

RESULTS OF PHOTOGRAPHIC IDENTIFICATION STUDY OF THE GRAY WHALE (*Eschrichtius robustus*) OFFSHORE NORTHEAST SAKHALIN ISLAND AND SOUTHEAST KAMCHATKA PENINSULA, RUSSIA, 2010

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Abstract

Photographic identification (photo-ID) studies of the Korean-Okhotsk gray whale population have been conducted in two feeding areas (the Piltun and Offshore areas) off the northeast Sakhalin Island region since 2002 to study the migration and biology of this species. A third area, Olga Bay, in the Southeast Kamchatka region, was added as a study area in 2006. The comparison of photo-ID results from the Sakhalin and Kamchatka regions in 2010 showed that 80 individuals were only seen offshore Sakhalin. Twenty-three whales were only seen offshore Kamchatka, and 25 whales were seen both offshore Sakhalin and offshore Kamchatka. Thus, a total of 128 whales were identified off Sakhalin and Kamchatka in 2010. Currently, there are a total of 187 identified whales registered in the Sakhalin Catalogue by the IBM FEB RAS team. Cow-calf pairs were first recorded in Olga Bay in 2008. In 2010, three cow-calf pairs were seen in Olga Bay in the early part of the field season. Later in the summer of the same year all three calves were recorded in the Piltun area. The data presented in this paper provide evidence that the Piltun area on the Sakhalin shelf may not be the only feeding area for cow-calf pairs. Further studies should be conducted to understand the importance of the Olga Bay, Kamchatka area.

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

Introduction

Photo identification (photo-ID) has proven to be a useful and low-impact technique for monitoring many species of marine mammals. When incorporated into a long-term monitoring program, photo-ID can help answer many ecological questions about the population dynamics of marine mammals. Photo-ID is a valuable tool in gray whale studies (Calambokidis *et al.*, 2002; Weller *et al.*, 2002), because individual gray whales bear uniquely distinguishable markings on their sides, backs and flukes. Individuals can be passively “tracked” over space and time by photographically “capturing” then subsequently “re-capturing” the same whale while recording the location and time the photographs were taken.

From 2002-2009, photo-ID studies of the critically endangered population of western gray whales (*Eschrichtius robustus*) 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 (Sakhalin Energy) oil and gas development projects. Two main feeding areas that are utilized during the ice-free season 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.

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, 2009) in water depths of about 15-24 m, and in Olga Bay (2006-2009) in water depths of about 5-17 m. In addition, western gray whales were repeatedly sighted in other far-eastern seas. From the photographs taken in the northern parts of the Okhotsk Sea in Kekurny Bay (July 13, 2006) and Babushkin Bay (July 28, 2006) three gray whales were identified, and one from them was detected in Piltun feeding area and in Olga Bay (Kamchatka) in 2007 (Tyurneva *et al.*, 2010).

This paper focuses on data collected in the summer and fall of 2010. Photo-ID studies were conducted in the two primary feeding areas offshore Sakhalin Island (Piltun and Offshore) and two Kamchatka areas (Olga Bay and Vestnik Bay) (Fig. 1).

Methods

The field procedure for the photo-ID work used by the IBM team offshore Sakhalin Island since 2002 is based on recommendations for photo-ID work of marine mammals, set forth in the International Whaling Commission Special Issue No. 12 (Hammond *et al.*, 1990). The research vessel *Akademik Oparin* was the base ship for the photo-ID effort, with the actual work conducted from a 3.8 m long Zodiac when weather and sea conditions allowed. On specified photo-ID days, when conditions permitted, the Zodiac was deployed from the mother vessel whenever gray whales were sighted. The whales' position (determined by GPS), the time, behavior, number of whales in the group¹, direction of their movement, the presence of other groups of gray whales, killer whales and passing vessels, and airplanes or helicopters in the observation area were also noted. The presence of mud plumes, both at whale feeding sites and when no whales were visible was recorded near the locations where the Zodiac was launched.

A Nikon D2X digital camera with a fixed 300 mm f/4 telephoto lens or a Nikkor 80-400 mm zoom lens with image stabilizer (IS) was used for photography. The photographs were recorded at a high resolution setting in large JPEG and RAW format. An attempt was made to photograph all aspects (head, back flanks and flukes) of each whale. A whale was photographed in sequence, from head to fluke on both the right and left sides, and the dorsal and ventral fluke surfaces. Priority was given to photographing the right and left sides of each whale, as fluking frequency varies with individual behavior and foraging depth. Preference was given to photographing the right sides (flanks) of the subject animal as right sides have been arbitrarily chosen among gray whale researchers as a baseline identifier.

Matchable right side photographs are required for an individual whale to be included in the photographic identification catalogues. A matchable quality photograph for photo-identification of gray whales is any photograph of the appropriate region of the body (aspect) that can readily be identified as belonging to a particular individual whale when compared to other photos of the same target region of that same whale. The photo-ID effort was conducted in Olga Bay, Kamchatka Peninsula (Fig. 1), using vessel-based field procedures similar to those used in the Offshore feeding area along Sakhalin Island. A Canon 40D digital camera equipped with Canon 75-300 mm zoom lens with IS was used for photography. All photos were taken at the highest possible resolution and saved in JPEG format.

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,

¹ Group size estimates were based on a consensus of the observers aboard the Zodiac and were later confirmed in the laboratory via photo-matching.

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.

Cow-calf pairs were recorded in accordance with methods outlined in the 2010 annual report (Yakovlev and Tyurneva, 2011).

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

During the 2010 feeding season, photo-identification of gray whales took place on the northeastern shelf of Sakhalin and in Olga Bay in southeastern Kamchatka. The main results of the photo identification studies in 2010, combined with results from previous years, are as follows:

Catalogue Overview

The Sakhalin WGW Catalogue now contains 187 fully identified individual gray whales. Some of these whales were registered repeatedly over several years, whereas others are new to the catalogue or were recorded once and not sighted again.

The catalogue of gray whales photo-identified on the Kamchatka shelf consists of photographs of animals observed in three areas (Khalaktyrskiy Beach, Vestnik and Olga Bays) during 2004 and 2006-2010. At present, this catalogue contains 140 fully identified animals. A total of 78 of these whales were also observed in different areas of the Sakhalin shelf during various years, and it is possible that most of them are western gray whales. It is still unclear to which population the other 62 animals belong that were photographed near Kamchatka Peninsula, but were not identified in the Sakhalin catalogue.

Whales Identified in 2010 on Both the Sakhalin and Kamchatka Shelves

In 2010, between August 4 and September 27, 105 whales were observed off the shore of Sakhalin. This number is higher than in 2008 (98 whales), but lower than in 2009 (117) and 2007 (125). This might have been due to shorter observation periods during the last three years and because of unfavorable weather conditions (table 1).

In 2010 we identified 10 new gray whales, including 8 calves. Two of the adult animals were first sighted in 2006 in Olga Bay (Kamchatka), and had only been recorded there until 2010 when they were also seen near Sakhalin.

Between June 22 and August 10, 2010, 82 whales were sighted in Olga Bay. Of these, 58 were already known, having been observed previously in Olga Bay. The other 24 were new to Olga Bay, but 15 of these had been seen off NE Sakhalin in previous years. Forty-eight of these 82 whales were registered in the Sakhalin WGW catalogue (table 1).

Since 2006, the number of identified whales in Olga Bay has grown every year. However, this could be attributed to the earlier start date and increased duration of the field seasons, which increases from year to year. In 2009 and 2010, the number of new whales (i.e. those that were identified for the first time) in Olga Bay also strongly depended on the observation dates. While the abundance of whales identified in both catalogues and in the Kamchatka catalogue only had decreased to 10 individuals by the end of the field season in September 2009, the total abundance dropped only slightly (from 27 to 25 whales) by the end of the 2010 field season on the 10th of August. It's worth mentioning that the number of whales with dual numbers (KOGW000/KamGW000) included in this figure, dropped significantly, from 11 to 2 animals.

Every year since the start of the surveys in Olga Bay in 2006, researchers have identified whales that had been registered as calves in the Piltun area in the previous year. Three of the five calves registered off the Sakhalin shelf in 2008 were identified in Olga Bay in 2009. In 2009, five out of

eight calves observed in Olga Bay (of which only one was sighted in Olga Bay in 2010) were recorded off Sakhalin (table 1).

In 2010, a total of 128 out of 187 animals contained in the A.V. Zhirmunsky IMB DVO RAN Sakhalin catalogue of gray whales were recorded, which includes sightings off both Sakhalin and Kamchatka (Yakovlev and Tyurneva, 2011). The total number of identified gray whales included in the Kamchatka and/or Sakhalin catalogues in 2010 alone was 162 +2 TEMP whales. Eighty + 2 TEMP of these were registered only on Sakhalin shelf and 57 only off the shore of Kamchatka (23 of which have been registered in the Sakhalin catalogue in the previous years) and 25 were seen in both locations (figure 2). At present, it is unknown whether all of the animals observed in Olga Bay, Kamchatka belong to the western population, or whether some of them belong to the eastern gray whale population.

Migration of Gray Whales between Feeding Areas in 2010

A total of 21 individuals were identified in the Offshore feeding area off the northeastern shore of Sakhalin island in 2010. Nine of these whales were observed in that area only. A total of 94 whales were identified in the Piltun feeding area, 78 of which were observed only in that region. No whales were observed during this season in Chayvo Bay. A group of 9 whales, 4 of which were not observed anywhere else during this season, was sighted in offshore Okha. During the length of the study, 2002-2010, 97 whales were identified in both the Piltun and Offshore feeding areas during one year and occasionally over several years. In addition, 94 individual whales were sighted only in the Piltun area and 5 were sighted only in the Offshore area (all of these numbers include temporary whales). A change in gray whale distribution was noted in 2010. In the Piltun area, some whales were sighted farther north than in previous years, beyond the 20-meter isobath. A similar distribution was also observed in 2004 and 2005. Whales were sighted in the Offshore area near or within the Arkutun-Dagi License Area. We believe that the variability in use of available feeding grounds offshore Sakhalin by gray whales is normal behaviour aimed at exploiting ever-changing forage habitat. During all these years, cow-calf pairs were registered only in the Piltun area (table 2).

Of the 82 whales identified in Olga Bay (Kamchatka) in 2010, 25 whales were spotted near Sakhalin later in the season. An additional 23 whales had been seen in Sakhalin in previous years but not in 2010 (figure 2).

Body Condition

Since 2005, we collected data to monitor gray whales' body condition (BC) within a feeding season. In 2010, 12 whales with poor BC were identified, including 4 nursing females. This constitutes 11.4% of the total number of identified animals (105 individuals). All calves observed during these years were physically normal (BC 0).

If the BC of a particular whale improved upon subsequent observation, then the data used in calculations of the number of malnourished animals was based on the latest observation. According to our observations, 25 whales improved their BC during the period of August 4 to September 27.

In Olga Bay, 41 of the 82 whales (50%) showed low BC. Three of these were nursing females.

The high percentage of gray whales with poor body conditions recorded near Kamchatka versus the Sakhalin may be explained by the early photo-identification survey period, as whales have just arrived to the feeding grounds from their winter-long fast and have not had time to accumulate body fat stores.

Cow-Calf Pairs

In 2010, 5 cow-calf pairs and 3 calves without mothers were recorded off Sakhalin. Cow-calf pairs were first sighted on August 8 during the 2010 field season. One of the photo-identified mothers (KOGW063) had been recorded previously with calves in 2003 and 2007. Two females

(KOGW093 and KOGW007) were identified as mothers for the first time in 2010. KOGW044 was recorded with a calf for the first time, but in previous years has been observed with a body condition class of 3 and 4. One of the calves, whose mother could not be determined, was observed together with an emaciated whale (in a masked position). This whale showed just its head and later laboratory analyses confirmed that it was KOGW064 based on data from the Kamchatka team. Three calves unaccompanied by cows were encountered in calf groups.

Three cow-calf pairs were recorded in Olga Bay (Kamchatka) in 2010. Three of the recorded mothers had been encountered offshore Sakhalin Island and Kamchatka Peninsula in previous years, and one of them was also photographed in the Piltun area in 2004 and 2007 with calves. The two other females had never been recorded as mothers.

Three cow/calf pairs were seen in Olga Bay only at the start of the field season. Later, all three calves were recorded in the Piltun area (Sakhalin Island), at which time one of them was encountered together with the mother. All three calves were first recorded there on August 8, 2010. Thus, the mothers of the two calves sighted without mothers off Sakhalin were identified later off Kamchatka Peninsula.

Separation of the pairs started in the end of August and lasted until the middle of September, which is consistent with the long-term observations. One of the photo-identified mothers was registered with calves in 2004 and 2006. Two other females identified as mothers in 2009 were registered in 2007. Three females were observed with calves for the first time. Two calves were observed without mothers, but identified in calf groups. All registered calves were well nourished without any signs of malnutrition.

Three of the mother-calf pairs were registered near the Kamchatka shore in June only. However, one of the pairs was later observed near Sakhalin and was seen there many times after that.

We cannot ignore the fact that the earlier survey times helped us in identifying cow/calf pairs in Olga Bay in 2009 and 2010. It is quite possible that the pairs were present in this area before 2008, but they were not identified as such because the calves had already separated from their mothers. The obtained data suggests that the Piltun area of the Sakhalin shelf may not be the only feeding area for mother-calf pairs and that a second feeding ground for foraging cow-calf pairs may be located in Olga Bay.

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Table 1. Number of grey whales (GW) identified during photo-ID studies offshore northeast Sakhalin Island and southeast Kamchatka Peninsula for all years of studies.

A	B	C	D	E	F
Year	GW identified off the Kamchatka coast	GW identified only off the Kamchatka coast and unknown in Sakhalin Catalogue, 2002-2010	GW identified off the Kamchatka coast and already known in Sakhalin Catalogue, 2002-2010	GW identified off the Sakhalin coast, 2002-2010	Numbers of GW known in Sakhalin Catalogue (2002-2010) identified in both regions during one year
2002	No data	No data	No data	47	47
2003	No data	No data	No data	82	82
2004	3	1	2	96	98
2005	No data	No data	No data	117	117
2006	13	8	5	121	128
2007	37	18	19	125	132
2008	50	25	24	98	122
2009	75	36	39	117	138
2010	82	34	48	105	128

Table 2. Whale movement between feeding areas, 2002-2010.

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

Year	Number of whales identified in the Piltun Area	Number of whales identified in the Offshore Area	Number of whales identified in the Offshore and Piltun Areas	Number of whales Identified in the Chayvo Area	Number of whales identified in the Chayvo/Piltun and Chayvo/Offshore	Number of whales identified in Northern areas	Number of whales identified in the Chayvo/Piltun/Offshore	Number of whales identified Near Okha
2002	13(12)	35(34)	1					
2003	51(47)	35(31)	4					
2004	95(89)	7(1)	6					
2005	115(105)	7(1)	6			5 (1)		
2006	105(67)	33(14)	17	28(7)	19/0		2	
2007	103(45)	71(25)	38	20	12/0		8	
2008	61(35)	62(36)	25	1(1)				
2009	79(60)	39(24)	13	14(6)	6/2			
2010	94(78)	21(9)	11	-	-	-		9(4)

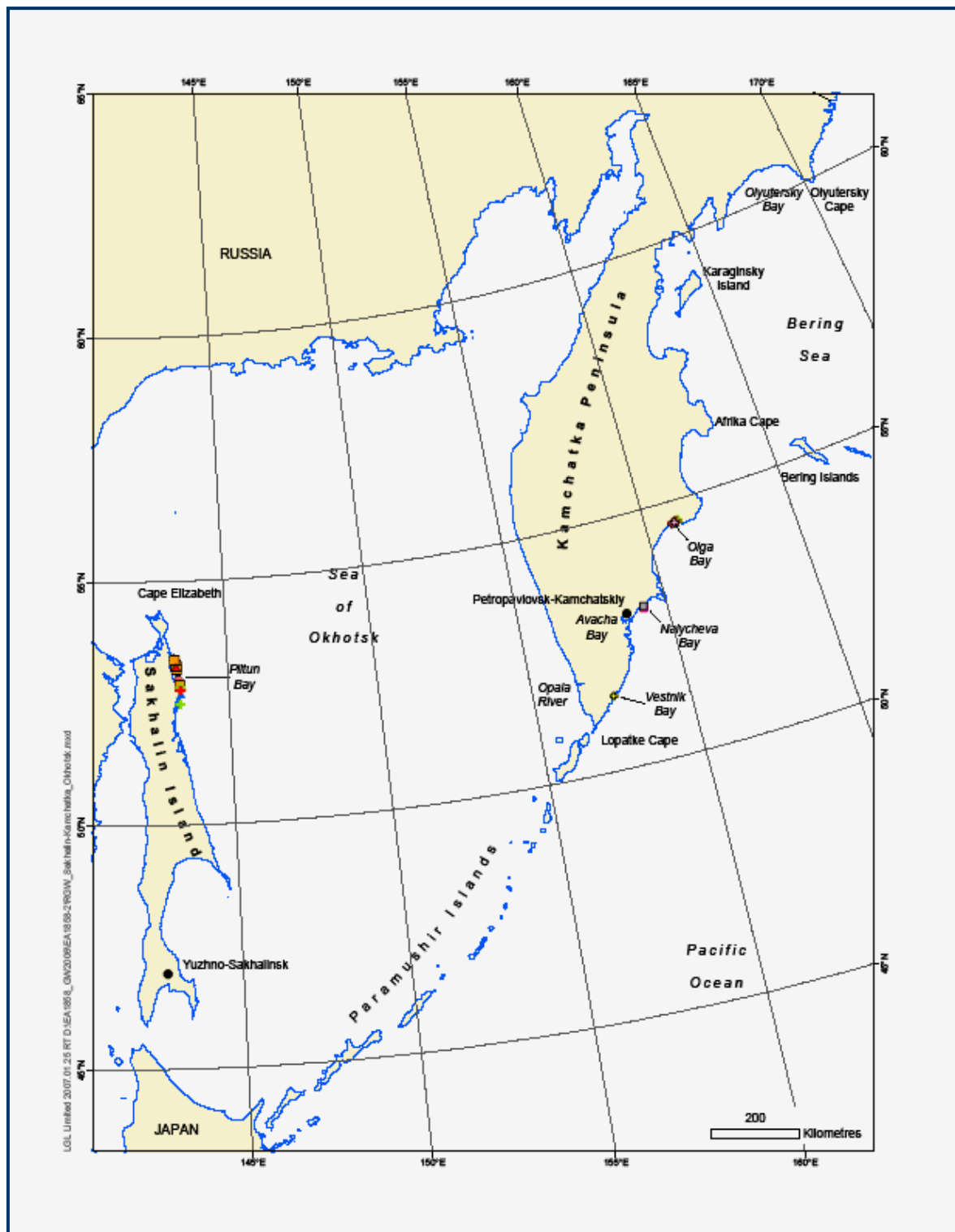


Figure 1. Map showing the recoding of photo-identified whales in known feeding areas offshore NE Sakhalin Island, southeast Kamchatka in the summer-fall season of 2009.

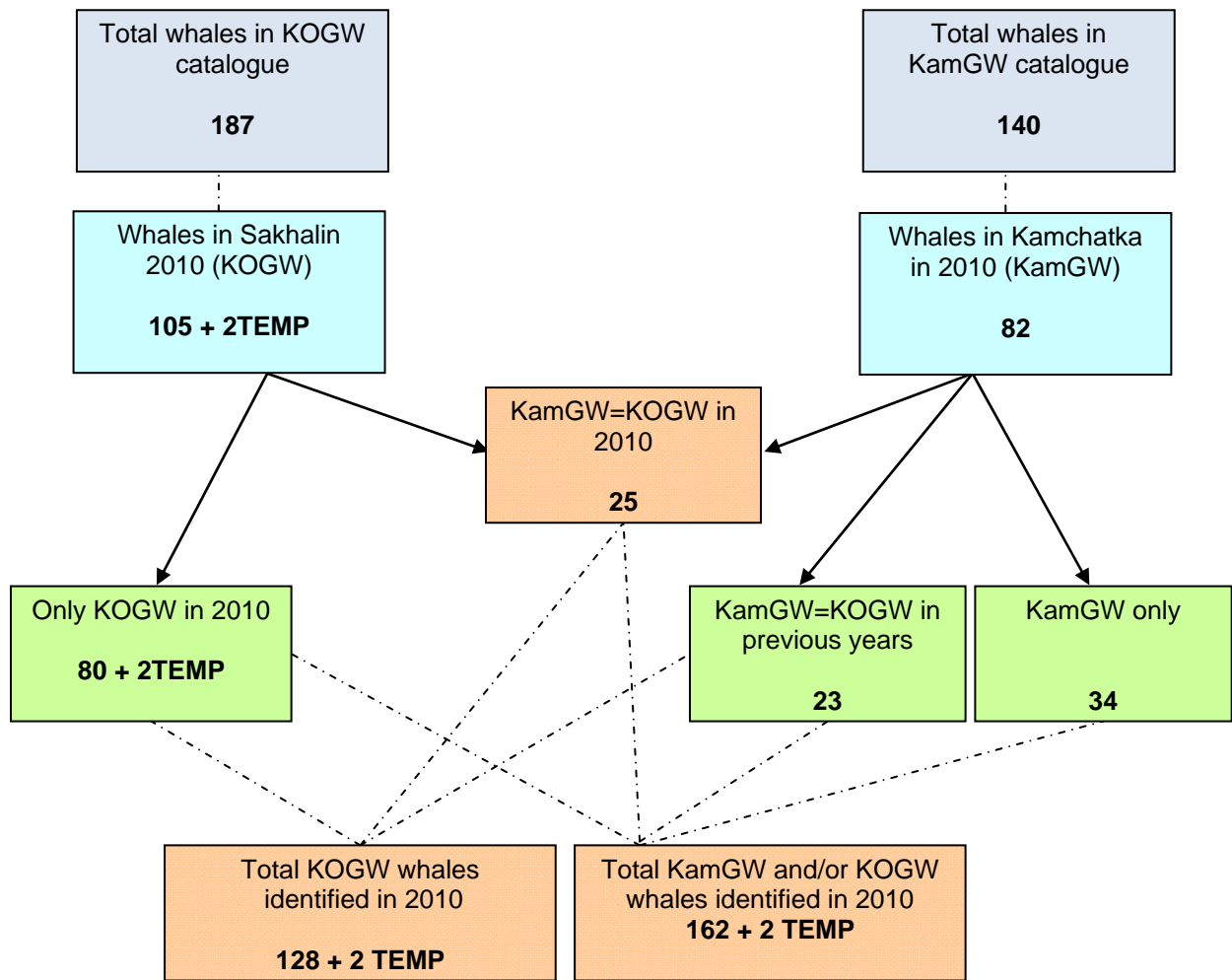


Figure 2. Population migration between the feeding grounds in 2010.

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.