - 6.
The air temperature ranged from 10,0° C to 30,0° C, and the surface water temperature ranged from 3,5° C to 23,0 ° C (Table 3), on average, the air temperature was 16,9°C, and the temperature of the surface water layer was 14,6°C. The minimum water temperature of 3,5°C was recorded on August 12 at 18:00 while the vessel was moving along the track at coordinates 55°47'87"N 145°10'65"E. Unsuitable conditions for observation at strong waves (4-7 points) were 18,9% (Table 4).
Over the entire period, of the total number of observations made, good weather conditions (clear, cloudy, partly cloudy and overcast) made up 86,5%, and bad (rain, fog) –13,5% (Table 5).
During the voyage, the South-East (20,5%), South-West (16,1%) and North-West (20%) winds were predominant (Table 6).

RESULTS OF SIGHTINGS

Sighting summary

Table 7 shows the summary of sightings recorded in the research area and during transit. The following species of baleen cetaceans were found: North pacific right whale, common minke whale, like minke whale, fin whale. The species of toothed cetaceans found: killer whale, white whale, sperm whale, Dall's porpoises of various subspecies, harbour porpoise. Due to short observation time of some whales, it was not possible to determine the species affiliation for 17 animals. Sighting positions of species identified were plotted in Figures 3a-p.

Detailed sightings of each species

Common minke whale

A total of 19 schools (24 animals) were sighted. In the research area, 12 schools (16 animals) were sighted, but the sighting positions were concentrated in the northern part (Figure 3 a). During transit, 7 schools (8 animals) were sighted (Figure 3 b).

Like minke whale

In the current season, we also observed animals like minke whale. This code was used to mark whales when, for some reason, it was impossible to determine with 100% certainty the species as common minke whale.

We observed such animals only in the research area (Figure 3 c), in the amount of 3 schools (3 animals).

North Pacific right whale

In the current season, 13 North Pacific right whales (9 schools) were recorded all animals were encountered in the research area, mainly in the norther part (Figure 3 d). One pair of cow and calf was observed. Very interesting behavior (social or sexual) of two whales was noted on 18 Aug. Initially, as we approached the whale, the animal stayed in one place for a long time. The whale quite often beated the surface water with tail fin for a long time until another whale appeared next to this animal, after which they began to move as a couple. The scientific team believes that this behavior was a signal to another animal.

Fin whale

Throughout the expedition fin whales were noted - 12 schools (23 animals) only in the research area (Figure 3 e). One cow and calf pair was observed.

Sperm whale

This species was found only in the research area (Figure 3 f) - 1 schools (1 animals). In fact, the sperm whale was spotted at 11 degrees starboard at as close a distance of 0.7 miles as possible. The cruise leader and senior researcher had no doubts about the identification of this whale - there was a high dorsal hump, followed by a row of knolls, a bushy blow was spouting forward to the left. Photographs could not be taken because the animal was observed for 1 minute and preparation of camera was not ready in time. Since during our observation the sperm whale showed its tail, the cruise leader decided to continue the research along the track route, since during deep diving, the sperm whale can stay under water for more than an hour.

Killer whale

During the current cruise, killer whales were encountered in several groups (5 schools) in the survey area in the amount of 22 animals (Figure 3 g). In these animals, 7 adult males were identified by typical dorsal fin. At the transit (Figure 3 h), we noted a single adult male according astern of the ship.

Dall's porpoise

Dall's porpoises recorded in the research area, by color types: Dall's porpoise (unidentified type) -96 schools (224 animals), Dall's porpoise (Dalli-type) - 14 schools (40 animals), Dall's porpoise (truei-type) - 2 schools (5 animals).

Dall's porpoised recorded during transit by color types: Dall's porpoise (unidentified type) -15 schools (46 animals), Dall's porpoise (Dalli-type) - 2 schools (5 animals), Dall's porpoise (truei-type) - 1 schools (5 animals).

Sighting positions of Dall's porpoised are plotted in figures 3i-n.

Harbour porpoise

A total of 2 harbor porpoises were recorded during the voyage (Figure 3 o).

White whale

When the vessel passed in transit mode to the research area, 49 belugas were recorded in the Amur Estuary and at the entrance to the Sakhalin Bay (Figure 3 p).

PHOTO-IDENTIFICATION

During the current expedition, photographs of whales suitable for photo-identification were obtained (Table 8): killer whale and North pacific right whale. A total of 457 images were obtained, 16 different animals were provisionally identified.

Estimated angle and distance training

Distance and angle estimation training was carried out on August 13th prior to sighting in the research area. Time elapsed – 2 hour 03 min (Appendix 2, Figure 5).

Estimated angle and distance experiment

Experiment was carried out on September 2th prior to sighting in the transit. Time elapsed – 3 hours 12 min. The time spent on the training and experiment is given in the table 2.

DISCUSSION

The most important feeding area of the common minke whale is the Sea of Okhotsk in the western North Pacific (Шунтов, 2016). The results of our past surveys in the Sea of Okhotsk have shown that the species is found in all its parts, and according to the data of 2020, including the central one. Solitary animals were observed in greater numbers, which is typical for this cetacean species.

The North pacific right whale is more common in the shelf zone and in the shelf edge (Бурдин и др., 2009). Our observations recorded the species, both singles and in pairs, in the open parts of the Sea of Okhotsk.

At the turn of the 20th and 21st centuries, the fin whale increased its numbers rather quickly (Шунтов, 2016). This is confirmed by regular encounter of this species in the Sea of Okhotsk (Myasnikov et all., 2016, Gushcherov et all., 2017,2018,2019,2020; Гущеров и др., 2018)

It is known that the bulk of sperm whales are concentrated in the oceanic waters of the Kuril Islands (Шунтов, 2016). In the central part of the Sea of Okhotsk, the sperm whale was observed only once in 2020, but it was the northernmost record during our past surveys.

Dall's porpoises are found both in the shelf zone and in the central part of the sea (Владимиров, 2001). Numerous encounters of this species are mentioned based on the results of our past surveys (Myasnikov et all., 2016; Gushcherov et all., 2017,2018, 2019). This year, as before, Dall's porpoises are the most abundant species.

The harbor porpoise mainly stays in shallow coastal waters and is rarely found at depths of more than 200 m (Бурдин и др., 2009). Therefore, in the current expedition, because most of the research area was deeper than 200 m, they were quite rare.

In summer, white whales feed in the Sakhalin Bay (Мельников, 2006; Бурдин и др., 2009). In different years, a different number of sightings of this cetacean species was noted (Gushcherov et all., 2017, 2019, 2020). In 2020, 49 belugas were observed at the transit crossing, feeding during this period.

In 2020, most of large and small cetaceans without Dall's porpoises were sighted in the northern part of the research area suggesting the possibility of redistribution or preparation for further migratory activity to the south.

Summarizing the above, we believe that the expeditions carried out in 2015 - 2020 have once again made a significant contribution to the activity of the Scientific Committee of the International Whaling Commission.

CONCLUSIONS

This 2020 season was the sixth year when the systematic sighting survey was carried out on R/V «Vladimir Safonov» in the Sea of Okhotsk. Throughout the expedition we noted the following species of cetaceans - common minke whale, North Pacific right whale, humpback whale, fin whale, sperm whale, killer whale, white whale, Dall's porpoises and harbour porpoise. Marine mammals lab specialists have gained necessary experience to carry out similar surveys based on the method authorized by the IWC/SC.

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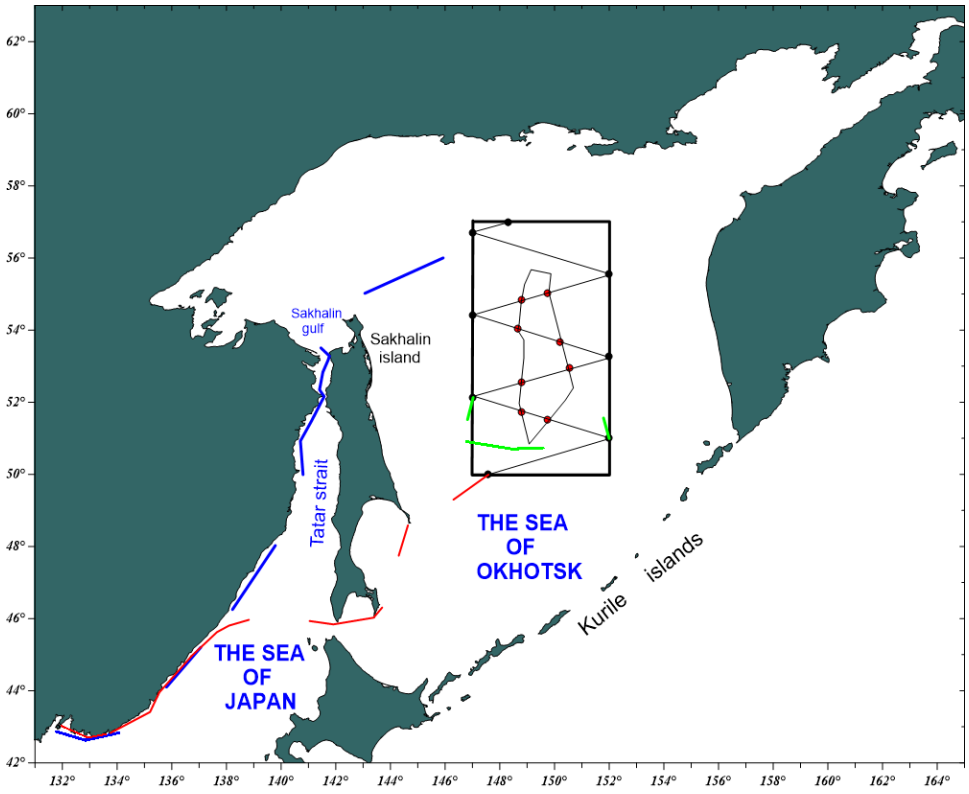

Figure 1. Research area and transit route for *ВЛАДИМИР САФОНОВ* (*VLADIMIR SAFONOV*) in the 2020 Okhotsk cetacean sighting survey. The blue line indicates the ship's route to the research area, the red line – indicates, the green line – transit in research area

Table 1. Coordinates of the way points in research area of Okhotsk Sea in 2020 cruise by «Vladimir Safonov».

№ way point	Coordinates	
	Longitude	latitude
1	148°18,17’	57°00,00’
2	147°00,00’	56°42,19’
3	152°00,00’	55°33,84’
4	147°00,00’	54°25,49’
5	152°00,00’	53°17,15’
6	147°00,00’	52°08,80’
7	152°00,00’	51°00,45’
8	147°34,67’	50°00,00’

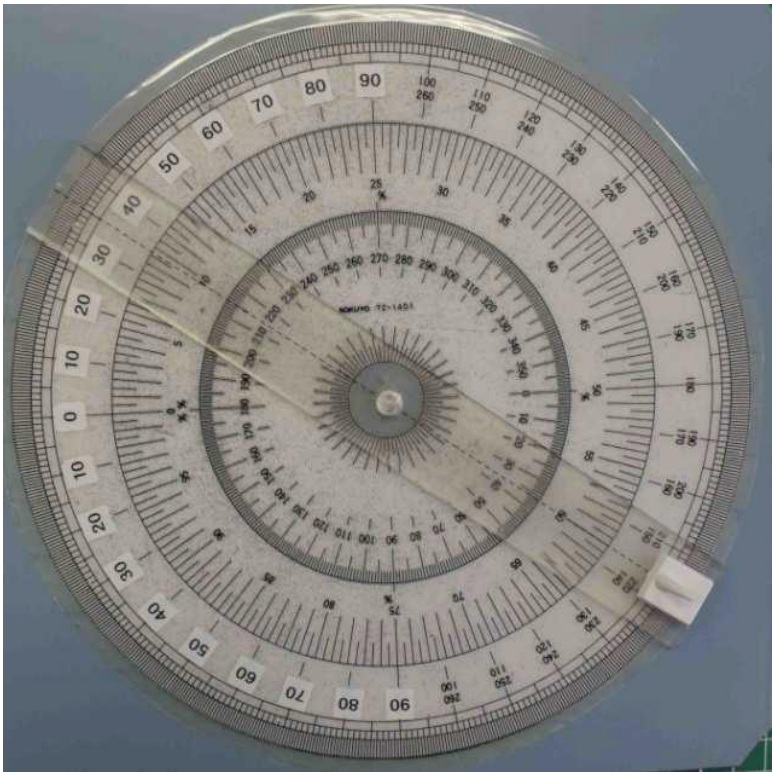

Figure 2. Angle board to support the angle estimation.

Table 2 - Summary of search effort of in 2020 cruise by «Vladimir Safonov»

Area	Start	End	Normal Closing mode		Normal Passing mode		Estimated angle and distance estimation training/ experiment
	Data/ Time	Data/ Time	Time	Distance (nmi)	Time	Distance (nmi)	
Vladivostok to research area	7-Aug. 06:45	12-Aug. 19:00	-	-	56:10	484,65	-
Research area	13-Aug. 07:47	29-Aug. 12:46	133:65	1177,28	09:08	88,48	Training 2:03
Research area to Vladivostok	29-Aug. 13:00	06-Sep. 19:00	-	-	35:39	336,23	Experiment 3:12
Total	-	-	133:65	1177,28	100:57	909,36	4:15

Table 3 - Air and SST temperatures during to 2020/8/7 – 9/6

Item	Air temperature	SST
Maximum	30	23
Minimum	10	3,5
Average	16,9	14,6

Table 4 - Observation of the sea state during to 2020/8/7 – 9/6

Sea state	0	1	2	3		5	6	7	Total
Observation	2	194	99	77	17	18	34	18	459
%	0,4	42,3	21,6	16,8	3,7	3,9	7,4	3,9	100

Table 5 - Observation of weather condition during to 2020/8/7 – 9/6

Weather	Clear	Slightly cloudy	Cloudy	Overcast	Rain	Fog	Total
Observation	26	66	107	177	14	45	435
%	6,0	15,2	24,6	40,7	3,2	10,3	100

Table 6 - Observation of wind speed and direction during to 2020/8/7 – 9/6

Wind speed (knots)	Wind direction										
	breeze	N	NE	E	SE	S	SW	W	NW	Total	%
breeze	2	0	0	0	0	0	0	0	0	0	0,0
1-3	0	28	4	9	44	32	39	12	26	194	42,3
4-6	0	10	20	0	17	11	4	13	24	99	21,6
7-10	0	14	0	3	25	4	3	11	17	77	16,8
11-16	0	0	0	10	0	0	0	0	7	17	3,7
17-21	0	0	2	0	0	0	3	2	11	18	3,9
22-27	0	0	0	0	4	1	19	3	7	34	7,4
28-33	0	0	0	0	4	8	6	0	0	18	3,9
Total	2	52	26	22	94	56	74	41	92	459	99,6
Total, %	0,4	11,3	5,7	4,8	20,5	12,2	16,1	8,9	20,0		100,0

Table 7 - Number of sightings during to Okhotsk Sea sighting survey in 2020

Species	Research area				Transit				Total			
	Primary		Secondary		Primary		Secondary		Primary		Secondary	
	Sch.	Ani.	Sch.	Ani.	Sch.	Ani.	Sch.	Ani.	Sch.	Ani.	Sch.	Ani.
Dall's porpoise (i-type)	14	40			2	5			16	45	0	0
Dall's porpoise (unidentified type)	92	215	4	9	15	46	-	-	107	261	4	9
Dall's porpoise (truei-type)	2	5	-	-	1	5	-	-	3	10	0	0
Harbour porpoise	1	2	-	-	-	-	-	-	1	2	0	0
Killer whale	5	22	-	-	1	1	-	-	6	23	0	0
White whale	-	-	-	-	2	49	-	-	2	49	0	0
Like minke whale	2	2	1	1	-	-	-	-	2	2	1	1
Common minke whale	11	14	1	2	6	7	1	1	17	21	2	3
North Pacific right whale	9	13	-	-	-	-	-	-	9	13	0	0
Fin whale	12	23	-	-	-	-	-	-	12	23	0	0
Sperm whale	1	1	-	-	-	-	-	-	1	1	0	0
Unidentified large cetacean	1	2	-	-	2	3	1	1	3	5	1	1
Unidentified small cetacean	-	-	-	-	1	4	-	-	1	4	0	0
Unidentified cetacean	4	7	-	-	-	-	-	-	4	7	0	0

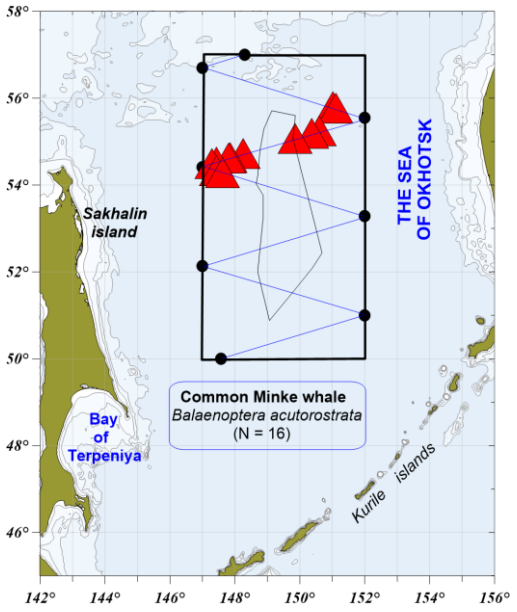

Figure 3 a. Sighting positions of common minke whale schools in research area. Red triangles show the sighting position

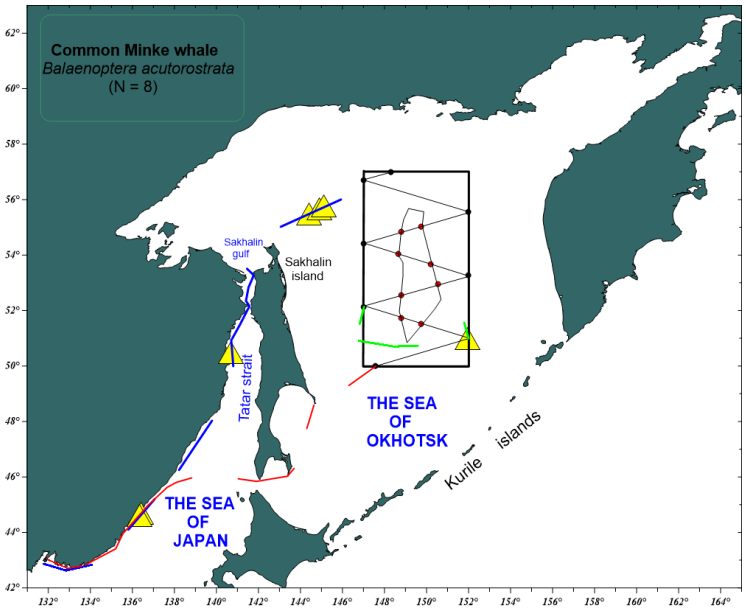

Figure 3 b. Sighting positions of common minke whale schools in transit. Yellow triangles show the sighting position. The blue line indicates the ship's route to the research area, the red line – indicates the ship's route from the research area, the green line – transit in research area

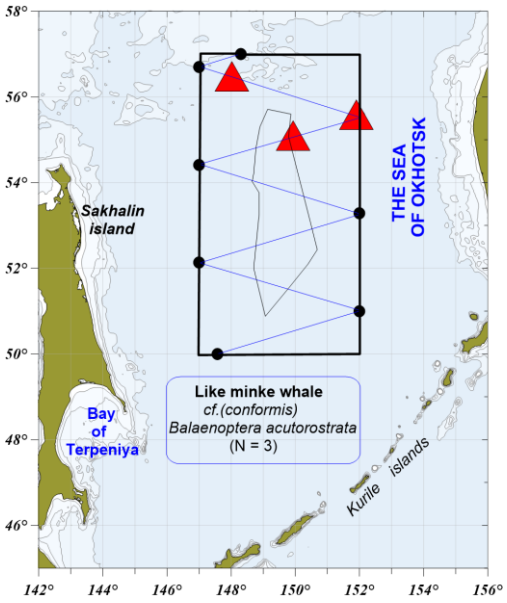

Figure 3 c. Sighting positions of like minke whale schools in research area. Red triangles show the sighting position

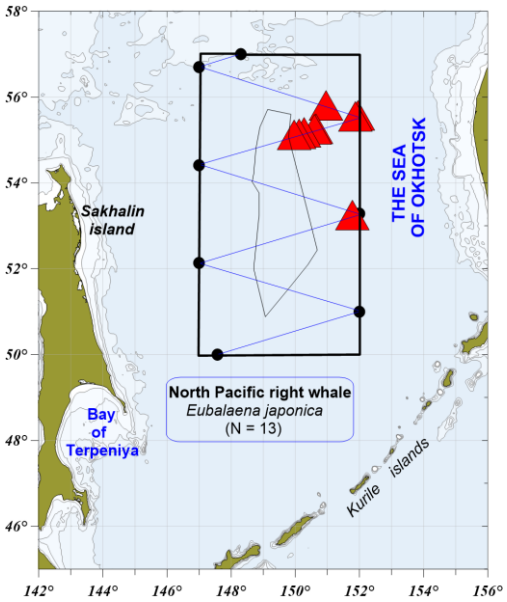

Figure 3 d. Sighting positions of North Pacific right whale schools in research area. Red triangles show the sighting position

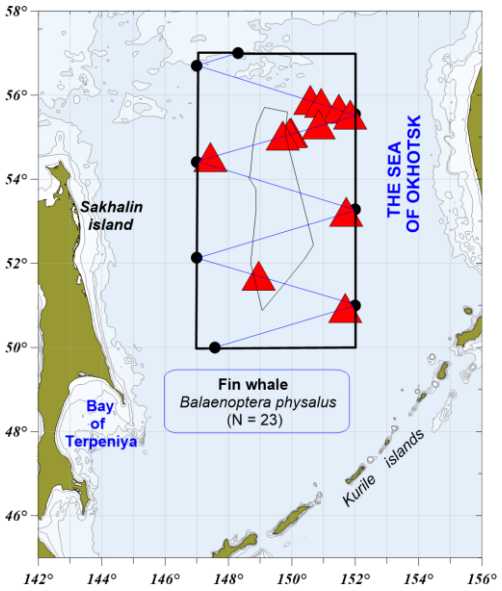

Figure 3 e. Sighting positions of fin whale schools in research area. Red triangles show the sighting position

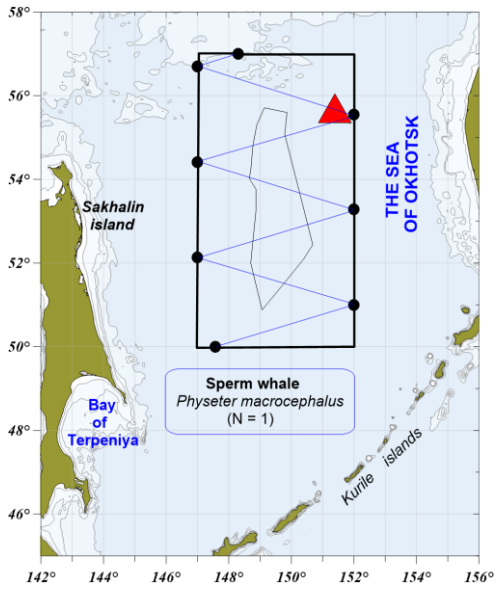

Figure 3 f. Sighting positions of sperm whale schools in research area. Red triangles show the sighting position

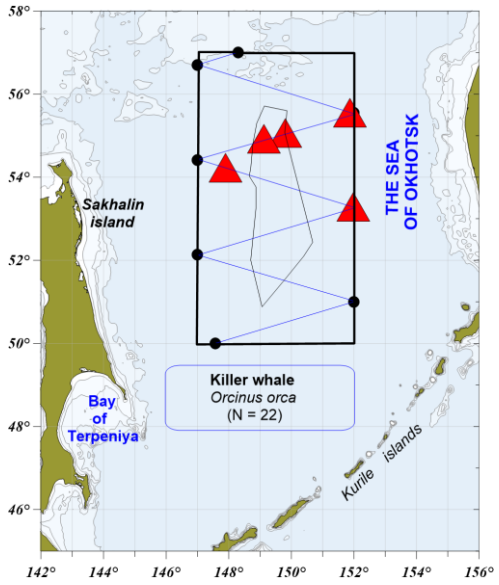

Figure 3 g. Sighting positions of killer whale schools in research area. Red triangles show the sighting position

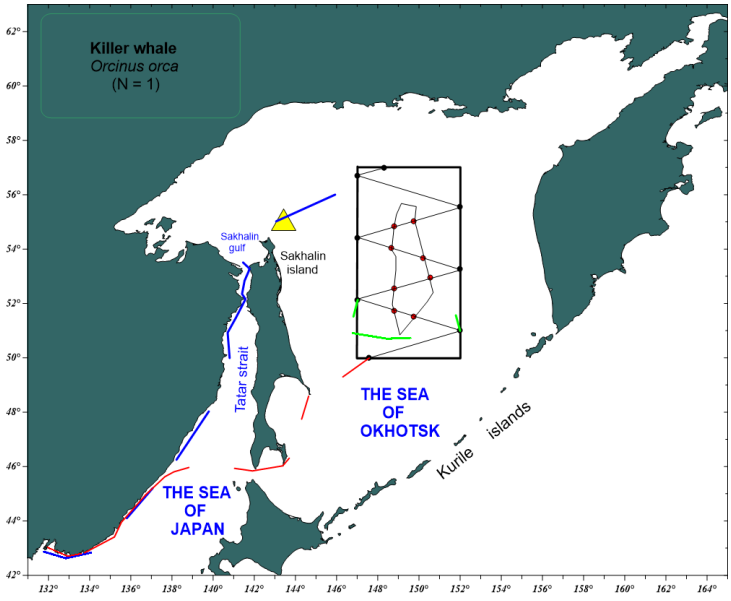

Figure 3 h. Sighting positions of killer whale schools in transit. Yellow triangles show the sighting position. The blue line indicates the ship's route to the research area, the red line – indicates the ship's route from the research area, the green line – transit in research area

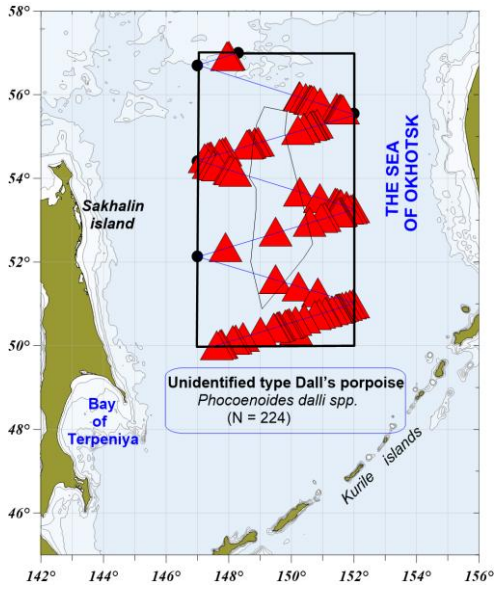

Figure 3 i. Sighting positions of Dall's porpoise (unidentified type) schools in research area. Red triangles show the sighting position

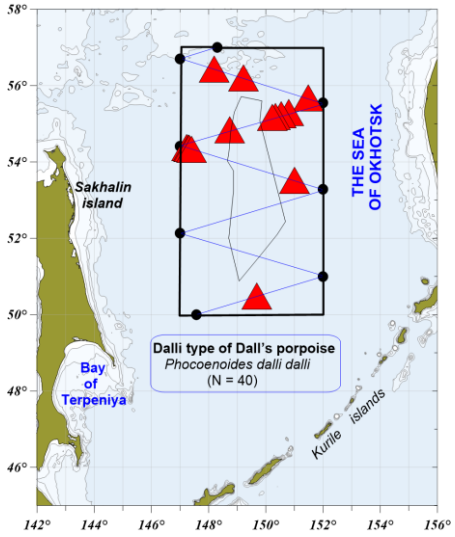

Figure 3 j. Sighting positions of Dall's porpoise (Dalli-type) schools in research area. Red triangles show the sighting position

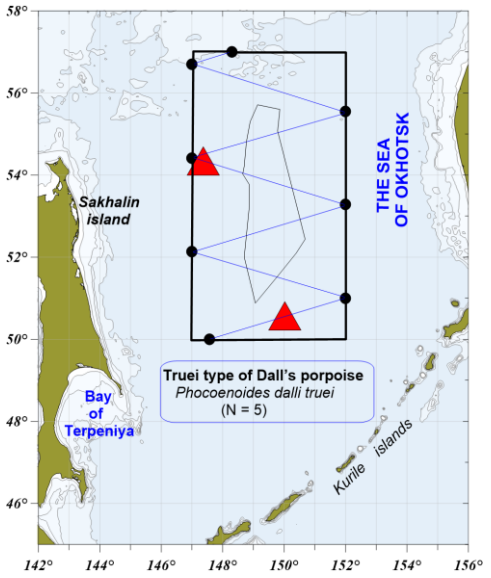

Figure 3 k. Sighting positions of Dall's porpoise (truei-type) schools in research area. Red triangles show the sighting position

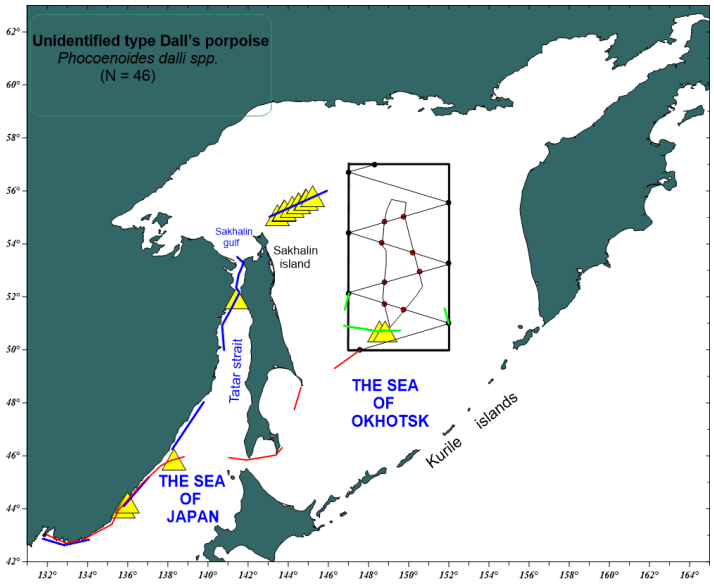

Figure 3 l. Sighting positions of Dall's porpoise (unidentified type) in transit. Yellow triangles show the sighting position. The blue line indicates the ship's route to the research area, the red line – indicates the ship's route from the research area, the green line – transit in research area

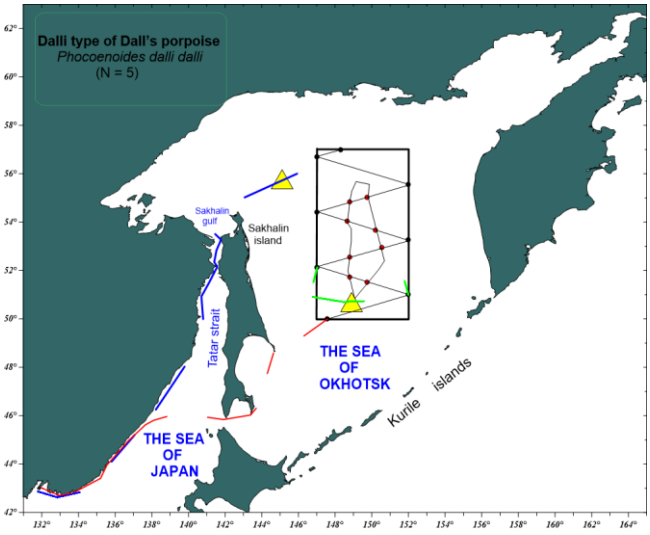

Figure 3 m. Sighting positions of Dall's porpoise (Dalli-type) in transit. Yellow triangles show the sighting position. The blue line indicates the ship's route to the research area, the red line – indicates the ship's route from the research area, the green line – transit in research area

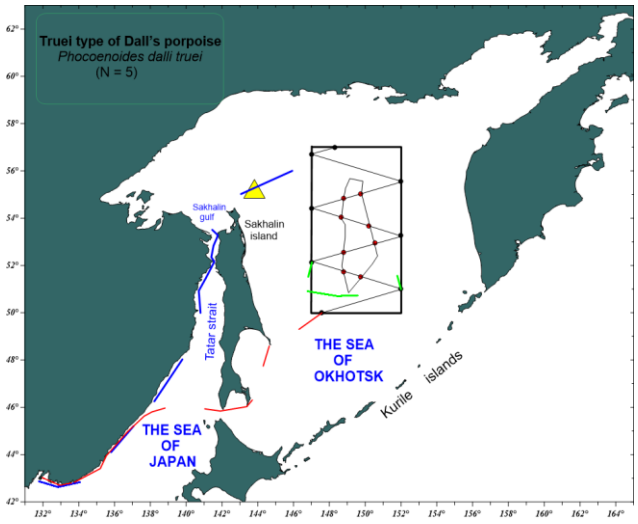

Figure 3 n. Sighting positions of Dall's porpoise (truei-type) in transit. Yellow triangles show the sighting position. The blue line indicates the ship's route to the research area, the red line – indicates the ship's route from the research area, the green line – transit in research area

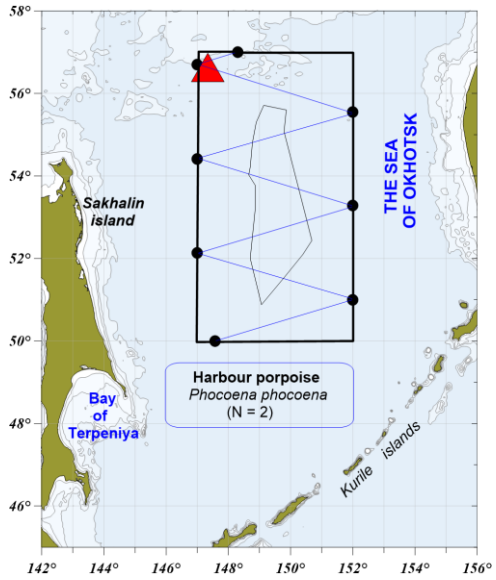

Figure 3 o. Sighting positions of harbour porpoise schools in research area. Red triangles show the sighting position

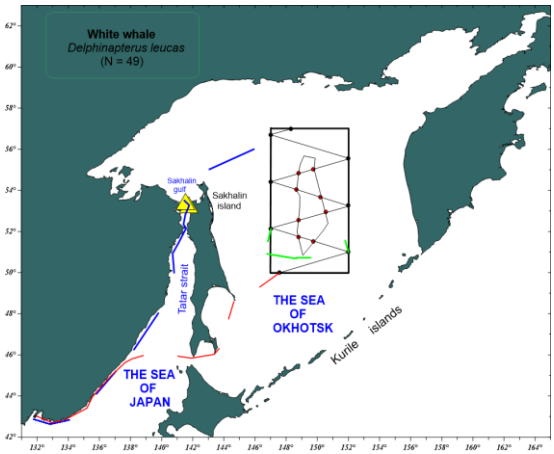

Figure 3 p. Sighting positions of white whale in transit. Yellow triangles show the sighting position. The blue line indicates the ship's route to the research area, the red line – indicates the ship's route from the research area, the green line – transit in research area

Table 8 – Provisional number of photo-identified animals during the 2020 survey.

Date	Species	Number of photos	Number of identified individuals
15.08.2020	North Pacific right whale	117	4
15.08.2020	Killer whale	26	2
16.08.2020	Killer whale	90	1
17.08.2020	Killer whale	94	6
18.08.2020	Killer whale	7	2
18.08.2020	North Pacific right whale	123	1

Appendix 1

R/V ВЛАДИМИР САФОНОВ (VLADIMIR SAFONOV)

Table 9. Specification of the research vessel *ВЛАДИМИР САФОНОВ* (*VLADIMIR SAFONOV*)

Length overall [m] 48.12
Molded breadth [m] 10.50
Gross tonnage (GT) 462.0
Barrel height [m] 15.0
Upper bridge height [m] 12.0
Engine power [kW] 970

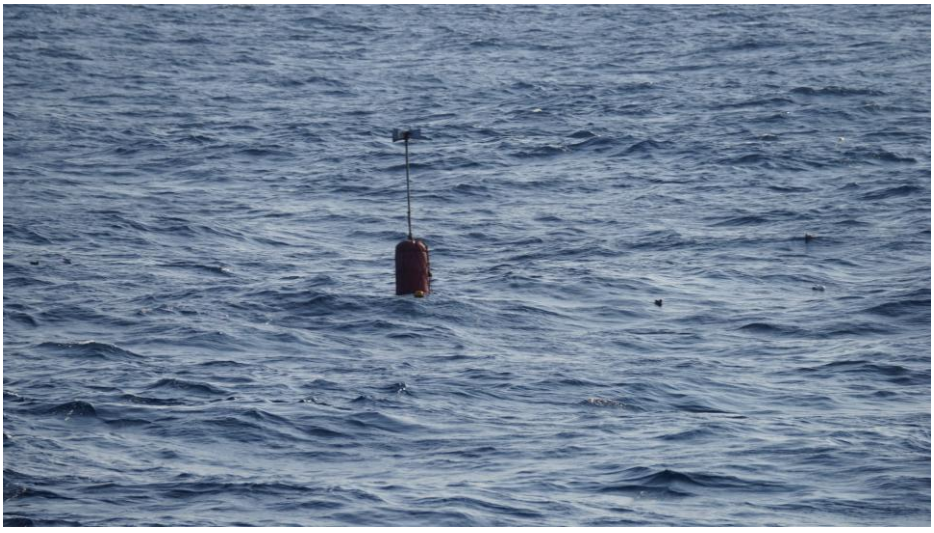

Figure 5. Radar reflecting buoy for estimated angle and distance training and experiment

Oversight report for the cetacean sighting survey in the Sea of Okhotsk in 2020

Tomio Miyashita
National Research Institute of Far Seas Fisheries

This year's project was heavily influenced by COVID-19, and many difficulties were encountered in its implementation. Usually I have visited to Vladivostok for the pre-cruise meeting in early August, but in 2020 I could not. So I have ordered the photos and the videos of the vessel and its equipment to check it readiness before starting, and the cruise leader has sent them. Then I could confirm the readiness for the cruise.

Based on last year's experience of species mis-identification (humpback/sperm), I instructed that an experienced scientist (cruise leader or senior scientist) should always be present on the top-barrel or the upper-bridge during the survey to confirm the species. In cases where the species is ambiguous, I also requested that they be photographed or videotaped as much as possible, if circumstances permitted. Therefore, I am confident that these measures have eliminated the errors in species identification this year.

As a result of looking at the past data, rounding errors in angle estimation have been seen recently, and I demanded that the angle board be rigorously used to correct them. The results show that the rounding error has been eliminated in this cruise.

During the cruise, detailed information of the research activities such as the positions (at noon, start and finish), the distance (with survey effort, without effort), the sighting information (number of schools and animals sighted by species, by primary/secondary), the weather information at noon and other description of activity if necessary has been informed everyday via e-mail. Each time a question arose, typically about species identification, I e-mailed it and received a response from the cruise leader.

This year, the weather was generally good through the research period, the vessel could covere 100% of the pre-determined track line. And large number of sightings have been obtained successfully. The fact that so much has been accomplished under the COVID-19 epidemic is a tribute to the tireless efforts of the cruise leader, researchers and crew. Finally, I am confident that this survey was carried out in accordance with the guidelines of the Scientific Committee.