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PHOTOGRAPHIC IDENTIFICATION OF THE KOREAN-OKHOTSK GRAY WHALE (Eschrichtius robustus) OFFSHORE NORTHEAST SAKHALIN ISLAND AND SOUTHEAST KAMCHATKA PENINSULA (RUSSIA), 2008

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Abstract

There are two primary gray whale feeding areas offshore northeast Sakhalin Island in the Sea of Okhotsk: the first, "Piltun" feeding area is a shallow area located along the coast adjacent to Piltun Bay; whales predominantly feed in this area in water depths <20 m. The second, Offshore feeding area is located at a distance of about 30-40 km southeast of Chayvo Bay with water depths of about 35-60 m. Both areas are abundant in potential prey for gray whales. Photo-ID studies of gray whales conducted in the Piltun and Offshore feeding areas in the period 2002-2008 confirmed the exchange of individuals between the two areas between and within feeding seasons. During the seven years of photo-ID effort, use of the Offshore feeding area by gray whales varied in intensity.

Over the past few decades, researchers have become aware of the presence of gray whales in the coastal waters offshore southeast Kamchatka during the summer-autumn and early winter months. Photo-ID studies conducted offshore Kamchatka in 2004, 2006, 2007 and 2008 substantiate these observations. Results from these studies demonstrate that the western gray whale population is not confined to their feeding grounds offshore Sakhalin during their summer-to-fall feeding season. In 2008, photo-ID studies were conducted in the two Sakhalin feeding areas and in Olga Bay, located on the southeast coast of the Kamchatka Peninsula. Results from the 2008 photo-ID effort show that 97 individuals from the Sakhalin catalogue were seen only offshore Sakhalin, 24 were seen only offshore Kamchatka, and one was seen at both locations; thus, a total of 122 whales from the Sakhalin catalogue were observed in 2008. An additional 25 gray whales were seen offshore southeast Kamchatka that have not been seen previously offshore Sakhalin, and therefore are not recorded in the Sakhalin catalogue.

KEY WORDS: WESTERN GRAY WHALE, PHOTO-ID, DISTRIBUTION, SAKHALIN, PILTUN, KAMCHATKA, OIL-GAS PROJECT.

Introduction

From 2002-2008, photographic identification (photo-ID) studies of the critically endangered population of western gray whales, have been conducted annually offshore northeast Sakhalin Island as part of an industry-sponsored monitoring program jointly funded by the Sakhalin-1 (ENL) and Sakhalin-2 (SEIC) oil and gas development projects. Two main feeding areas have been identified along the northeast Sakhalin coast: the Piltun feeding area adjacent to Piltun Bay (52°40' N to 53°30' N), where whales predominantly feed in shallow waters <20 m depth, and the Offshore area approximately 30-40 km east of Chayvo Bay (51°50' N. to 52°25' N), where whales feed in greater water depths of 35-60 m. Gray whales utilize these feeding areas during the ice-free season.

More recently, western gray whales have also been identified feeding on the southeast coast of the Kamchatka Peninsula. For example, western gray whales were observed in Nalycheva Bay (2004) in water depths of about 30 m, in Vestnik Bay (2006, 2007) in water depths of about 15-24-m, and in Olga Bay (2006-2008) in water depths of about 5-17 m.
In the summer and fall of 2008, photo-ID studies were conducted in the two primary feeding areas offshore Sakhalin Island and in Olga Bay (Fig. 1). Whales were also photographed if opportunistic sightings occurred outside of these regions. The photo-ID effort offshore Sakhalin Island took place between June 25 and July 23, 2008 and between August 24 and October 10, 2008 during the annual western gray whale monitoring and research expedition of the RV Akademik Oparin. Between July 24 and August 23, 2008, the Akademik Oparin set out for reconnaissance surveys in the northern Sea of Okhotsk, along the western shores of Kamchatka, and along the northern part of the Kurile Islands as part of a joint expedition by the Pacific Institute of Bioorganic Chemistry (PIBOC FEB RAS) and A.V. Zhirmunsky Institute of Marine Biology of the Far Eastern Branch of the Russian Academy of Sciences (IMB FEB RAS).

Methods

Visual observations of marine mammals were conducted from the base vessel during daylight hours in all types of weather. Information about the locations of gray whales gathered in the course of these continuous observations, which were conducted concurrently with other components of the western gray whale monitoring program (benthic prey sampling, marine mammal observations, acoustic monitoring, hydrological studies) allowed the photo-ID team to travel directly to gray whale aggregations and reduce search time. When the vessel approached within approximately 1 km of a gray whale or a group of gray whales, the vessel was brought to a full stop and a zodiac of 3.8-m length was launched. The zodiac was equipped with a 45 HP four-stroke Mercury outboard motor, a Speedtech digital depth finder and a Magellan 320 portable global positioning system (GPS). The zodiac team consisted of a boat driver, a data recorder, a digital video camera operator and a digital camera photographer. Photographs were taken using a Nikon D1X or D2X digital camera with Nikkor 300 mm f/4 fixed telephoto lens or Nikkor 80-400mm f/4.5-5.6D VR zoom lens . Video footage was recorded with a Sony DSR TRV 730 (Digital 8), Canon Optura 20 or Sony HDR-HC7 mini DV digital video camera.

During each zodiac mission, the time, position, depth, distance to the whale(s), number of whales in the area, whale behavior, direction of movement of the whales, presence of killer whales, passing vessels, airplanes or helicopters, presence of mud plumes, sea surface temperature and salinity were recorded and documented. Photo-ID of gray whales was also performed from the bridge of the Akademik Oparin during times when other activities of the monitoring program took priority; however, the usefulness of these photographs is limited because of the remoteness of the whale(s) from the vessel.

The 2006 photo-ID effort in Olga Bay was conducted from a base vessel following similar field procedures as offshore Sakhalin. Photo-ID work in 2007 and 2008 was performed using zodiacs launched from shore. Whales were photographed with a Canon 40D digital camera equipped with a Canon 75-300mm f/4-5.6 IS USM zoom lens.

To recognize whales by their distinguishing marks on their sides and flukes, standard photo-recognition methods specified by the International Whaling Commission were applied (Hammond et al., 1990). Confident left-to-right side matches were established based on the following criteria: (1) the whale was photographed as a solitary individual; (2) sequences of the left and right side were compared with flukes in common for a single sighting; and (3) as a final check to compare matches and assist with right to left matches, whale knuckle height, spacing and ratios were considered (Calambokidis et al. 1999). Whale body color

served as the basic feature for whale identification; scars and barnacle spots were used as additional features for comparison. Whales identified offshore of the Kamchatka Peninsula were assigned catalogue numbers KamGW# in the Kamchatka catalogue, and whales identified offshore Sakhalin Island were assigned catalogue numbers KOGW# in the Sakhalin catalogue. Whales identified in both regions carry two (KamGW# and KOGW#) catalogue numbers and appear in both the Kamchatka and Sakhalin catalogues.

Analysis of photo-ID data also incorporated the identification of whales with deviations from the "physiological norm". Such deviations included: (1) emaciation ("skinny" whales); and (2) obvious sloughing of skin or other anomalous skin conditions.

Results

The main results of the photo identification studies in 2008, combined with results from previous years, are as follows:

1. Identified whales in the Sakhalin gray whale catalogue: The 2002-2008 catalogue of photo-identified western gray whales offshore Sakhalin Island currently includes 165 fully identified, individual whales (Table 1). Some of these individuals have been recorded repeatedly in separate years, while others are new to the catalogue or have not been recorded for some time.

2. Identified western gray whales in 2008 (Sakhalin and Kamchatka): In 2008, 97 individuals from the Sakhalin catalogue were seen only offshore Sakhalin, 24 were seen only offshore southeast Kamchatka (Olga Bay), and one was seen at both locations; thus, 122 whales from the Sakhalin catalogue were observed in 2008 (Fig. 2).

3. Identified whales in the Kamchatka gray whale catalogue: At present (i.e., as of 2008), the Kamchatka gray whale catalogue contains a total of 78 whales; 39 of these whales are also listed in the Sakhalin catalogue. A total of 50 gray whales were seen offshore southeast Kamchatka in 2008, including 25 that had not been observed previously offshore Sakhalin and therefore are not recorded in the Sakhalin catalogue (Fig. 3). It is currently unclear if these whales belong to the western or eastern population.

4. Survey effort offshore Sakhalin in 2008 (compared to 2007): Fewer individual whales were identified offshore Sakhalin in 2008 (98) than in 2007 (125), and less effort was expended on photo-ID offshore Sakhalin in 2008 (29 days) than in 2007 (62 days). Consequently, there were about 2.5 times fewer Sakhalin records on which to perform photo-identification in 2008 than in 2007. Therefore, it is possible that the lower number of whales recorded offshore Sakhalin in 2008 than in 2007 may, in part, have been due to the difference in effort between the two years.
The 2008 photo-ID findings are supported by estimates from the 2008 distribution surveys, which indicate that that the number of gray whales offshore Sakhalin Island was approximately 100 individuals. However, it should be considered that the 2008 distribution survey effort was also lower in 2008 than in 2007 particularly during the month of August, when weather conditions were especially severe (only two full on-shore distribution surveys were completed in August 2008 compared to 10 in August 2007, Vladimirov et al., 2008, 2009).

5. Movement between feeding areas: Photo-ID studies are useful to help understand how whales utilize different feeding areas within the same year (i.e., intra-annually) and between years (i.e., inter-annually):

Intra-annual movement between feeding areas:. Of the 98 whales seen in Sakhalin waters in 2008, 36 were seen only in the Piltun feeding area, and 36 were seen only in the Offshore feeding area (Table 2). One whale was

seen only near Chayvo Bay. The remaining 25 whales were seen in both areas (including one whale that was also seen near Okha), indicating that some whales utilise both feeding areas during the same season. Intra-annual movement of whales between the Piltun and Offshore feeding areas was also observed in 2007, 2006 and during earlier years. In 2007 for example, 38 whales seen in the Piltun feeding area were also recorded in the Offshore feeding area.

It also has been found that some whales feed offshore Kamchatka and Sakhalin during the same season: in 2008 one whale was first observed in Kamchatka and later during the season offshore Sakhalin. In 2006, two whales observed offshore southeast Kamchatka in were observed feeding offshore Sakhalin later during the same season. Similarly, 13 whales sighted offshore southeast Kamchatka in 2007 also were observed offshore Sakhalin in 2007.

Inter-annual movement between feeding areas:. Some whales seen only in the Piltun feeding area in 2008 had been recorded in the Offshore feeding area in previous years. Half of the whales (25 out of 50) seen offshore southeast Kamchatka in 2008 had been recorded offshore Sakhalin in previous years, and ten whales that had been recorded offshore southeast Kamchatka in 2007 were sighted offshore Sakhalin in 2008. In 2007, 20 out of 37 whales sighted offshore southeast Kamchatka had been sighted offshore Sakhalin in previous years. Similarly, five out of 13 whales sighted offshore southeast Kamchatka in 2006 were observed offshore Sakhalin Island either during previous or subsequent years.

6. Other potential feeding areas: Data exist which suggest that areas other than northeast Sakhalin and southeast Kamchatka also are visited by members of the western gray whale population. In 2006, the IBM photo ID laboratory was asked to process data gathered in Kekurny Bay (July 13, 2006), and Babushkin Bay (July 28, 2006) in the north of the Sea of Okhotsk. From these data, three whales were identified and assigned catalogue ID numbers NOGW# (Vladimirov et al., 2007). In 2007, one of these three whales was sighted in the Piltun feeding area and in Olga Bay and given catalogue ID numbers KOGW#/KamGW#.

In 2008, a joint survey expedition from PIBOC DVO RAN and IBM DVO RAN took photos of one whale in Zakatny Bay offshore Shiashkotan Island (Kurile chain) that had been recorded in Olga Bay offshore Kamchatka in 2007. This whale was sighted in Olga Bay later during the same (2008) feeding season. On June 6, 2008 researchers photographed a whale offshore Medny Island (Aleutian chain) that had been recorded in Olga Bay and offshore Sakhalin in 2007. This whale was sighted in Olga Bay in August 2008. On July 8, 2008 researchers photographed 4 whales offshore Karaginsky Island (northeast Kamchatka) that had not been sighted anywhere previously (Fig 1).

7. Cow-calf pairs: So far (until 2008), cow-calf pairs had only been recorded in the Piltun feeding area, and often near the mouth of Piltun Bay, where high prey abundance and shallower waters allow mothers to teach their calves to forage.

In 2008, three cow-calf pairs and two independent, “possible calves” were photographed in the Piltun feeding area; in 2007, there were six cow-calf pairs and three possible calves.

For the first time, one cow-calf pair was recorded in the shallow waters of Olga Bay, Kamchatka in 2008. Previously the mother had been recorded offshore Sakhalin in 2002-2006 and in Olga Bay in 2007; she also had been seen with calf offshore Sakhalin in 2003. Although this new information indicates that cow-calf pairs can be found in areas other than Piltun, our data currently indicate that this is uncommon; no cow-calf pairs were recorded in Kamchatka in 2004, 2006, and 2007.

8. Movement between feeding areas by young whales: A total of eight whales that were sighted in Olga Bay offshore Kamchatka in 2008 had been recorded as calves offshore Sakhalin in 2007. One of the whales identified offshore Kamchatka in 2006, 2007 and 2008 had been recorded as a suckling (current year's calf) in the Piltun area in 2004, and was not sighted offshore Sakhalin in subsequent years. Two whales identified offshore Kamchatka in 2006, 2007 and 2008 had been recorded as sucklings in the Piltun area in 2003, and were not sighted offshore Sakhalin in subsequent years. One whale sighted offshore Kamchatka in 2007 and 2008 had been recorded as a calf offshore Sakhalin in 2005 and has also been sighted offshore Sakhalin in 2006 and 2007.

9. Emaciated whales: Photography can also be used to record the nutritional and pathological body condition of gray whales. The suboptimal, and occasionally, emaciated body weight of some whales arriving offshore Sakhalin Island in spring generally improves during the summer feeding season. In 2006-2007, the condition of most underweight whales was observed to improve over the course of the season.

In 2008, 20 whales (including 3 nursing cows) were under-weight when they were first seen offshore Sakhalin at the beginning of the season. During the course of the season, the body weight of 8 whales improved to optimal classes. Furthermore, 5 of the 6 cows that had calves and suboptimal body condition in 2007, were again photographed in 2008; all 5 had regained optimal body weight. As in previous years, the body weight condition of all calves during 2008 was optimal.

10. Whales with abnormal skin conditions: Photographs were also used to assess abnormal skin conditions. No whales were recorded with skin sloughing in 2008; this condition was recorded in previous years. However, the development of new white patches on the skins of two individuals was recorded in 2008; it is not yet clear what these conditions signify.

Conclusions

Based on the results presented here, it appears that non-calf members of the gray whale population move between feeding areas (Piltun, Offshore and southeast Kamchatka) both inter-annually and intra-annually. One possible explanation for this behavior are changes in food abundance and availability; however, further work (particularly, benthic data sampling and analysis) is required to substantiate this conclusion.
Half of the whales presently contained in the Kamchatka gray whale catalogue (39 out of 78) have been identified as western gray whales, while the affiliation of the other half remains unknown. Similarly, half of the whales observed offshore southeast Kamchatka in 2008 (25 out of 50) are known from the Sakhalin catalogue, while the other half is not. These results are suggestive of two possibilities: Either, a potentially significant portion of the whales with unknown affiliation are western gray whales that have not yet been sighted offshore Sakhalin Island, or, these gray whales belong to the eastern population. In the first case, the reason why some western gray whales have not yet been observed offshore Sakhalin would remain to be investigated. In the second case, the logical conclusion would be that the eastern and western gray whale populations are not completely distinct in the geographic sense, but that their feeding grounds overlap and some mixing of the two populations occurs.

Recent identification of one western gray whale in the northern Sea of Okhotsk, one western gray whale offshore Shiashkotan Island (Kurile chain) and one western gray whale offshore Medny Island (Aleutian chain) based on limited data indicates that western gray whales may be encountered in regions other than northeast Sakhalin or southeast Kamchatka. However, to date these observations are few, and it remains unclear how many whales from the western gray whale population visit these regions and for what reasons.

A better understanding of the western gray whales' movements between feeding areas and their degree of site fidelity (e.g., how many feeding areas exist, how frequently are they visited and under which conditions) can be obtained only after accumulation of additional data in further studies.

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Table 1: Number of whales identified during photo-ID studies from 2002-2008 offshore northeast Sakhalin Island.

Year	Number of whales (total for year)	First observed in 2002	First observed in 2003	First observed in 2004	First observed in 2005	First observed in 2006	First observed in 2007	Number of new whales per year	Number of whales from previous years not sighted in current year	Number of whales in catalogue
A	B=C+D+E+F +G+I	C	D	E	F	G	H	I	J	H=B+J
2002	45(1)*							45(1)		45(1)*
2003	82	35						47	10(1)	92(1)*
2004	95(1)*	39	32(1)					24	21(1)	116(2)*
2005	117(1)*	41	39(1)	18				19	18(1)	135(2)*
2006	121(5)*	42	37	15	14			13(5)	27(1)	148(6)*
2007	125(5)	40	39	16	10	7		13(5)	35(5)	160(10)*
2008	98	33	33	17	5	3	2	5	67(10)	165(10)*

Table 2: Whale movement between feeding areas, 2002-2008.

Year	Number of whales identified in Piltun Area	Number of whales identified in Offshore Area	Number of whales identified in Offshore and Piltun areas	Number of whales identified in Chayvo area	Number of whales identified in Chayvo /Piltun and Chayvo / Offshore	Number of whales identified in Northern areas	Number of whales identified in Chayvo /Piltun/Offshore
2002	12(11)	35(34)	1				
2003	51(47)	35(31)	4				
2004	95(89)	7(1)	6				
2005	115(112)1	7(2)	5			5(1)	4
2006	105(67)	33(14)	16	28(7)	19(1)		2
2007	93(48)	70(25)	38	20(0)	13/0		7
2008	61(36)	61(36)	25	1(1)		1	1

Values in parenthesis indicate number of animals reported only in the specified area and not sighted in other surveyed areas.

Figure 1. Map showing the number of photo-identified whales in known feeding areas offshore NE Sakhalin Island, southeast Kamchatka and the Kuril Islands in the summer-fall season of 2008.

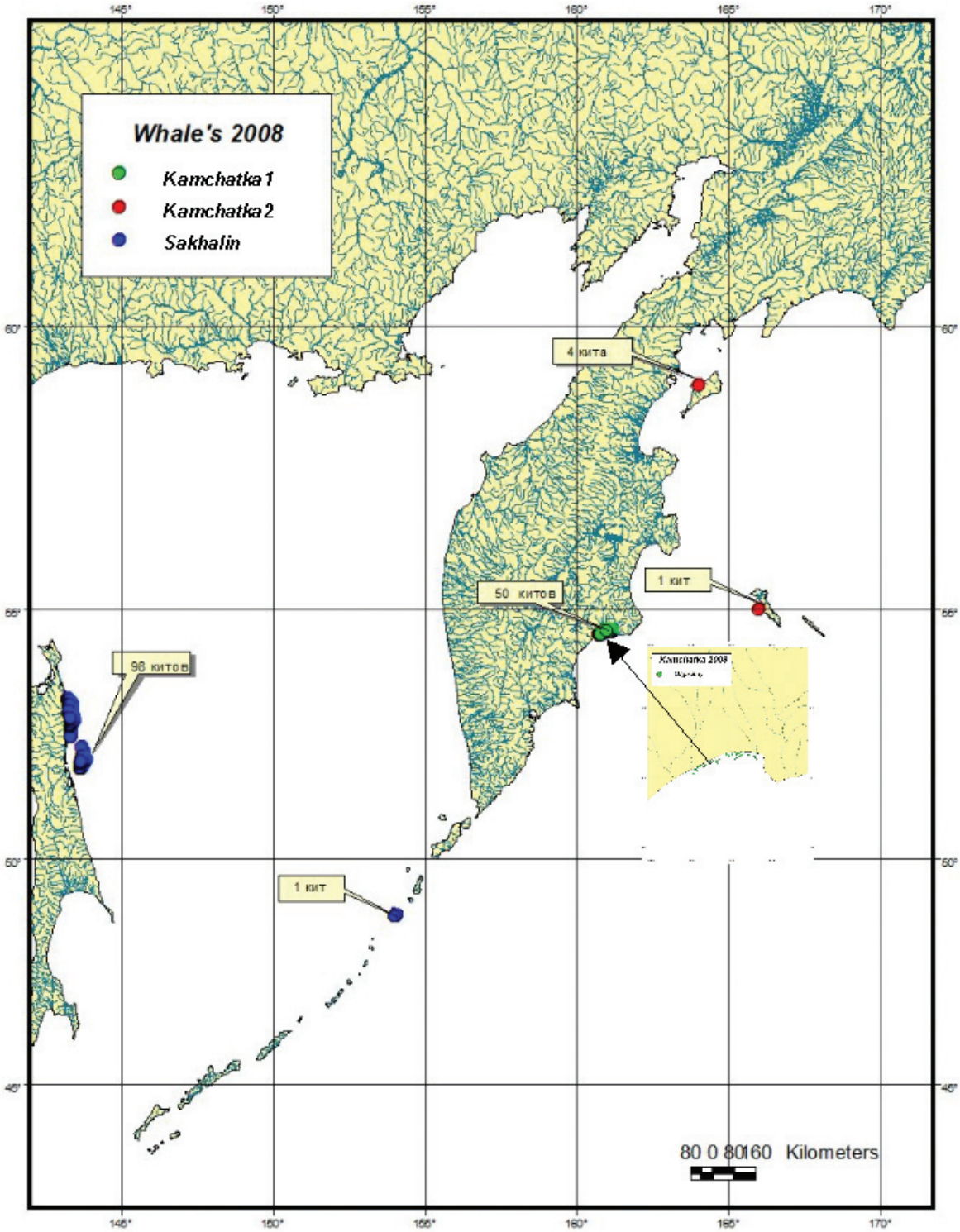

Figure 2. Diagram indicating the numbers of whales only in 2008 Sakhalin catalogue including the whales that were registered in 2008 at Kamchatka

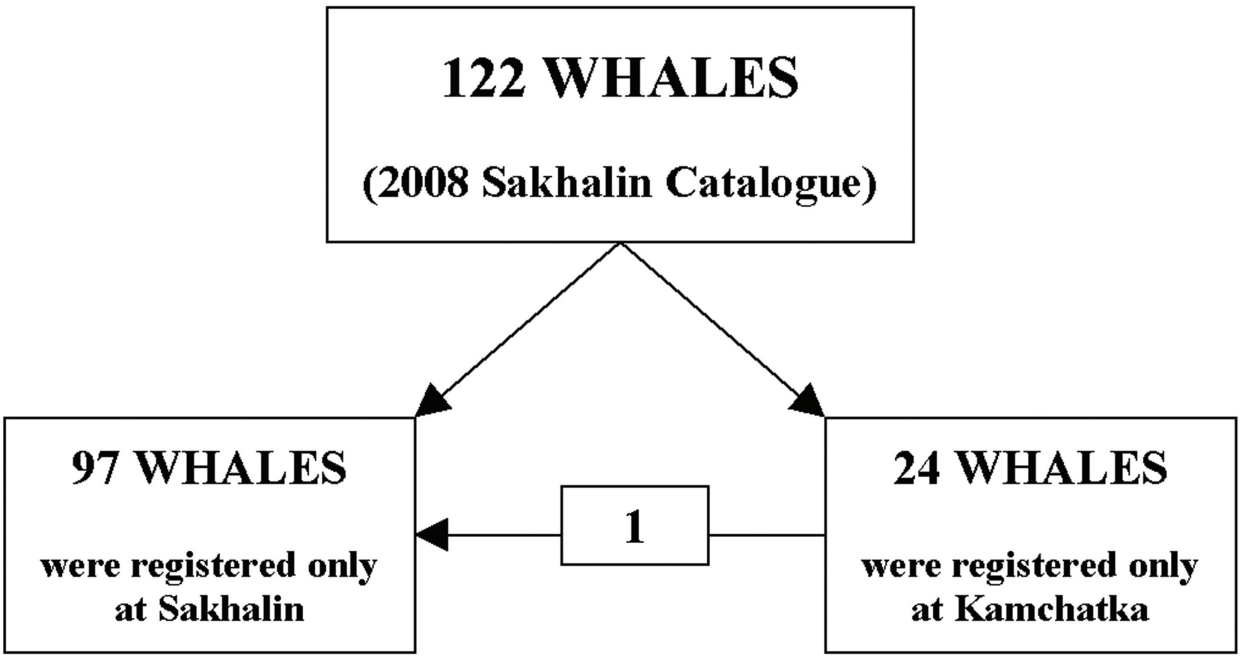
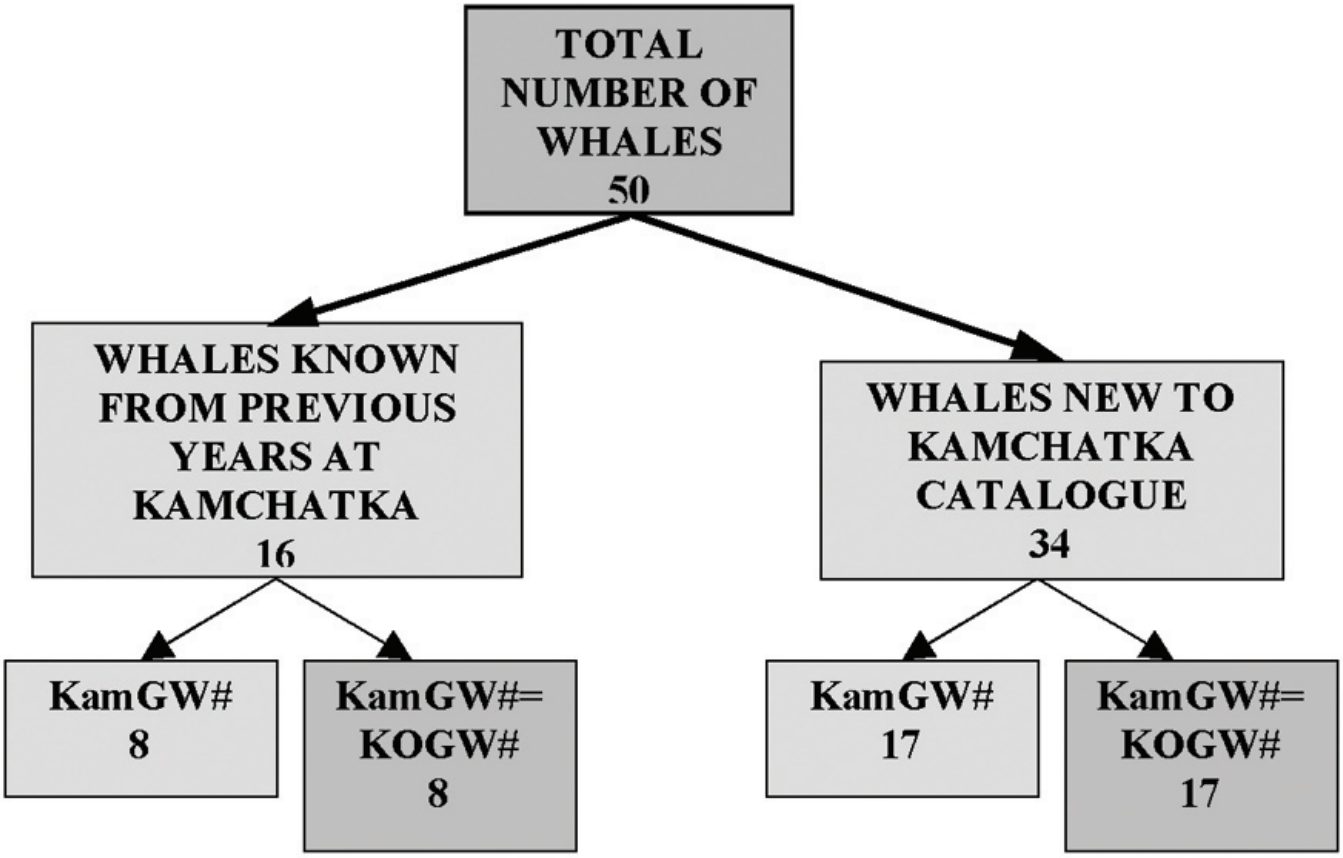
Figure 3. Figure 3. Diagram of gray whales recorded in Olga Bay in 2008. Catalogue numbers KamGW# indicate whales observed offshore Kamchatka, and catalogue numbers KOGW# indicate whales seen offshore Sakhalin. Whales seen in both areas appear in both catalogues.