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**2012 PHOTO-IDENTIFICATION STUDY OF WESTERN GRAY WHALES (*Eschrichtius robustus*)  
OFFSHORE NORTHEAST SAKHALIN ISLAND AND SOUTHEAST KAMCHATKA PENINSULA, RUSSIA**

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**ABSTRACT**

The total number of western gray whales identified off northeast Sakhalin Island and Olga Bay (Kamchatka Peninsula) in 2012 was the highest since the start of the photo-ID program in 2002 conducted by the Institute of Marine Biology, Far East Branch, Russian Academy of Sciences (IMB FEB RAS) as part of the ENL-Sakhalin Energy-funded Joint Monitoring Program. A total of 144 individual gray whales were documented by the IMB team off the coast of Sakhalin Island; 14 individuals, including 9 calves, were identified as new whales, i.e., registered for the first time. Seventeen gray whales, including 3 calves, were identified in Olga Bay (Kamchatka) in 2012; 6 of these whales have been sighted offshore Sakhalin in earlier years. Thus, out of 219 gray whales recorded in the IMB Sakhalin gray whale catalogue, 150 individuals were documented off Sakhalin and Kamchatka in 2012.

In 2012, whales actively used the main feeding areas off the north-eastern coast of Sakhalin: 74 individuals were identified in the Offshore feeding area (54 of which were seen only in that area); 87 individuals were seen in the near-shore Piltun feeding area (61 of which were seen only in that area); and 10 whales were seen in Chaivo Bay area (3 of them were recorded only there).

In 2012, 14 gray whales, including one nursing female, have been identified with poor body condition (BC), comprising 9.7% of the total number of gray whales identified offshore Sakhalin (144 individuals). Thus, based on the the number of animals observed, reproductive success, body condition and use of feeding grounds, it can be concluded the population is in good health.

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

## Introduction

Photo-identification (photo-ID) is a valuable tool in gray whale studies (Darling 1984; Würsig *et al.* 1999, Calambokidis *et al.* 2002; Yakovlev and Tyurneva 2005), because individual gray whales bear unique identifiable markings on their skin. Photo-ID has proven to be a useful and low-impact technique for monitoring the population and when incorporated into a long-term monitoring program, it can help answer ecological questions about the population dynamics of marine mammals. Tracking the movements of gray whales during their feeding period can broaden the understanding of their feeding ecology. As the whales move among feeding areas they may target certain prey species in each area. Photo-ID sighting data allows one to follow these movements through the seasons and establish patterns of habitat use.

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 (operated by Exxon Neftegas Limited) and Sakhalin II (operated by Sakhalin Energy) oil and gas development projects. Two main feeding areas along the northeast Sakhalin coast utilized by GWs during the ice-free season have been identified: the nearshore Piltun feeding area adjacent to Piltun Bay (52°40' N to 53°30' N), where gray whales predominantly feed in shallow waters <25 m depth, and the offshore area approximately 30-40 km east of Chayvo Bay (51°50' N to 52°25' N), where gray whales feed in water depths of 35-60 m. Researchers from the Institute of Marine Biology of the Far East Branch of the Russian Academy of Science (IBM FEB RAS) (henceforth "IBM team") have been working in both Piltun and Offshore feeding areas every year since 2002 (Yakovlev and Tyurneva 2003, 2005; Yakovlev *et al.* 2007, 2013).

Data about the whales' movements within and between seasons can only be collected through repeat sightings of individually recognizable whales within those seasons (Meier *et al.* 2007; Vladimirov *et al.* 2008a,b). The frequency of sightings over the whole 2002-2012 period is another important factor in studying whale movement among different areas. In general, the time allocated for observational studies of cetaceans tends to be small due to the challenging, costly, and labor-intensive nature of this type of research. The benefit of a long-term monitoring program is that with increasing duration of the study, the same individuals continue to be photographed over time, resulting in more sighting data allowing more robust analyses of patterns regarding whale movement and feeding area utilization.

By incorporating geographic data in the sighting histories of known whales and whale groups, habitat use patterns can be established. These baseline datasets are useful for continued monitoring of the whales and for recording any potential deviations in geographic or temporal use patterns that may arise in the future.

The majority of identified gray whales return to Sakhalin feeding areas each year and some degree of fidelity to these areas is displayed by most of the identified individuals. Some individual whales are sighted on the feeding areas off Sakhalin irregularly, not every season. The absence of those individuals in the near-shore Piltun feeding area during certain years is sometimes due to individuals being missed by the photo-ID team. It can also be explained by their presence in the offshore feeding area during that year..

Some gray whales recorded offshore Sakhalin (listed in the IBM Sakhalin gray whale catalogue) have also been observed off the southeast coast of the Kamchatka Peninsula, both

within the same year and in different years (Yakovlev *et al.* 2007, 2009; Tyurneva *et al.* 2010a). To date, gray whales were mainly studied in Vestnik and Olga Bay (2006-2012) in water depths of about 5-17 m (Yakovlev *et al.* 2013).

Seasonal fluctuations in blubber fat reserves in baleen whales are normal after winter periods of fasting and during migration (Perryman and Lynn 2002), and cows can be substantially thinner during years in which they are nursing calves (Pettis *et al.* 2004; Weller *et al.* 2004). Photo-ID methods can be used to detect these natural fluctuations, as well as abnormal changes in physical condition (Pettis *et al.* 2004).

In 2005 and 2007, an extended field season covering most of GW feeding season yielded the data on the body condition (BC) of underweight whales arriving in the beginning of the feeding season. It was observed to improve over the course of the feeding season. This overall improvement was also documented in 2012 (Yakovlev and Tyurneva 2006, 2008; Yakovlev *et al.* 2013).

Prior to 2008, the shallow-water Piltun area on the shelf of Sakhalin Island was considered to be the only feeding ground for the cow/calf pairs. But in 2008 the first cow/calf pair was found in Olga Bay on the eastern shelf of the Kamchatka Peninsula. This mother was also recorded with calves on the shelf of Sakhalin Island in previous years (Tyurneva *et al.* 2010a,b). Research conducted off the Kamchatka Peninsula in 2009 - 2012 demonstrated that mothers with calves also used Olga Bay for feeding (Yakovlev *et al.* 2013). These identified females included both individuals known from the Sakhalin catalogue and those not encountered on the shelf of Sakhalin Island. Calves and cow/calf pairs were observed to relocate from Olga Bay to the Piltun area on the shelf of Sakhalin Island during the same season (Tyurneva *et al.* 2012).

## Methods

The field procedure for the photo-ID work used by the IMB team offshore Sakhalin Island since 2002 is based on recommendations for photo-ID work of marine mammals set forth by International Whaling Commission in Hammond *et al.* (1990). In 2012, the research vessel *Igor Maksimov* 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. When conditions permitted, the Zodiac was deployed from the base ship whenever gray whales were sighted. The whales' position (determined by GPS), time, behavior, number of whales in the group, direction of their movement, the presence of other groups of gray whales, killer whales, passing vessels, and airplanes or helicopters in the observation area were noted. The presence of mud plumes, both at whale feeding sites and when no whales were visible, was recorded.

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 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. 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.

Off Kamchatka Peninsula, photo-ID studies were conducted in Olga Bay (Fig. 1) using vessel-based field procedures similar to those used 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.



**Figure 1.** Map showing the areas of photo identification surveys off NE Sakhalin Island and southeast Kamchatka in the summer-fall season of 2012.

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 be readily identified as belonging to a particular individual whale when compared to other photos of the same target region of that same whale.

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 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.

Cow/calf pairs were recorded in accordance with methods outlined in the 2012 annual photo ID report (Yakovlev *et al.* 2013).

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 2012, conducted offshore Sakhalin and in Olga Bay, Kamchatka, , are as follows:

### Catalogue Overview

The photographs collected in 2012 were post-processed and matched with whale images from previous years. Of particular interest is not only the information gathered relating to new whales, but also data pertaining to whales that have been identified in previous years, since combining these data expands sighting history information about individual GWs. The Sakhalin WGW Catalogue now contains 219 identified individual gray whales documented off Sakhalin Island over a period of 2002-2012. Most of these whales were sighted repeatedly over several years, whereas 14 gray whales, including 9 calves, were new to the catalogue in 2012. Data on the number of whales identified offshore northeast Sakhalin Island over the study years of 2002-2012 are presented in Figure 2.

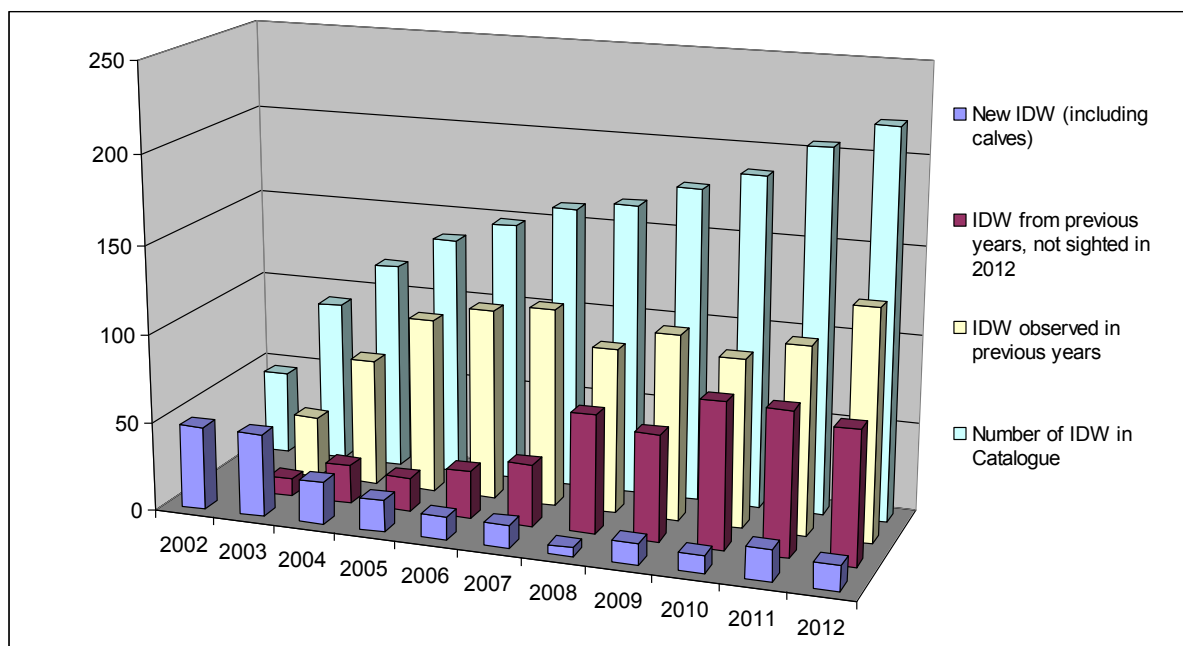


Figure 2. Numbers of Gray Whales Recorded in the Catalogue and Identified during 2002-2012 Offshore Northeast Sakhalin Island

A separate Kamchatka Gray Whale catalogue consists of photographs of whales observed off the coast of Kamchatka in three areas, Khalaktyrskiy Beach, Vestnik Bay, and Olga Bay, during 2004 and 2006-2012. At present, this catalogue contains 155 identified gray whales.

A total of 85 (55%) of these gray whales were also photographed offshore Sakhalin in the period 2002-2012, and therefore are part of the Sakhalin feeding aggregation. It is yet unclear to which population the other 70 (45%) gray whales belong which were sighted near Kamchatka Peninsula but have not been documented off Sakhalin.

#### ***Whales Identified in 2012 offshore Sakhalin Island and Kamchatka Peninsula***

In 2012, 144 gray whales were documented offshore Sakhalin Island. This number is the highest of all previous study years. The high number of GWs off Sakhalin Island in 2012 may partially be explained by the increased photo survey efforts in the offshore area, where the research group has noted an increase in the number of gray whales. In 2012 the photo-ID team had good working conditions in all the known feeding areas near Sakhalin Island. The increased number of observations indicates a link between the research effort and the number of whales recorded. In 2012, 14 new gray whales, including nine calves and five non-calves, were identified off Sakhalin Island. One of the five new "non-calves" may also be a calf, but there is not sufficient data to reliably identify it as such. All the new gray whales have never been seen before by the IBM team in any of the known regions.

In 2012, a total of 17 whales were documented in Olga Bay offshore Kamchatka. Eleven gray whales of these 17 have been observed previously in Olga Bay; the other six gray whales, including 3 calves, were new to the Kamchatka catalogue. Six of these 17 whales were also registered in the IBM Sakhalin western gray whale catalogue. These six whales, which have a dual number (KOGW/KamGW), were recorded for the first time and only once off Sakhalin Island as calves in 2007, 2008, and 2009, and have never been seen there since. As evidenced by a whale that was identified as a suckling calf in 2005 off Sakhalin Island and then visited the offshore area of the Kamchatka Peninsula every year for five years, but had not been sighted off Sakhalin Island until 2012, some young gray whales may not return to the feeding areas at Sakhalin Island for several seasons. In most years since 2006 (but not in 2012) researchers have sighted gray whales in Olga Bay (Kamchatka) that previously had been identified as calves in the Piltun Bay area, e.g., three of the five calves sighted off Sakhalin in 2008 were identified as juveniles in Olga Bay in 2009

In 2012 a total of 150 out of 219 animals were documented that are listed in the IMB Sakhalin catalogue of gray whales (i.e., those gray whales seen off Sakhalin); this number includes gray whales recorded off both Sakhalin (144) and Kamchatka (6). The total number of gray whales documented in 2012 and listed in the Kamchatka and/or Sakhalin catalogues was 161 whales. In 2012, there were no within-season movements of recorded gray whales between the Sakhalin and Kamchatka areas. At present, it is unknown whether all of the animals observed in Olga Bay belong to the Sakhalin feeding aggregation.

#### ***Movements of Gray Whales between the Sakhalin Feeding Areas in 2012***

Whale movement patterns between the coastal (Piltun and Chayvo) and Offshore feeding areas off Sakhalin Island have been studied based on repeat sightings of identified animals in both areas over the 2002-2012 study (Figure 3).

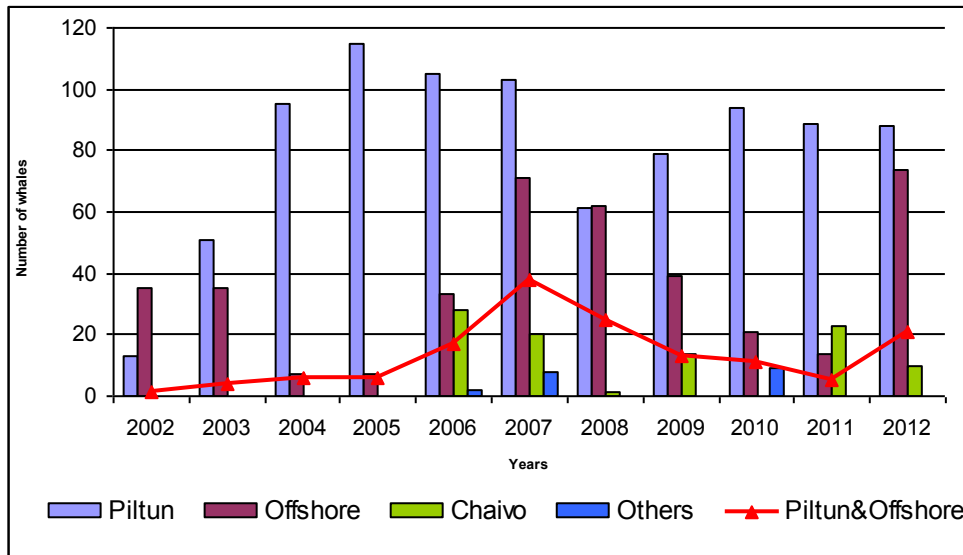


Figure 3 Number of whales seen in main Feeding Areas Off Northeast Sakhalin Island, including animals seen in both Piltun and Offshore area in 2002-2012

In 2012, of the 144 animals documented off Sakhalin, a total of 74 individuals were identified in the offshore feeding area. Of these whales, 54 individuals were sighted in only there. A total of 87 whales were sighted in the Piltun feeding area, 61 of which were observed only in that area. In the small area of Chayvo Bay, 10 whales were sighted, and three of these were seen only here (Figure 4).

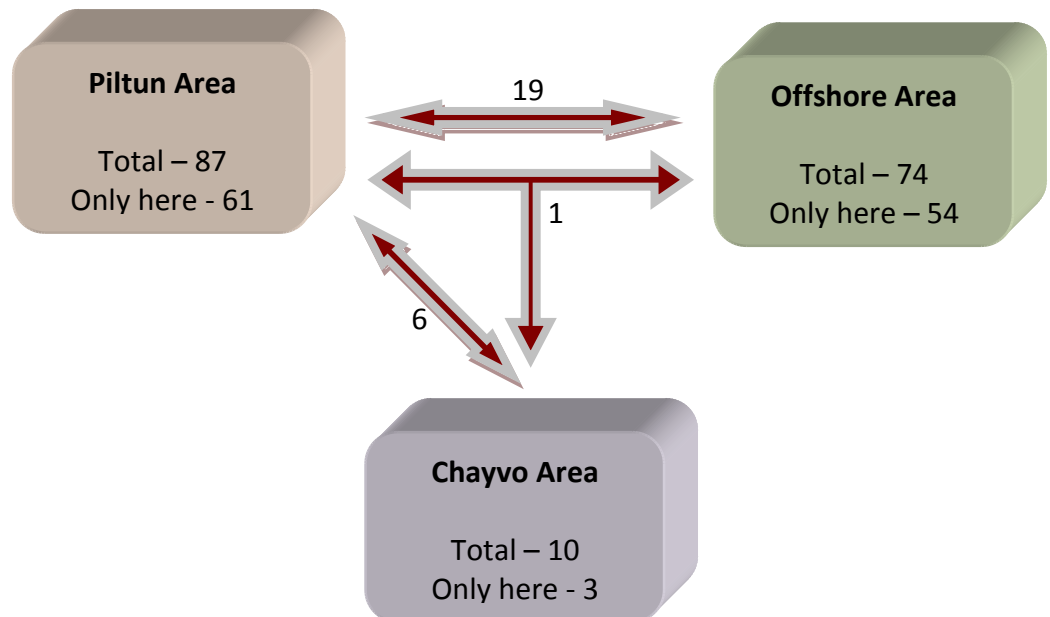


Figure 4 Diagram of Gray Whale Movements within Known Feeding Areas Offshore Northeast Sakhalin Island in the Summer-Fall Season of 2012.

During the 11 years of the study (2002-2012), 106 whales have been recorded using both the Piltun and Offshore feeding areas, either during the same year or over several years. In addition, 109 individual whales were recorded only in the Piltun area and 3 individual whales were recorded only in the Offshore area. One whale was documented near Cape Elizabeth (northern tip of Sakhalin Island) in 2005 and has not been seen since. We believe that gray

whales' use of all available feeding grounds offshore Sakhalin is a normal behavior aimed at optimal utilization of an ever-changing distribution of food resources. During all the study years, cow/calf pairs have been recorded only in the Piltun area and not in the Offshore area

### **Body Condition**

In 2012, 14 thin gray whales were identified off Sakhalin, including 1 nursing cow, totaling 9.7% of the number of whales recorded off Sakhalin (144 individuals). It was impossible to determine the condition of eight nursing cows in 2012. All calves observed over the years were physically normal (BC 0). Of the seven cows that came with calves to Sakhalin in 2011, all seven had restored their BC to a normal level by 2012. Thus, the 2012 season can be deemed a successful whale foraging season.

In 2012, 17 gray whales were sighted in Olga Bay off Kamchatka. There, nine of the 17 gray whales (53.0%) identified in 2012 were thin. Two of these gray whales were determined to be nursing females.

### **Cow/Calf Pairs**

In 2012, eight calves without mothers and only one cow/calf pair (nine calves in total) were recorded off Sakhalin. The first calf was recorded on August 20. The cow identified as the mother had already been recorded with calves three times in previous years. The eight unassociated calves were encountered either near the identified cow/calf pair or in calf groups. There was one other gray whale that may have been a calf but there was insufficient data to reliably define it as such. An early separation of cow/calf pairs may have occurred in 2012, which made it impossible to identify most of the mothers.

It has been established that the Piltun area of the Sakhalin shelf is not the only feeding area for cow/calf pairs and that there is at least one other such area located in Olga Bay off Kamchatka, where cow/calf pairs have been recorded since 2008 (Yakovlev *et al.* 2009, 2011a, 2011b).

In 2012 two cow/calf pairs were identified in Olga Bay. Both cows were sighted only in Olga Bay and are not included in the Sakhalin gray whale catalogue. Neither cow had been sighted with calves in previous years.

### **CONCLUSIONS**

IMB photo ID team documented in 2012 off Sakhalin and Kamchatka 150 gray whales included in the IBM Sakhalin catalogue - the highest number of individuals identified in one season.

Based on this number of animals, the reproductive success (9 calves), and the ability to recover after malnourishment (within and between seasons), it can be concluded the population is in good health.

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