Status of western gray whales off northeastern Sakhalin Island, Russia in 2013

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ABSTRACT

The western gray whale population is critically endangered and its continued ability to survive is of concern. The most recent abundance estimate is 140 (SE = ± 6; CV=0.043) whales for the age 1-plus (non-calf) population size in 2012 (Cooke et al. 2013). The collaborative Russia-U.S. research program on western gray whales summering off northeastern Sakhalin Island, Russia, has been ongoing since 1995 and has produced important data used to determine the conservation status of this critically endangered population. This paper reviews findings from 2013 research activities and combines such with data from previous years, in some cases dating back to an opportunistic survey in 1994. Photo-identification research conducted off Sakhalin Island in 2013 resulted in the identification of 94 whales, including nine calves and two previously unidentified non-calves. One known female, sighted in previous years, was observed for the first time with a calf in 2013. With this new record, 31 females have been observed with one or more calves at some point during the study. When 2013 data are combined with results from 1994-2012, the Russia-U.S. catalog consists of 223 photo-identified individuals.

KEYWORDS: WESTERN GRAY WHALE; RUSSIA; POPULATION BIOLOGY; BEHAVIOR; CONSERVATION

INTRODUCTION

Gray whales (*Eschrichtius robustus*) are recognized as comprising two populations in the North Pacific Ocean. Significant mitochondrial and nuclear genetic differences have been found between whales in the western North Pacific (WNP) and those in the eastern North Pacific (ENP) (Lang *et al*., 2011). The ENP population ranges from calving areas in Baja California, Mexico, to feeding areas in the Bering, Beaufort, and Chukchi Seas. The WNP population feeds in the Okhotsk Sea off Sakhalin Island, Russia, and in nearshore waters of the southeastern Kamchatka Peninsula (southwestern Bering Sea).

The historical distribution of gray whales in the Okhotsk Sea greatly exceeded what is found today (Reeves *et al*., 2008). Whales associated with the Sakhalin feeding area can be absent for all or part of a given feeding season (Bradford *et al*., 2008), indicating they probably use other areas during the summer and fall feeding period. Some of the whales identified feeding in the coastal waters off Sakhalin, including reproductive females and calves, have also been documented off the southern and eastern coast of Kamchatka (Tyurneva *et al*., 2010). Further, whales observed off Sakhalin have been sighted off the northern Kuril Islands in the eastern Okhotsk Sea and Bering Island in the western Bering Sea (Weller *et al*., 2003).

Recently, mixing of whales identified in the WNP and ENP has been observed. Lang (2010) reported that two adult individuals from the WNP, sampled off Sakhalin in 1998 and 2004, matched the microsatellite genotypes, mtDNA haplotypes, and sexes (one male, one female) of two whales sampled off Santa Barbara, California in March 1995. In 2010-2011, three whales were satellite-tracked from the WNP to the ENP (Mate *et al*., 2011). Finally, photographic matches between the WNP and ENP, including resightings between Sakhalin, the U.S., Canada and Mexico have further confirmed use of areas in the ENP by whales identified in the WNP (Weller *et al*., 2012; Urban *et al*. 2013). Despite this level of mixing, significant mitochondrial and nuclear genetic differences between whales in the WNP and ENP have been found (Lang *et al*., 2011).

Although it is clear that some whales feeding off Sakhalin Island during the summer/fall migrate to the west coast of North America during the winter/spring, observations of gray whales in the WNP off Japan, Korea and China

during the winter/spring suggest that not all gray whales in the WNP share a common wintering ground (Weller and Brownell, 2012; Weller et al. 2013). Little is known about the current migratory routes and wintering areas in the WNP, but historical evidence indicates that the coastal waters of eastern Russia, the Korean Peninsula and Japan were part of the migratory route and that areas in the South China Sea were used as wintering grounds (Weller *et al*., 2002; Weller and Brownell, 2012; Weller et al. 2013).

Western gray whales travel for thousands of miles to feed on the abundant soft-bottom benthic communities in the western part of Bering and Okhotsk Seas. This feeding period is extremely important for these slow breeding whales, and any disturbance preventing, reducing or limiting feeding can potentially lead to physiological stress and compromise the health of these whales. The near-shore affinity of gray whales makes them particularly vulnerable to environmental fluctuations and anthropogenic activities. For the past decade, industrial development in the coastal waters of northeastern Sakhalin, namely oil and gas development and related exploration (including seismic surveys, offshore platform installation, pipeline construction, dredging, vessel traffic) became a cause for concern, especially since the oil and gas fields overlap with the primary feeding ground of western gray whales (Blokhin and Burdin, 2001; Gailey *et al*., 2011). Many individuals return annually to the same feeding sites off northeastern Sakhalin Island, indicating a site-specific dependence to this geographic area (Weller *et al*., 2007). This critically important habitat is especially vital for nursing females and their calves, as female energetic requirements are increased during lactation, and calves need to be ready to separate and begin to feed on their own.

The western gray whale population is critically endangered and its continued ability to survive is of concern (Weller *et al*., 2002a; Baillie *et al*., 2004). Hunted to such low numbers in the mid 20th century that some thought it to be extinct, the population remains highly depleted today (Weller *et al*., 2002a; Cooke *et al*., 2013). The International Whaling Commission (IWC) and the International Union for Conservation of Nature (IUCN) have each expressed serious concern about the status of this population and have called for urgent measures to be taken to help ensure its protection (see Baillie *et al*., 2004; IWC, 2004; Reeves *et al*., 2005).

This report reviews summary findings from 2013 research activities on WNP gray whales off Sakhalin Island in the Russian Far East and integrates new information with data from previous years, in some cases ranging back to 1994. Discussion of the current status of the population and a review of threats to its continued survival, including potential impacts associated with large-scale oil and gas development activities and fisheries on the summer feeding ground, and entrapments in trap nets off Japan during migration, are provided herein.

METHODS

The overall consistency in research design, data collection techniques and data analysis maintained in 2013 allowed inter-annual comparisons to be made. Additional information, collected during more limited surveys off Piltun in 1994 and 1995 (Brownell et al., 1997; Weller et al., 1999), is also presented here to better describe inter-annual trends and facilitate a long-term interpretation for some results. Data from these 1994 and 1995 studies include gray whale photographs obtained between 7-12 September 1994 during the filming of a wildlife documentary by H. Minakuchi (for description see Weller et al., 1999) and from 14-20 August 1995 during a pilot study to determine the feasibility of conducting boat- and shore-based research in the study area (Brownell et al., 1997).

Study area

The study area is located near Zaliv Pil'tun (referred to as Piltun Lagoon) on the northeastern shore of Sakhalin Island, Russia (Fig. 2). The lagoon is approximately 80-90 km long and 15 km across at its widest point. A single channel connecting the inner lagoon with the Okhotsk Sea occurs at 52° 50' N and 143° 20' E, and has considerable biological influence on the surrounding marine environment. A lighthouse, near the lagoon channel, served as the base from which studies reported here were conducted. The nearshore marine environment of the study site is mostly sand substrate, characterized by a gradually sloping and broad continental shelf. Water depths within 5 km of shore are mostly less than 25 m deep. Despite the similarity of Piltun Lagoon to the coastal lagoons used during the winter by eastern gray whales off Baja California, Mexico, whales do not enter this lagoon.

Photo-identification surveys

Gray whales have distinctive body markings, such as natural coloration and pigmentation patterns, as well as scars that are unique to an individual and can be used for individual recognition. Boat-based photo-identification surveys were conducted on all good weather days during the 2013 study period. Identical methodology was employed during each survey, with the primary objective of encountering and photographically identifying as many whales as possible. Previous photo-identification data gathered in the Piltun area between 1995 and 2012 used right-side dorsal flank markings for identification (Brownell et al., 1997; Weller et al., 1999, 2006a), and for the sake of intra- and inter-annual reliability, we continued this methodological approach. Attempts were made to photograph the right

dorsal flank of each whale, followed by efforts to photograph the left dorsal flank and fluke. The majority of whales identified to date now have images of right and left flanks as well as ventral surface of flukes in the photo-identification catalog allowing for useful identification images to be collected from nearly any body region.

Photographic/video surveys involved slow travel in a 4.5 m outboard-powered inflatable boat. To photograph whales we used a Nikon D7000 digital camera with a 100-400 mm Nikon lens. Measures of environmental conditions, water depth, geographic position, and group size were recorded for each group photographed.

RESULTS

Survey effort and photo-identification

Sixteen photo-identification surveys, with a total of 107.6 hrs spent at sea and 54.4 hrs spent in direct observation of 148 whale groups, were conducted between 3 July and 30 August in 2013 (Table 1). In 2013, nine surveys were conducted in July, and seven in August. Between 1994 and 2013, 223 western gray whales have been identified during 411 boat-based surveys off northeastern Sakhalin Island (Table 1). One hundred ten of the whales in the photo-catalog were animals first identified as calves, while the remaining 113 whales were considered non-calves (i.e. adults or subadults). However, not all of these 223 individuals are thought to be alive (see Cooke et al., 2013).

Table 1. Annual survey effort, groups encountered, and whales identified in 1994-2013.

Year	Sampling Period	Number of Surveys	Observation Hours	Groups Encountered	Whales Identified
1994	09/07 - 09/12	1			9
1995	08/15 - 08/19	5	10.1	23	28
1997	07/09 - 09/08	22	33.4	114	47
1998	07/06 - 09/29	35	50.5	125	54
1999	06/29 - 10/13	56	122	434	69
2000	06/25 - 09/16	40	56.5	365	58
2001	06/25 - 09/25	49	101.8	448	72
2002	07/01 - 09/25	36	75.6	411	76
2003	07/15 - 09/13	22	41.7	219	75
2004	07/29 - 09/12	21	33.8	194	94
2005	07/04 - 09/09	20	40.9	160	93
2006	07/23 - 08/25	10	24.1	96	79
2007	07/26 - 09/09	20	32.2	187	83
2008	07/08 - 08/21	12	47.0	38	45
2009	06/24 – 08/26	17	67.0	126	82
2010	08/09 - 08/26	4	11.5	40	42
2011	06/28 - 08/26	14	32.7	83	82
2012	06/24 - 08/30	11	48.8	78	88
2013	07/07 - 08/24	16	54.4	148	94
Overall		411	884.0	3289	223 [1]

[1] The number of whales identified annually includes resightings of individuals from previous years, resulting in a total of 223 identified individuals. The number of whales identified does not correspond to the size of the population.

Ninety-four naturally marked individual whales, including 9 calves, were identified during 2013 (Table 1, 2). In 2011, the highest number of calves (12) was identified off northeastern Sakhalin among all years of our research.

Although, in 2013 this number was lower than in 2011, it was almost twice higher than in 2012. Of the 85 non-calves identified in 2013, 83 whales (97.6%) had previous sightings in the Piltun area during 1994-2012 photographic efforts (Table 2). The mean pod size for all groups (n=148) encountered during 2013 was 2.1 ± 1.39 ranging from 1 (63 groups, or 42.6 %) to 8 (2 groups, or 1/3 %) individuals per pod. In general, all whales were distributed in water depths ranging from 4.2 (mostly mother-calf pairs) to 24.0 m (average 11.2 ± 3.65).

Thirty-three (35%) individual gray whales were observed only once throughout the 2013 field season; 21 (22%) whales were sighted twice. Two individuals were seen seven times within the 2013 season. Both of these whales were new calves observed a few times with their mothers and few times after weaning. Their mothers have been photographed multiple times in previous years. However, both of these females were observed as first-time mothers with their calves in 2011. Six individuals identified as calves in 2011 came back to Piltun feeding area in 2013. Also, three calves of 2012 were encountered in 2013; one of them was photographed six times throughout the season.

Table 2. Annual sighting trends and resighting percentages, 1994-2013.

Year	Whales Identified	Number of Calves	New Non-Calves	% Non-Calves Previously Identified
1994[1]	9			
1995[1]	28	2	20	23.1%
1997	47	2	25	44.4%
1998	54	8	5	89.1%
1999	69	3	12	81.8%
2000	58	3	3	94.5%
2001	72	6	6	90.9%
2002	76	9	3	95.5%
2003	75	11	2	96.9%
2004	94	8	3	96.5%
2005	93	6	4	95.4%
2006	79	4	3	96.0%
2007	83	9	2	97.3%
2008	45	3	0	100.0%
2009	82	7	2	97.6%
2010	42	3	1	97.4%
2011	82	12	1	98.6%
2012	88	5	4	95.2%
2013	94	9	2	97.6%

[1] Data from 1994 and 1995 were opportunistic and pilot in nature (respectively) and are thereby viewed as incomplete for some of the reported values.

Mother-calf pairs

Eight mother-calf pairs and one already weaned calf were identified in 2013. All eight mothers have been sighted in the study area prior to 2013; however, one of them, known since 1997, has never been observed in previous years with a calf. This new mother contributes to the total of 31 known reproductive females documented since 1995. Two females (observed as mothers in 2011, and now in 2013) were first identified as calves themselves in 2001 and 2002, respectively. We presume that these are their second calves and their first calving interval was two years. One female observed with a calf in 2013, and also in 2011 and 2009 (for the first time), was identified as a calf herself in 1998. This makes her calving intervals equal to two years as well.

The first sighting of a mother-calf pair in 2013 occurred during our second photo-ID survey, on 9 July. Six mother-calf pairs were identified in July, and three pairs were initially observed in August. One mother-calf pair separated in July, two pairs in August and two pairs sometime between July and August. In three other pairs, calves remained with their mothers at our last sighting, and therefore, no information on weaning time for them was documented (Table 3). The calf that was already weaned prior to the first sighting on 20 August, was observed alone and also in a group in association with adult whales.

Table 3. Mother -calf pair IDs, dates of first sightings and separation dates

Mother ID #	Calf Field ID #	First Time Observed	Last Time Observed Together	First Time Observed Separated
099	01	09 July 2013	21 August 13	NA
003	02	10 July 2013	15 July 13	20 August 13
107	03	11 July 2013	07 August 13	14 August 13
076	04	15 July 2013	15 July 2013	27 July 2013
001	05	28 July 2013	22 August 13	24 August 13
056	06	28 July 2013	28 July 2013	07 August 13
092	07	07 August 2013	21 August 13	NA
026	08	14 August 2013	14 August 2013	NA
Unknown	09	20 August 2013	23 August 2013	NA

DISCUSSION

A number of biological parameters in concert with a variety of human-related threats, as identified during the current long-term study and discussed below, raise concern about the ability of the western gray whale population to rebound from its highly depleted state and highlight the importance of continuing the long-term research and monitoring program.

Population size

Given the new data about movements of some WNP gay whales from the Sakhalin feeding grounds to Mexican wintering grounds, a reevaluation of the western gray whale population estimate is necessary. Data we collected over more than 15 years research supports the idea that the size of the western gray whale population is extremely small compared to most other baleen whale populations. Photo-identification studies off northeastern Sakhalin Island have identified a total of 223 individual whales during 411 surveys conducted between 1994 and 2013. Although our photo-catalog now contains 223 whales, not all of these individuals are assumed to be alive. A population assessment by Cooke et al. (2013) using a Bayesian individually based stage-structured model fitted to the same photo-identification data as used in the mark-recapture studies, has recently been completed. The most resent WNP gray whale abundance estimate of 140 (SE = ± 6, CV=0.043) whales for the age 1-plus (non-calf) population size.

Reproduction and survival

In 2013, a known female sighted in previous years was observed for the first time with a calf. With this new record, 31 females have been observed to produce one or more calves during the 1994-2013 study period. Compared to other species and populations of large cetaceans, the number of breeding females in the WNP gray whale population is still very low and the Piltun area still remains the main area of feeding for females and calves. Although calves are being born annually, the limited number of known reproductive females in combination with relatively low calf survival is likely to be limiting potential population growth (Bradford et al., 2006; IISG, 2006; Cooke et al., 2008). In recent years, the calving interval in the western population appears to be shifting from a three-year interval to a two-year interval (Weller et al., 2009). If this change persists, the general increase in calf production will continue and result in an increase (albeit slow) in the growth rate of the population.

Mother-calf pairs

Eight mother-calf pairs were identified during the 2013 season. All eight mothers have been sighted in the study area prior to 2013; however, one of them has never been observed in previous years with a calf. The annual return of reproductive females while pregnant, resting and lactating indicates that the near shore Sakhalin Island feeding area is of significant importance to the continued survival of this population. The behavior of these females indicates that this feeding ground is vital to population survival and growth.

Threats to the population

With recent evidence that some individuals photographed off Sakhalin migrate to the eastern gray whale wintering areas, additional potential threats to WNP can be identified. First of all, there is a risk that the WNP population size is even smaller than previously estimated (see Weller and Brownell 2012). Further, the migration distance from the WNP to the ENP has increased by almost 3000-4000 km. These changes create new risks for calves traveling with mothers to feeding grounds in the WNP. In addition to the biological difficulties (e.g., small population size, low number of reproductive females) that western gray whales face, the onset of large-scale oil and gas development programs off Sakhalin Island in the mid-1990s introduced new threats to the future survival of the population

(Weller et al., 2002a; Reeves et al., 2005; IISG, 2006). Sakhalin Island is a region rich with large reserves of offshore oil and gas that, until recently, have been unexploited. Industrial activities on the continental shelf of this region have steadily increased in the past ten years and are scheduled to expand at a rapid pace into the future. Oil and gas development activities that may negatively impact western gray whales include: (1) disturbance from underwater noise associated with seismic surveying (Weller et al., 2002b; 2006b, 2006c), pipeline dredging, ship and helicopter traffic and platform operations; (2) direct interactions between whales and an oil spill or other waterborne chemicals, ships, and possible entanglements in cables or lines; and (3) habitat changes related to seafloor modifications associated with dredging and sand pumping activities that may adversely impact gray whale prey (for reviews see Reeves et al., 2005; IISG, 2006).

It is also plausible, however, that the change reflected whales being displaced from the feeding area or, worse, indicates partial abandonment of what has traditionally been a critical feeding habitat (especially for mother-calf pairs) for the population. While natural variation in food resources and other biological factors are being investigated by industry-sponsored research groups, additional investigations need to be undertaken to examine the possible contributions of pile driving activities and a seismic surveys that both occurred in close proximity to the nearshore feeding ground in summer 2008, 2010, and 2012. Until more conclusive explanations can be drawn with regard to the low number of whales observed in 2008, the influence of industrial activities cannot be ruled out as contributing factors.

Another significant threat to the western gray whale population involves incidental catches in coastal net fisheries, particularly off Japan, within their migratory route (Weller et al., 2002a; Kato et al., 2005, 2006, 2007; Brownell et al., 2007; Weller et al., 2008). In 2005, three female western gray whales (one mother-calf pair and one yearling) died in fishing nets on the Pacific coast of Japan during their northward migration. Unfortunately, in 2007 another young female western gray whale died after being entrapped in a trap net also on the Pacific coast of Japan (Anonymous, 2007a,b, c; Brownell et al., 2007; Kato et al., 2007; Weller et al., 2008). Projections from recent population assessments suggest that if this level of net-related mortality continues, there is a high probability the population will decline to extinction (Cooke et al., 2008). In addition, an analysis of anthropogenic scarring of western gray whales found that 18.7% (n = 28) of 150 individuals identified between 1994 and 2005 were determined to have been previously entangled in fishing gear (Bradford et al., 2009), further highlighting the overall risks coastal fisheries pose to western gray whales. Finally, while nothing is known about net entrapments or entanglements in other regions (e.g., Korea and China) within the range of the population, it is likely that coastal net fisheries outside of Japan also contribute to some level of mortality. In fact, the first entanglement of a western gray whale was documented off northeastern Sakhalin in 2013 (see below).

Although there are historical data on gray whales sightings in waters off Japan, South Korea and China, and also documented net entrapments near Japan, the wintering grounds for western population remain unclear (Weller et al. 2008; Weller and Brownell 2013; Weller et al. 2013). Some western gray whales are seen near Kamchatka, and both intra-annual and intra-seasonal exchange of individuals between feeding grounds off Sakhalin and Kamchatka are documented (Tyurneva et al. 2010, our data). In 2010 a satellite-tagging project was initiated off northeastern Sakhalin and continued in 2011. A male gray whale, which was observed as a calf in 1997 and sighted in most years of study in the Piltun area, was tagged and tracked during October 2010–February 2011. Five more whales were tagged in 2011, but only two of them transmitted for long enough to reveal anything about migration. Both whales moved at the same time to the east of the Okhotsk and Bering Sea towards North America. One of the tags (whale "Agent") stopped transmitting in the Gulf of Alaska, while the tag attached to the female "Varvara" transmitted all way to Mexico lagoons and back to Sakhalin Island (Piltun area). This individual traveled over 22,000 km from Sakhalin feeding grounds to the Mexico and back in 5 months. In total, nearly 30 whales observed on the feeding grounds off Sakhalin in different years were photographically matched to portions of the eastern North Pacific (Weller et al. 2012, Urban et al., 2013). This highlights that the range and potential threats this population may face may be on a larger scale than previously anticipated.

Such a wide range in distribution makes whales vulnerable to other unknown threats to the western gray whale population including continued mortality from an undetermined level of suspected poaching in the central portion of the range (Brownell and Kasuya, 1999; Baker et al., 2002), as well as a potential increase in the likelihood of disturbance, exposure to pollution, and probability of ship strikes due to substantial nearshore industrialization and shipping congestion throughout the migratory corridor(s).

Fishing activity and entanglement incident

Increasing fishing activity has been developing within the western gray whale nearshore feeding grounds for the past two years. In 2012, fishing occurred mainly inside Piltun lagoon; however, the scale of the 2012 fishing operation was dramatically smaller compared to 2013. In 2013, a nearshore salmon fishery was established both inside

and south of the Piltun lagoon (Fig. 1). Two trap-nets ~1.5 km in length were placed perpendicular to the coastline. Such nets increase the potential for gray whale interactions, especially because whales in this area are on average 1.5 km from shore (Gailey et al. 2011). In addition, mothers with calves or recently weaned calves occur significantly closer to shore, commonly within 0.8 km (Sychenko 2011). Throughout the 2013 and previous feeding seasons, whales were observed to frequently utilize the area in proximity to the fishing nets. In addition to the fishing nets, an increase in fishing-related activities was notable, including a large increase in the presence of smaller fishing vessels as well as large (> 80 m). Such large-scale fishery activities in the Piltun area have heightened concerns that the numbers of operations in the main feeding area of western gray whales are likely to increase and have a direct impact on the animals, such as causing injuries or death to the whales.

During the 2013 field season, one of the most frequently sighted western gray whales was observed to be entangled with fishing rope wrapped around the caudal peduncle near the fluke with an associated open wound. The whale with the rope was identified as individual no. 035 (“Ponchik”) from the Russia-U.S. photo-catalog of western gray whales. Ponchik is known to be a male who was first sighted in 1995 and frequently encountered in the Piltun area. He is also known to be a father of multiple calves off Sakhalin, and in 2004, he was photo-documented in the eastern North Pacific off Vancouver Island, Canada. In 2013, Ponchik was sighted four times: 9 and 14 July 22 and 24 August. His entanglement was first observed from photographs taken on 22 August. The photographic evidence was presented to the Western Gray Whale Advisory Panel as well as IUCN and IWC. After considerable deliberation, it was concluded that immediate disentanglement efforts were not realistic due to logistic difficulties, deteriorating late season weather conditions in the Sea of Okhotsk, and a low probability of finding Ponchik. Without ensuring the fishing gear was removed from this individual, his future survival is uncertain. This presents the first documented entanglement of a gray whale off northeastern Sakhalin, and coincides with increasing fishing activities within the western gray whale neashore Piltun feeding area.

CONCLUSIONS

Based on the results reported here, it is clear that the western gray whale population could be even smaller than we have estimated and it is precariously balanced between survival and extinction. In addition to the variety of biological factors that may be limiting population growth, large-scale oil and gas development programs that may alter the prey base or introduce disturbance to feeding whales, as well as entrapment and entanglement in fishing gear, especially in trap nets off Japan, are of serious concern with regard to the future survival of the population.
Given the continued uncertainty regarding the ability of the western gray whale population to increase from its depleted state, potential impacts and future activities of oil and gas development as well as fisheries off the northeastern Sakhalin Island coast need to be closely monitored and stringently mitigated to reduce disturbance to the lowest possible level. In addition, net entrapments of western gray whales off Japan and elsewhere can lead the population to extinction (IISG, 2006; Cooke et al., 2008; Brownell et al., 2007; Weller et al., 2008). Thus, human related mortality during migration and in the (yet to be determined) wintering area(s) must be addressed and mitigated to the lowest possible level. Where scientific knowledge is lacking, the precautionary principle should be applied as the best measure of protection. With this in mind, the photo-identification and genetic biopsy research conducted since 1995, and reviewed here, must be continued to further monitor survival of individuals, describe the overall population trend and to recommend further conservation and protection measures.

In conclusion, protection of the Sakhalin Island feeding habitat, including the coastal lagoon systems that appear integrally related to the high benthic biomass used by the whales in the nearshore area, is clearly paramount to successful conservation of the western gray whale population. The unique method of benthic feeding by these whales makes them an "umbrella" species (Hooker and Gerber, 2004), whereby protection of their habitat provides protection for the biological diversity of the entire northeastern Sakhalin Island shelf. Thus, the feeding habitat of the western gray whale needs to be considered a "hot spot" for conservation planning now and in the future and every effort should be taken to protect its biological integrity. In continuation of this research and looking for the development of additional western gray whale conservation measures, the next step should be intensifying research of gray whales off Kamchatka, and create the observation point on gray whale migration along Kamchatka coast, possibly on the lighthouse in Petropavlovsk-Kamchatsky.

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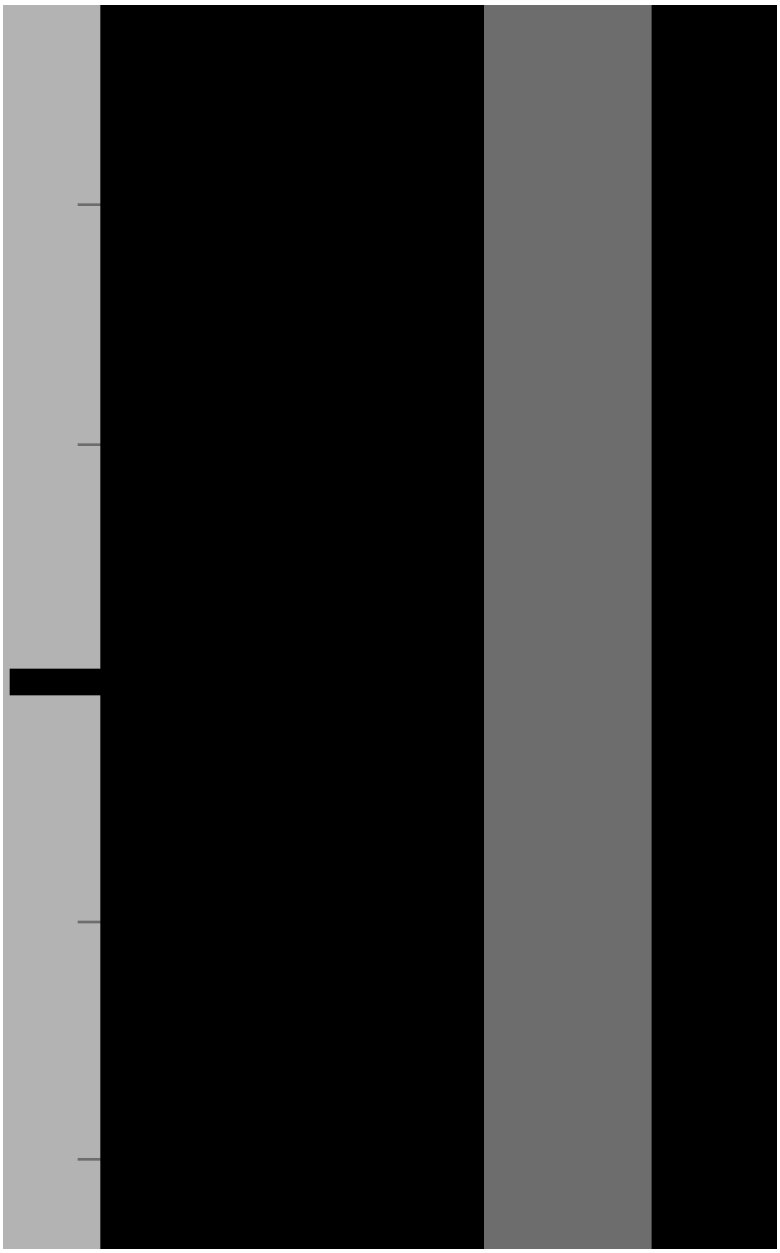

Figure 1. Gray whale sighting locations in 2013 are denoted in red. Positions of salmon fishing trap-nets are denoted in yellow.