PHOTOGRAPHIC IDENTIFICATION OF THE KOREAN-OKHOTSK GRAY WHALE (*ESCHRICHTIUS ROBUSTUS*) OFFSHORE NORTHEASTERN SAKHALIN ISLAND AND SOUTHEASTERN KAMCHATKA, RUSSIA, 2006

Final Report

Prepared for:

Exxon Neftegas Limited and Sakhalin Energy Investment Company Ltd.
Yuzhno-Sakhalinsk
Russia

Authors:

Yuri Yakovlev, Olga Tyurneva and Vladimir Vertyankin

June 2007

RUSSIAN ACADEMY OF SCIENCES
FAR EASTERN BRANCH

INSTITUTE OF MARINE BIOLOGY

"Approved"
Director Institute
of Marine Biology
FEB RAS
Academician
A.V. Adrianov

REPORT ON THE RESEARCH PROJECT

PHOTOGRAPHIC IDENTIFICATION OF WESTERN GRAY WHALES (*ESCHRICHTIUS ROBUSTUS*) ON THE NORTH-EAST SHELF OF SAKHALIN ISLAND AND ON THE SOUTH-EAST COAST OF KAMCHATKA PENINSULA, RUSSIA, 2006

Final Report

VLADIVOSTOK

2007

TABLE OF CONTENTS

STUDY PARTICIPANTS II
ACKNOWLEDGEMENTS IV
LIST OF FIGURES V
LIST OF TABLES V
LIST OF APPENDICES VI
INTRODUCTION 1
PURPOSE AND OBJECTIVES 2
BACKGROUND 3
STUDY AREAS AND METHODS 6
Offshore NE Sakhalin 6
Field Photo-Identification Along *Sakhalin Island* 7
Photo and Video Analysis 10
RESULTS 12
Scope of Work 12
Photo-Identification from the Zodiac and Vessel Deck 15
Group Sizes and Distribution 20
Whale Movements between Known Feeding Areas Offshore Sakhalin Island 23
Sightings and Identified Whales 24
Repeat Sightings, Site Fidelity and Association Patterns 24
Cow/Calf Pairs 26
Physical Condition 26
Body Weight 26
Skin Sloughing 36
DISCUSSION 36
REFERENCES 42

STUDY PARTICIPANTS

Project Aspects	Name	Place of Work
Field Photography and Videography Offshore Sakhalin		
Photographer, team leader	Yuri Mikhailovich Yakovlev	Marine Biology Institute of the Far East Branch of the Russian Academy of Sciences
Video camera operator	Nikolai Ivanovich Selin	Marine Biology Institute of the Far East Branch of the Russian Academy of Sciences
Data recorders	Konstantin Anatolyevich Drozdov & Alexander Kalachev	Pacific Institute of Bioorganic Chemistry of the Far East Branch of the Russian Academy of Sciences
Zodiac operator	Nikolai Ivanovich Prokhorov	Marine Biology Institute of the Far East Branch of the Russian Academy of Sciences
Project Management and Training		
Training: Familiarization with protocols, analysis procedures	Christina Tombach Wright	LGL Limited environmental research associates, Sidney, Canada
Project Management	Steve Johnson Sonya Meier Christina Tombach Wright	LGL Limited environmental research associates, Sidney, Canada
Data Management and Analysis		
Image processing, catalogue preparation IT and computer support Data analysis	Olga Yuryevna Tyurneva Yuri Mikhailovich Yakovlev Konstantin Anatolyevich Drozdov Arseny Yuryevich Yakovlev Olga Nikolayevna Miroshnikova	Photo-identification laboratory of the Marine Biology Institute, Vladivostok
Writing of the Report		
Writing of the Report	Yuri Mikhailovich Yakovlev Olga Yuryevna Tyurneva	Photo-identification laboratory of the Marine Biology Institute, Vladivostok

Report Review	Sonya Meier Christina Tombach Wright Lisanne Aerts Igor Zhmaev James Hall Rodger Melton Vladimir Nechayuk	LGL Limited environmental research associates, Sidney, Canada LGL Alaska Research Associates, Inc LGL Sakhalin, Russia Exxon Mobil Upstream Research Company Sakhalin Energy Investment Company
Field Photography and Videography Offshore Kamchatka Peninsula		
Photographer, team leader	Vladimir Vertyankin	Federal State Agency Sevvostokrybvod, Petropavlovsk-Kamchatsky
Data recorder	Valery Anatolyevich Vladimirov	All-Union Research Institute of Fisheries and Oceanography (VNIRO), Moscow
Zodiac operator	Yuri Vladimirovich Vertyankin	Federal State Agency Sevvostokrybvod, Petropavlovsk-Kamchatsky

ACKNOWLEDGEMENTS

The whale photographic identification surveys were made possible by the participation of scientific personnel and crewmembers of vessels of the Far East Branch of the Russian Academy of Science. Special thanks go to V. B. Ptushkin and I. N. Turkin, captains of the vessels *Professor Bogorov and Akademik Oparin*, for leading the cruise and managing safe operations; to boatswains A. P. Afanasyev and A. I. Reshetnyak for providing safe and successful zodiac launches and recoveries, and to N. I. Ivanov (Institute of Geography, Vladivostok) for ensuring uninterrupted communication between the zodiac and the base vessel; to marine observers A. T. Ashchelkov, N. V. Chursinova, A. G. Afanasyev-Grigoryev and M. S. Kornienko (Marine Biology Institute, Far East Branch of the Russian Academy of Sciences, Vladivostok) for providing information on whale distribution and transmitting this information on whale movements to the zodiac during the 2005 photo-ID surveys; to K. A. Drozdov and O. N. Miroshnikova for help in processing the data; and to I. N. Zhmaev (LGL Limited, Sakhalin) and V. E. Nechayuk (Sakhalin Energy Investment Company) for overall coordination of the fieldwork.

A number of experts from LGL Limited environmental research associates, (Sidney, British Columbia, Canada) and LGL Alaska Research Associates, Inc. (Anchorage, Alaska, USA), provided support and training. We wish to thank Steve Johnson, Sonya Meier, Sergei Yazvenko for project preparation and management, Christina Tombach Wright for providing technical training and support, Julia Yazvenko and Igor Zhmaev for translation during training sessions, Peter Wainwright, Robin Tamasi, Tony Mochizuki, Igor Zhmaev and Yury Bychkov for technical assistance in the creation and management of a digital photo organizational database and GIS mapping, and Dorothy Baker for computer support.

Support and funding for this study were provided by the Sakhalin-1 (operator Exxon Neftegas Limited) and Sakhalin II (operator Sakhalin Energy Investment Company) projects. We wish to thank Rodger Melton and James Hall of Exxon Mobil Upstream Research Company and Vladimir Nechayuk of Sakhalin Energy Investment Company for their support.

LIST OF FIGURES

Figure 1. Percentage of animals in groups relative to the total number of whales sighted and photographed during the period from 2002 to 2006 (field data).

Figure 2. Percentage of photo-identified underweight gray whales relative to the total number of whales sighted offshore Sakhalin Island over 5-day periods during the 2006 field season.

LIST OF TABLES

Table 1. Photo-ID effort (days) during expeditions to Sakhalin Island, 2002-2006.

Table 2. Photo-ID effort and number of photographs taken from the zodiac in 2006.

Table 3. Descriptive statistics of photo-ID work, NE Sakhalin Island (field data), 2006.

Table 4. Depths recorded from the zodiac during photo-ID, 2006.

Table 5. Numbers of whales identified during the 2002-2006 period.

Table 6. Assessment of photographic coverage of four standard aspects of gray whale sightings identified from 2002-2006.

Table 7. Whale movements between feeding areas, 2002-2006.

Table 8. Gray whale group size and encounter rates in known feeding areas, based on photographs taken only from a zodiac, 2003-2006.

Table 9. Frequency of repeat sightings of photo-identified gray whales (IDW) in 2006.

Table 10. Inter- and intra-year frequency of sightings of identified gray whales (IDW), 2002-2006.

Table 11. Body condition (BC) classes for whales sighted, 2003-2006.

Table 12. Inter-year comparison of the body condition (BC) of cows and calves, 2005-2006.

Table 13. Number of gray whales identified in 2004 and 2006 in different areas offshore Kamchatka.

Table 14. Completeness of photographic coverage (four standard aspects) of all known gray whales identified offshore Kamchatka in 2004 and 2006.

Table 15. Frequency of sighting of photo-identified gray whales offshore Kamchatka (KamGW) in 2004 and 2006 in comparison with sightings offshore Sakhalin Island (KOGW), 2002-2006.

Table 16. Body condition classes for whales observed offshore Kamchatka in 2004 and 2006 in comparison with whales observed offshore Sakhalin Island.

LIST OF APPENDICES

Figure A1. Gray whale photo-ID sites along the NE coast of Sakhalin Island, 2006.

Figure A2. Gray whale photo-ID locations along the SE coast of the Kamchatka Peninsula in 2004 and 2006 and locations of encounters with the whales that used the NE coast of Sakhalin Island, 2002 to 2006.

Table A1. Time spent at each gray whale sighting from a zodiac, 2006.

Table A2. Gray whale group size at each sighting in the course of photo-ID efforts from the zodiac during the 2006 expedition.

Table A3. Aspects photographed of gray whale individuals off the NE coast of Sakhalin Island and offshore the Kamchatka Peninsula in 2002-2006.

Table A4. Number of sightings of photo-identified gray whales in different areas during the 2002-2006 expeditions on the NE Sakhalin shelf and on the SE Kamchatka shelf.

Table A5. Occurrence of photo-identified gray whales on the northeastern Sakhalin shelf, 2002-2006,.

Table A6. Dates and locations where identified gray whales were observed off the NE Sakhalin shelf and SE Kamchatka shelf, 2002-2006.

Table A7. Occurrence of gray whales offshore Sakhalin Island, encountered cows with calves, physical body condition (PCB) class and skin condition, 2002-2006.

INTRODUCTION

According to the latest information on gray whales (*Eschrichtius robustus*), they currently form two distinct populations: eastern (California-Chukchi or Eastern North Pacific) and western (Korean-Okhotsk or Western North Pacific) (Swartz et al. 2006). The potential overlap of both populations beyond the boundaries of their well known ranges offshore eastern Kamchatka has also been hypothesized (Vertyankin et al. 2004).

The eastern gray whale population reached its peak in 1999, when it exceeded 26,000 animals (Rugh et al. 1999), although some data from recent studies in 2001/2002 suggest that the population has since declined to approximately 18,000 (Rugh et al. 2005). In November 1991, by resolution of the U. S. National Oceanic and Atmospheric Administration (NOAA), the eastern gray whale was removed from the endangered species list, where it had been listed since 1967.

In contrast, the western gray whale population numbers far less than the eastern population and the conservation status of the Korean-Okhotsk gray whale population has received increasing attention in recent years (Webster 2003). The western gray whale population has been classified as endangered (Category I) in the Russian Federation Red Book (Perlov et al. 1996; Russian Federation Red Book 2000). The United States government also classifies the western population as an endangered species (U.S. Fish and Wildlife Service [USFWS] 1997).

Presently, western gray whales are considered by the World Conservation Union (IUCN) to be critically endangered (Hilton-Taylor 2000; Weller and Brownell 2000). The IUCN criteria used to support this classification were as follows: (1) the population in question is both geographically and genetically isolated (LeDuc et al. 2002); and (2) there are probably fewer than 50 animals in the population capable of reproduction (Hilton-Taylor 2000; Weller and Brownell 2000; Bradford, 2003).

Much of the gray whale life cycle takes place in the coastal waters of densely populated countries with intensive fishing and shipping. Western gray whales are likely exposed to anthopogenic activity during all three stages of their life cycle: (1) during whale reproduction in the southern part of their range, the location of which is currently unknown; (2) during prolonged north-south migrations, the route which is currently unknown; and (3) in their known feeding areas off the northeast coast of Sakhalin Island, Russia. Historically, the distribution of gray whales in the Sea of Okhotsk apparently has included Sakhalin Bay (on the west side of the NW end of Sakhalin Island), Akademiya and Tugurskiy bays south of the Shantarskiy Islands (in the far western part of the Sea of Okhotsk, west of the NW end of Sakhalin Island), offshore NE Sakhalin Island, Shelikhova, Penzhinskaya and Gizhiginskaya bays in the far northeastern part of the Sea of Okhotsk, and the waters west of the Kamchatka Peninsula (Krupnik 1984; Yablokov and Bogoslovskaya 1984; Sokolov and Arsenyev 1994; Perlov et al. 1996). The long-held belief that the whales' wintering grounds were along the southern coast of the Korean Peninsula (Rice 1998) has not been substantiated to date. The gray whales' wintering grounds are now believed to be located in the South China Sea, possibly along the coast of Guangdong province and/or around Hainan Island (Rice 1998). However, specific

calving sites have never been observed. In addition to potential impacts on whales from increased vessel traffic associated with commercial and recreational navigation, the countries of Southeast Asia still have strong traditions involving the consumption of whale meat (Lento et al. 1998; Wang 1998). Furthermore, as highlighted in 2005 and 2006 by the reported four deaths of western gray whales by accidental entanglement in fishing nets of the west coast of Japan, the fishing industry poses a significant threat to the survival of this species.

Photographic identification (hereafter referred to as "photo-ID") of marine mammals has proven to be a useful tool for monitoring wild populations of animals while minimizing the impact on individuals. When incorporated into a long-term monitoring program, photo-ID can be a valuable tool used to answer many ecological questions about populations of marine mammals. For small or isolated populations, photo-ID can be used effectively in assessing population size and variation over time (Whitehead et al. 1997; Cerchio 1998; Stevick et al. 2001; Bradford 2003; Weller et al. 2003, 2004; Calambokidis and Barlow 2004). For large whale populations, photo-ID has been used to identify long migration routes (Best et al. 1993; Darling et al. 1996; Craig and Herman 1997; Salden et al. 1999; Weller at al. 2002), feeding ranges, and interannual changes in whale distribution (Calambokidis et al. 2002, Clapham et al. 1993). For these large whale species, photo-ID can be used as an effective method of examining health indicators of individuals as well as the overall health of groups or populations (Pettis et al. 2004; Bradford et al. 2005; Yakovlev and Tyurneva 2005a,b,c; 2006). Photo-ID has proven to be an especially useful tool in gray whale studies (Darling 1984; Würsig et al. 1999, Calambokidis et al. 2002), as individuals are distinctly distinguishable by characteristic markings on their sides, backs and flukes.

Coastal waters are often zones of species overlap, and environmental and anthropogenic disturbance (Goldberg 1993) and in many instances photo-ID is the only way to identify external indicators of the animals' health. In areas with a high risk of human impact on the environment (discharges of domestic and industrial wastes, development of oil and gas fields, intensive fishing and maritime traffic, large-scale mariculture, mass tourism), photo-ID of whales often serves as a useful tool in resolving some conflicts. Photo-ID with the purpose of monitoring whale populations and timely identification of negative phenomena may in some cases help prevent or mitigate conflicts.

PURPOSE AND OBJECTIVES

Sakhalin Energy Investment Company Ltd. (SEIC) and Exxon Neftegas Limited (ENL) are currently operators of projects participating in the development of oil and gas reserves in the Sea of Okhotsk offshore NE Sakhalin Island, Russia, while a number of other companies are poised to begin developing reserves in the region. Oil and gas development is in proximity to gray whale feeding areas offshore NE Sakhalin Island. Data are required to monitor the status and design appropriate measures to minimize potential effects on the western gray whale population. Photo-ID work is a key tool in effective monitoring studies necessary for providing data and input into mitigation development strategies and in monitoring their effectiveness.

The technical objective of the work was to continue photo-ID studies to assess the whales' annual return rates and patterns of site fidelity for known individuals and to define the size, structure and status of the population. Photo-ID techniques can be used to assess various aspects of western gray whale ecology such as:

- abundance estimates for small and isolated populations;
- inter- and intra-annual fidelity of individual whales to specific feeding areas, individual foraging patterns and movement between feeding and migration areas;
- individual associations and group stability;
- number, status and habitat use of cow/calf pairs (calf birth and survival rates) and timing of cow-calf separation (weaning);
- physical status and individual health indicators; and
- population demographics and structure.

BACKGROUND

Two primary gray whale feeding areas have been identified off Sakhalin Island. A shallow-water (generally <20 m) feeding area is located along the coast adjacent to Piltun Bay (Brownell and Chun 1977; Sobolevsky 2000; Weller et al. 2004; Blokhin et al. 2003, 2004; Yakovlev and Tyurneva 2003, 2004, 2005a,b,c; Vladimrov et al. 2005). Another deeper water "Offshore" feeding area is located about 30-40 km off of Chayvo Bay, in waters of 35-60 m deep (Miyashita et al. 2001; Maminov and Yakovlev 2002; Blokhin et al. 2003, 2004; Yakovlev and Tyurneva 2003, 2004, 2005a,b,c; 2006) (Figure 1). However, whales are also observed along the entire northeast coast of Sakhalin Island (Blokhin et al. 2004). Gray whales begin arriving off northeast Sakhalin Island in late May, when the sea ice has cleared, with some whales remaining until early December, when ice formations reappear.

Photo-ID of gray whales belonging to the western population is currently carried out by two groups of investigators. The Russian-US photo-ID group has been active in the Piltun feeding area between 1994 and 2006 (Würsig et al. 1999, Weller et al. 2000, 2001, 2003, 2004, 2005, 2006). Specialists from the Institute of Marine Biology (IBM) of the Far East Branch of the Russian Academy of Science (DVO RAN) began working in both (Piltun and Offshore) feeding areas in 2002 and had been active each year since (Yakovlev and Tyurneva 2003; 2004; 2005a,b,c; 2006).

According to the results of these surveys, 150 whales had been identified by the end of 2005, the estimated size of the population being in the neighborhood of 120 (Weller et al. 2006; Cooke et al. 2006). The group has noted a high percentage of animals returning to the area each year and a high degree of seasonal fidelity to the Piltun feeding area among most of the identified individuals (Weller et al. 2004). It has also been noted that some individuals revisit the area irregularly, skipping some seasons, and their absence in the coastal waters may be partly explained by discovery of the Offshore feeding area in 2001.

There have been reports of previous observations in this Offshore area (Sobolevsky 2000; Miyashita et al. 2001), and it is quite probable that the area was used by gray

whales prior to 2001. Any data on whale sightings in the Offshore prior to 2001 are incidental and survey effort was low. Photo-ID of gray whales in the Offshore area in in 2002 (Yakovlev and Tyurneva 2003) confirmed that some individuals observed in the Offshore area were also present in the Piltun feeding area; inter- and intra-year interchange of whales between feeding areas was also confirmed. These results suggest that the whales travel between their summer feeding sites, most likely in search of their preferred prey. Specialists from the Russian-US photo-ID group had established that nine out of ten whales photographed in the Offshore area in 2003 were sighted before in the Piltun feeding area (Weller pers. comm. May, 2004).

Over the past few decades, researchers have become aware of the presence and increasingly wide distribution, from one year to another, of gray whales in coastal waters off SE Kamchatka during the summer-autumn and early winter months (Appendix Figure A2) (Vertyankin et al. 2004). According to ship-based surveys conducted on an annual basis by the Kamchatka Regional Fisheries Management Agency (Kamchatrybvod), whales had been sighted in coastal waters SE of the tip of the peninsula since 1979. It has also been pointed out that since the mid-eighties, lone whales started appearing near the SE coast of Kamchatka during the summer months (Blokhin et al. 1985; Vladimirov 1994).

It has been assumed that after whaling was discontinued in 1946, gray whales became more abundant and started visiting the waters along the east coast of Kamchatka from Dezhnev Bay in the north to Cape Tri Sestry in the south. In addition to Avachinskaya Bay (one whale in December 2003), other sightings offshore eastern Kamchatka include: Vestnik Bay (six whales on 30 June 30 1994, near Cape Nalychev (seven or eight whales on 11 September 2002) and in Olga Bay (11 whales on 10 June 2002) (Nikulin et al. 2004).

Since whales appeared in coastal waters off SE Kamchatka in 1983 when they were for the first time sighted near Tri Sestry Bay (51°20’ N, 157°26’ E), they were observed to move farther north each subsequent year. For nearly eight years, up to seven whales congregated near Vestnik Bay. Gray whales then appeared in the area of Khalaktyrsky Beach near Petropavlovsk-Kamchatsky, where as many as six individuals were sighted. Since 1995, gray whales have been encountered in Olga Bay and 10 years later, 13 to 15 animals were sighted during a single helicopter survey (Burkanov, unpublished data).

Of particular interest are frequent sightings of gray whales in coastal waters around the Komandorsky Islands. Similar to the gray whales off Kamchatka, appearance of gray whales near the Bering Island at a remote distance from the mainland is becoming a regular occurrence (Mamaev 2002; Vertyankin et al. 2004).

In regards to the west coast of Kamchatka, according to Blokhin (1996) no gray whales were sighted in its waters over many years of observations. Yet, in August of the year 2000, a small gray whale was seen entering the Bolshaya River (Nikulin et al. 2004). There is evidence (Maminov and Blokhin 2004), that far fewer gray whales have been sighted along the west coast of Kamchatka, as compared to the east coast.

In 2004, gray whales were sighted and photographed during surveys in Vestnik Bay off Kamchatka. This was the first attempt made to compare photographs taken off

Kamchatka with whales already identified from the currently available catalogue (2002-2005) from pictures taken offshore NE Sakhalin (Tyurneva et al. 2006).

Large-scale studies of whale food resources offshore NE Sakhalin Island funded by the oil and gas production sector began in 2001 and continued in 2002, 2003, 2004 and 2005 (Fadeev 2002, 2003, 2004, 2005, 2006). The shallow waters (5-15 m) in the Piltun feeding area are distinguished by an abundance of potential prey for gray whales, including amphipods, isopods, bivalve mollusks and worms that form concentrations along the ocean bottom. In 2004, concentrations of sand lance, a potential gray whale prey item, were found off Piltun in waters more than 20 m deep (Fadeev 2005).

The offshore area is characterized by high concentrations of tube-dwelling ampeliscid amphipods. “Shifts” in the gray whale distribution in both the Piltun and the Offshore feeding areas within and between seasons have been noted by a number of authors (Johnson 2002; Weller et al. 2004; Perlov et al. 2003; Blokhin et al. 2003, 2004) and are considered to be at least partly a reaction to seasonal changes in the distribution and abundance of prey (Fadeev 2003, 2004, 2005).

Higher whale population density has been reported in some parts of feeding areas compared to others. For example, a high whale population density has been reported, as a rule, (1) in the southern part of the Piltun feeding area near the mouth of Piltun Bay (Maminov 2004; Weller et al. 2004; Blokhin et al. 2004; Vladimirov et al. 2005), where cow/calf pairs were often observed (unpublished ENL/SEIC data), and (2) in the northern part of the Piltun feeding area (Blokhin et al. 2003, 2004; Gailey et al. 2004; Maminov 2004). Uneven distribution of gray whale prey may explain the congregations or seasonal changes in the distribution the whales and the movement of individual animals both within feeding areas and between the Piltun and Offshore feeding areas (Maminov and Yakovlev 2002). Until very recently, gray whales of the western population have never been seen to feed on cumaceans. In 2004, congregations of sand lances also known as gray whale prey were found in the waters of Piltun Bay at depths in excess of 20 m (Fadeev 2005).

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 significantly 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 abnormal changes in body condition due to disease or starvation (Thompson and Hammond 1992; Pettis et al. 2004).

Studies indicate a relationship between reproductive success and body condition (Pettis et al. 2004), and photo-ID makes it possible to look at the relationship between the birth rate and physical condition at both individual and population levels. In 1999, the Russian-US photo-ID team noted that some of the whales they observed were abnormally thin (emaciated) (Weller et al. 2000). They used the following features to identify an emaciated whale:

- a visible subdermal protrusion of the scapulas with characteristic thoracic depressions where the pectoral flippers connect with the body;
- noticeable depressions around the blowhole and head; and

- a pronounced ridge along the dorsal spine of the lumbar and caudal vertebrae resulting in a bulge along the lateral flank.

In the course of photo-ID surveys performed in 1999 (Weller et al. 2000, 2004), it was recognized that 23.2% of all identified whales (16 out of 69) displayed one or more of the above features, and during similar surveys in 2000 (Weller et al. 2001, 2004), half (30 out of 58 or 51.7%) of identified gray whales were placed in the emaciated category. In 2001, 21 out of 72 adult gray whales (29.9% of adults) in the western populations were placed in this category (Weller et al. 2003, 2004). In 2002, the percentage of emaciated whales dropped to 11.8% of the observed total (9 out of 76) (Weller et al. 2004), and in 2003, 4.0% (3 out of 75) of whales were rated as emaciated (Weller pers. comm. May 2004). It should be pointed out, however, that some of the gray whales placed in the emaciated category in the course of survey during one year had their weight restored within the subsequent year, whereas whales not rated as emaciated during the previous year were deemed to be emaciated during the next survey (Weller et al. 2004). During all those years, cows with calves were considered to be emaciated.

In 2002 (September-October), photo-ID was conducted by IBM specialists together with other surveys in both the Piltun and Offshore feeding areas. Photographs were taken from a zodiac launched whenever the conditions were acceptable for routine studies from the sea-going base research vessel (tug *Nevelskoy*). The zodiac was launched when gray whales appeared and the sea state was suitable for photo-ID work. Since the research vessel was also used for other gray whale-related activities (prey sampling, observations, acoustic monitoring), photo-ID was performed as far as possible only when whales appeared during performance of other survey tasks.

The discovery in September 2001 of a new primary gray whale feeding area, the Offshore area (Maminov and Yakovlev 2002), offered IBM researchers the opportunity to study whales in detail in this area for the first time in 2002 and to determine whether there were movements of whales between the two feeding areas. Large numbers of gray whales were present in the Offshore area in 2002 and 2003 (Yakovlev and Tyurneva 2003, 2004; Blokhin et al. 2003, 2004; Maminov 2003; Weller et al. pers. comm. May 2004) and numbers were variable each summer in 2004 and 2005 (Yakovlev and Tyurneva 2005, 2006). Photo-ID of gray whales covered the entire stretch of coastal waters off NE Sakhalin, including the Piltun and Offshore feeding areas.

The current study monitors the number of individuals in the population and the number of cows with calves, to determine the physiological condition of gray whale individuals, and to provide data on the whales' seasonal and daily movements in both the Piltun and Offshore feeding areas, as well as their movement between areas.

STUDY AREAS AND METHODS

Offshore NE Sakhalin

The study area covers the entire northeast coast of Sakhalin Island, including the Piltun feeding area (52°40' N to 53°30' N) stretching along the shore of Piltun Bay,

and the Offshore feeding area located offshore of Chayvo Bay (51°50' N. to 52°25' N.) at depths of 35-60 m. Photo-ID effort was concentrated in these two feeding areas, but whales were also photographed opportunistically if encountered outside of these regions.

The research vessels *Professor Bogorov* and *Akademik Oparin* were the base ships for photo-ID and other parts of the monitoring program, including vessel surveys of marine mammals, prey studies, and acoustic studies.

Field Photo-Identification Along *Sakhalin Island*

Photo-ID of gray whales in 2002 and 2003 was performed from a zodiac with a two-stroke outboard motor. Starting in 2004, a 3.8 m long zodiac was equipped with a 45 HP four-stroke Mercury outboard motor to reduce noise and pollution. Photography work was conducted from the zodiac when weather and sea conditions allowed it to be used safely. As safety is the primary concern for everybody involved in the project, the work was halted in the presence of weather conditions unfavorable for photo-ID (dense fog; high, wind-driven waves; torrential rain; high seas; and poor light).

Visual observations of marine mammals were conducted from the vessel during daylight hours in all types of weather. Information about the locations of gray whales gathered in the course of these continuous observations, conducted concurrently with other vessel research monitoring tasks, allowed the photo-ID team to travel directly to gray whale aggregations and reduce search time. This was particularly important in the Offshore feeding area, where the distance between groups of whales or individuals was relatively large, and the whales' movements were less predictable.

When the vessel approached within approximately 2 km of a group of gray whales the vessel was brought to a full stop. The bridge then informed the photo-ID team members of the whale sighting, and after a safety briefing, the zodiac was launched from the vessel. In the Piltun area, procedures were implemented to ensure the safety of whales and vessels, with zodiacs being used as the primary platforms for whale observations. The base vessel ship sailed in parallel with the shoreline at the required safe distance to offer the zodiac crew whatever assistance it might need.

The zodiac was equipped with a digital depth finder and a portable global positioning system (GPS) navigator. Each zodiac was also outfitted with all safety equipment required for sea safety procedures. The research team consisted of a boat driver, a data recorder, a digital video camera operator and a digital camera photographer.

Upon initial sighting of a whale, the driver slowed the zodiac to idling speed and maneuvered to a vantage point approximately 100 m from the whale(s). From that point, the whales' position (as determined by the GPS), the time, behavior, number of whales in the area, direction of their movement, the presence of killer whales, and passing vessels, airplanes or helicopters in the observation area were noted. The presence of mud plumes, both at whale feeding sites near the launch and when no

whales were visible, was also recorded. Secondary indicators of whale feeding, such as circling or diving birds or shoaling fish, were also recorded. If whale foraging was observed (as confirmed by mud plumes or assumed from typical movements and behavior), the exact GPS position of the whales was recorded and communicated to the mother ship via VHF radio.

Upon completion of the photo-ID mission, and only after the zodiac and the whales had vacated the area in question, the vessel would return to the previously transmitted GPS coordinates to obtain benthic prey samples using a Van Veen bottom grab sampler (Fadeev 2005). All data was recorded on waterproof data sheets and entered into a laptop computer at the end of each photo-ID mission.

To minimize potential impacts on whales, the zodiac would approach to a distance of 100 m from the whale to photograph an individual. The frame and video recording counter numbers in reference to the whales identified, the position (as determined by GPS), the depth (according to digital depth finder data), the temperature (at the sea surface) and salinity of the water, the distance to the whale, and the course according to compass readings were recorded on data sheets. The data was recorded during each mission and each photo session as the parameters changed.

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 use of a high-quality digital camera provided the possibility of rapid data acquisition and reduced the time spent on image processing and archiving at the end of the survey season. The photographs were recorded at a high resolution setting in large RGB JPEG format. Video footage was recorded using a Canon Optura 20 miniDV digital video camera.

Video footage was particularly important for documenting body condition characteristics of the whales (e.g., protruding scapulae, depressions behind the blowhole) that are often difficult to distinguish in a still photograph due to lighting features, timing, and position of the whale in the picture. Contact with a group of whales was maintained until all the individuals sighted had been photographed, if possible, or after approximately one hour, regardless of the number of aspects photographed, to avoid the potential for disturbing the animal over an extended time period. The zodiac then withdrew from the group of whales. These procedures were repeated each time additional whale groups were sighted and photographed. A sighting number was given to each of these encounters.

A “sighting” is defined as the observation and photographing of a solitary individual or a group of two or more whales swimming in direct proximity to each other (within 10 body lengths) with coordinated dive and surfacing times and directions of movement relative to other individuals in the group.

Group size estimates were based on a consensus of the observers aboard the zodiac and were later confirmed by photographic confirmation in the laboratory via photo-matching. A “calf” was defined as an individual up to one year old (current year’s offspring) as established by their small body size (about one-third a mature

adult) and demonstrating a close association with a particular adult whale (Wells and Scott 1990; Weller et al. 2004).

Images of individual gray whales consist of various aspects of the body: head, back flanks, and flukes. An attempt was made to photograph all aspects of each whale. Whales were 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 tendencies vary with individual behavior and foraging depth. Traditionally the right and left flanks have been considered for standard identification in photo-ID of gray whales. The ventral surface of the flukes was considered as a supplemental view to aid in identification (Weller et al. 2002; Calambokidis et al. 2002; Yakovlev and Tyurneva 2006).

Since the likelihood of repeated recognition of an individual (via matching) increases as more information for that individual is amassed in the catalogue, a fourth view – the dorsal fluke surface – was added as supplemental information for the identification process. The dorsal fluke surface of individual whales can often be displayed even in shallow feeding areas, when deeper diving may not be feasible. The method of adding aspects in an attempt to improve recognition accuracy, especially during the early years of data collection and catalogue preparation has been used successfully in work with other marine mammal species (McConkey 1999; Bannister 2000; Glockner-Ferrari and Ferrari 2000).

After each photo-ID mission was completed, the zodiac would return to the mother ship. All the digital images were loaded into a notebook computer and a backup external hard disk from the camera memory cards (CF Transcend 4 Gb 120x and Lexar 2 Gb 40x) and were archived on CD and DVD. The information recorded on data sheets was entered into a MS Access database and archived in Excel. Backup copies were made and also archived on external disks, CD and DVD. All digital data was stored on three different digital media at all times. All archival data CDs were also duplicated and the backups were stored at various offsite locations whenever possible.

Offshore SE Kamchatka

Photo-ID work was conducted from the fishing schooner *Grodno* in July-August 2004. Two days of photographic effort were spent in the area of Khalaktyrsky Beach in Avacha Bay near Petropavlovsk-Kamchatsky. The water depth at the photo-ID site in that area was approximately 33 m. In August 2006, photography work was carried on aboard the seiner *Aterina*, when a special survey was undertaken along the stretch from Cape Seniavin (southern tip of Vestnik Bay about 51°35’ N) to Cape Kozlov (about 54°50’ N) about 750 km long (Appendix Figure A2). Water depths in the corresponding photo-ID areas varied from 15 to 24 m. Gray whales were also opportunistically photographed from the ship in Vestnik Bay in early July 2006.

Field Photo-ID on Kamchatka Peninsula

During the 2006 photo-ID effort in Olga Bay, Kamchatka, the same standard field procedures used along Sakhlain were used to photograph whales. The survey

protocols used for both offshore Sakhalin Island and the Kamchatka Peninsula were based on recommendations for photo-ID of marine mammals, set forth in the International Whaling Commission Special Issue No. 12 (Hammond et al. 1990). Whales were sighted from the bridge of a vessel cruising at a distance of up to two miles from the shore along the 30-40 m isobath. The water depth in the photo-ID area within the confines of Olga Bay varied from 5 to 17 m.

Upon initial sighting of whales, the vessel slowed to a full stop at a distance of less than 1 km. The whales were observed from the bridge for some time in order to count them, identify behavioral traits and monitor their movements. Once these parameters had been determined, an Achilles inflatable boat was launched carrying a driver, a photographer and a data recorder.

The boat approached the group of whales at slow speed to a distance of at least 100 m to minimize potential impacts on whales before they started being photographed in the following sequence to the best possibility: right and left sides of the body, then dorsal and ventral fluke surfaces.

During the session, the local coordinates, distance to the whales, water depth, whale data (number of individuals in the group, behaviorial traits, presence of feeding spots), weather conditions and other necessary data were entered in the data sheets. Then all the findings were entered in the computer database on board the ship.

A Canon 20D digital camera with a Canon 750-300 mm lens and an image stabilizer was used for photography. The whale photographs were loaded into the computer, then a backup external hard disk and DVD from the camera memory cards.

Photo and Video Analysis

Since 2005, IMatch software has been used for storage and processing of the 2002-2006 database. Digital photographs of whales were processed for subsequent identification work and updating the gray whale database using the Adobe Photoshop 7.0 and Adobe Illustrator 10 software packages. The best photographs of each sighting were printed on a color Epson Photo Stylus 960 printer using high-quality paper and compiled into a pre-catalogue portfolio. Backup digital copies of all photographs were produced on a daily basis.

Standard photographic matching procedures for pattern-based matching of flanks and flukes were followed as described in the International Whaling Commission Special Issue No. 12 (Hammond et al. 1990). The process has been improved since that time by other specialists studying gray whales and other large whales (Calambokidis et al. 2002; Weller et al. 2004).

The following whale body areas (aspects) were selected to create the catalogue (in order of priority): right (RS) and left (LS) sides of the body, and dorsal (DF) and ventral (VF) fluke surfaces. For each sighting, the photographs for that sighting and that daily mission (zodiac deployment from the base ship) were reviewed, and from all of the photographs of the same animal, the best photos were selected to be included in the annual pre-catalogue. Each new sighting was compared to previous

sightings obtained during that year. If a match was made to an existing image, the photograph was grouped with other photographs of that individual.

After the photographs had been grouped according to individual animals based on available aspects, the pictures were compared to the catalogue images for previous years. It was decided during processing of the 2004 materials that in the event of discovery of a new whale, if high-quality photographs of the right side of the individual were available, it would be assigned a new identification number. In the discovery of a left side only or the discovery of a left side with other aspects, but without a quality image of the right side, the whale would be given a temporary identification number to avoid situations with composite whales. A composite whale is defined as single individual with a separate catalogue number assigned to each side (right and left sides) with the result that the whale is incorrectly counted as two distinct individuals when in fact both sides belong to one animal. This can lead to an over-estimation of population numbers if catalogue-only counts are considered for population monitoring, and appropriate statistical modeling is not applied.

Identification numbers were not assigned on the basis of fluke photos that could not be matched to corresponding right or left side images of known whales.

All images were then cross compared to all of the “best” type-specimen photographs of existing whales from the 2002-2005 period to establish the recurrence of sightings of the same whales and to ensure that no duplicate whales were included in either the previous years’ catalogues or the current pre-catalogue.

All photos were rated on a five-tier system: excellent, good, fair, poor, and trash/other photographs. A confident match was not made unless the photographs were considered to be of good or excellent quality (poor-quality photographs were used for supplemental information only or were digitally archived for potential future use). Trash photos (or ‘other’ photos) are either place holding photos used to separate whale sightings in the field, or contain no gray whale information and are archived offsite.

Side to fluke matches were considered to be reliable when taken in sequential order, and when each successive frame contained parts of the animal visible in the previous frame. Digital photography greatly assisted during the side to fluke matching process.

Confident left to right side matches were established based on the following criteria: 1) the whale was photographed as a solitary individual; (2) two sequences 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, S. Swartz & M.L. Jones pers. comm).

This process was conducted at least three times before left to right matches could be assigned a probability of 90% or higher, after which the images were transferred from the pre-catalogue to the annual catalogue. All whale sighting matches, as well as (a) right-left matches and (b) side-fluke matches, were verified by at least two

identification specialists. Whale body pigmentation was the primary feature used to distinguish individuals, with scars and barnacle patches supplementing the matching process.

If the annual pre-catalogue matching appeared reliable, the whales would be given permanent identification numbers and transferred to the final catalogue. After the annual catalogue was complete, discrepancies between the current catalogue and the main catalogue were corrected. Any new information and photographs obtained during the last expedition were added to the main catalogue and any updates to catalogue information were marked within the database. Special attention was devoted to identifying whales with various deviations from the "physiological norm," including: (1) dividing whales with deviations in body physical conditions (BC) into categories; and (2) whales with obvious sloughing of skin or anomalous skin conditions.

Complete analysis of video footage had not been performed at the time this report was prepared. Video data to date has only been used as an ancillary aid to assist in solving any discrepancies with whale sightings and questions about body condition.

RESULTS

OFFSHORE NORTHEAST SAKHALIN

Scope of Work

Photography and video photography of whales were conducted on a zodiac from the base vessels *Professor Bogorov* (14-21 August) and Akademik Oparin (22 Augist -9 October 2006). The effectiveness of the photo-ID team was largely dependent on weather conditions. Work was often interrupted not only by periods of vessel travel to perform other tasks, but also by storm layovers.

The breakdown of time spent by the expedition aboard the vessels in 2006 was as follows: out of the 73 days of the voyages (from 3 August to 14 October), 60 were working days, seven were travel days and six were storm shelter days (Table 1).

A survey day was counted if any whale (or group of whales) was photographed, from either the zodiac or main vessel deck, either during a dedicated photo-ID survey or opportunistically while the mother vessel was anchored performing other research tasks. Whales were photographed from a zodiac on a total of 19 days. Combined data from a number of years regarding the breakdown of time spent on photo-ID work in the study of whales are given in Table 1.

Table 1. Photo-ID effort (days) during expeditions to Sakhalin Island, 2002-2006.

Year	Dates	Duration of expedition (days)	Number of working days	Time in transit (days)	Vessel sheltered because of storm (days)	Photo ID days from zodiac/ from vessel and zodiac	Number of missions	Number of sightings from zodiac	Number of whales encountered from zodiac/ from deck	Total number of photos
2002	Aug 30-Oct 25	57	27	17 including stormy days	11	13/-	24	72	93/-	2602
2003	Jul 21-Sep 27	69	40	16 including call at Nikolaevsk-na-Amure and stormy days	13	17/22	35	86	146/37	7482
2004	Jul 30-Oct 07	70	56	9 including stormy days	5	16/24	27	113	209/57	9647
2005	Jul 12-Oct 07	88	75	6 including stormy days	5	32/34	56	186	384/58	17600
2006	Aug 03 -Oct 14	73	60	7 including stormy days	6	19/33	26/52	109	238/150	16703

Since photo-ID effort may yield certain information about animals' avoidance from or habituation to a workboat, it is common practice to take certain parameters into account. Although weather conditions impose known limitations on more objective comparison of such efforts from one season to another, statistical data accumulated over many years may be instrumental in establishing some patterns or correlations between field survey parameters and behavior of individuals in a population. The scope of such work and photo-ID of gray whales offshore Sakhalin Island is shown in Table 2 as well as Appendix Tables A1 and A2.

Table 2. Photo-ID effort and number of photographs taken from the zodiac in 2006.

N	Date	Number of zodiac missions per day	Duration of each mission (min)			Number of pictures from zodiac		
			Mission 1	Mission 2	Total	Mission 1	Mission 2	Total
1	8/14/06	1	195		195	776		776
2	8/19/06	1	374		374	1050		1050
3	8/22/06	1	155		155	323		323
4	8/24/06	2	110	55	165	413	64	477
5	**8/26/06**	1	145		145	450		450
6	8/31/06	1	70		70	236		236
7	9/02/06	1	155		155	166		166
8	9/04/06	2	35	125	160	0	637	637
9	9/06/06	2	55	115	170	563	681	1244
10	9/07/06	1	110		110	293		293
11	9/08/06	1	105		105	327		327
12	9/13/06	1	140		140	422		422
13	**9/13/06***	1		218	218		1139	1139
14	**9/16/06**	2	195	190	385	751	881	1632
15	**9/17/06**	1	105		105	362		362
16	9/27/06	2	170	129	299	420	532	952
17	9/28/06	2	30	100	130	0	381	381
18	9/29/06	1	135		135	87		87
19	10/01/06	1	251		251	861		861
20	10/09/06	1	135		135	405		405
	Total	26			3602			12220

Highlighted and bold dates correspond to offshore area sightings
* *Corresponds to Chayvo area sightings*

Improvements in photo-ID techniques have enabled researchers to take large numbers of photos at each whale sighting and the supplemental photos became useful matching aids in the photo lab, and have dramatically improved the likelihood of matching any given photograph to the catalogue. These additional photographs of individual flukes and various body parts without the characteristic dorsal hump in the center of the image (the standard photo-ID shot) could then be matched with whale aspects that were not seen in previous years. This improved the effectiveness of each whale mission and increasing the likelihood of accurate identification.

Photo-Identification from the Zodiac and Vessel Deck

Photography from an inflatable boat is the main data gathering method. The number of highly informative photographs from a vessel is small because of the remoteness of the object. Whale photographs taken from the deck of a vessel may serve as valuable ancillary material for the main photo-ID effort. Processing of photographs using the Photoshop 7 software has made it possible to upgrade the quality of some shots from “fair” to “good”. Since photographs were taken from the vessel deck when the expedition members were busy doing some other work or else in transit and during stops, such photography yielded valuable, albeit limited, additional data on daily and seasonal movements of whales within their feeding areas. It has added to records of repeat sightings of known individuals within any given field season (Yakovlev and Tyurneva 2003; 2004; 2005a,b,c; 2006).

In 2006, whales were photographed from a zodiac over a total of 19 days with varying output, including 16 days in the Piltun area, two days in the Offshore area and one day in the Chayvo Bay area. During this season, 8639 photographs were taken in the Piltun area, 2442 in the Offshore area and 1139 near Chayvo Bay (Table 3). From the vessel deck, 4483 shots were taken of 150 whales sighted throughout the expedition period (field data on sightings without photo-ID). A total of 16,703 shots of 388 gray whales sighted throughout the voyage (field data) (Table 3).

Summarized data on photographic, effort, and other characteristics of the surveys are given in Tables 1, 2, 3 as well as Appendix Tables A1 and A2. Depths were measured from the zodiac at whale diving points (Table 4).

Table 3. Descriptive statistics of photo-ID work, NE Sakhalin Island (field data), 2006.

Parameters	Piltun area	Offshore area	Chayvo area	Total
Number of whale photography days (from zodiac)	26 (16)*	7 (3)*	3 (1)*	33 (19)*
Number of sightings[1]	87	16	6	109
Total number of whales sighted (from zodiac and vessel deck)	182	36	20	388 (238 and 150
Average number of whales sighted per survey day (from zodiac and vessel deck)	11.4	12	20	11.76
Average number of whales sighted per sighting (from zodiac)	2.9	2.2	3.3	2.18
Total duration of sightings (minutes)	1624	430	152	2206
Average sighting duration (minutes)	18	22	25	21.6
Number of whale photographs (from zodiac)	8639	2442	1139	12220
Average number of whale photographs per day	539.9	814	1139	611
Average number of whale photographs per sighting	99.3	152.6	189.9	112.1
Average number of photographs per sighted whale	47.5	67.8	56.9	32.1

[1] The first sighting on 2 September was not included because of sudden fog

** On some days, photographs were taken in different areas.*

Table 4. Depths recorded from the zodiac during photo-ID, 2006.

N	Date	Depths measured from the zodiac at each sighting (m).													Average depth (Piltun area)	Average depth (Offshore area)	Average depth (Chayvo area)
		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13			
1	8/14/2006	24	17	3	3	3	6	5							8.71		
2	8/19/2006	12	22	15	12	20	15	16	9	15	22	15	22	14	16.08		
3	8/22/2006	24	32	25	26	22	25								25.67		
4	8/24/2006	6	4	8	13	11	12	15	16						10.63		
5	**8/26/2006**	45	45	48												46.00	
6	8/31/2006	23															
7	9/2/2006	12	27	23											20.67		
8	9/4/2006	32	14	20	15	9	13								17.17		
9	9/6/2006	16	11	13	12	15	12	12							13.00		
10	9/7/2006	28	22	24	24										24.50		
11	9/8/2006	12	12	16											13.33		
12	9/13/2006	17	19	15	17	11									15.80		
13	**9/13/2006**						13	12	14	15	13	12					13.17
14	**9/16/2006**	48	48	46	45	43	46	51	51							47.25	
15	9/17/2006																
16	9/27/2006	28	6	7	7	7	21	15	16						13.38		
17	9/28/2006		17	14	18										16.33		
18	9/29/2006																
19	10/1/2006	13	16	12	16	16	16	17							15.14		
20	10/9/2006	15	18	10	7										12.50		
															15.92	46.63	13.17

Highlighted rows (gray) and bold type indicate measurements taken in Offshore area. Bold type indicate measurements taken in Chayvo area
Highlighted rows (light gray) indicate no measurements taken

Data pertaining to whales identified during previous study years are of particular interest, since they provide more extensive and precise information about specific animals. Data on the numbers of whales identified in four years of studies are given in Table 5.

Table 5. Numbers of whales identified, 2002-2006.

Year	Number of whales (annual total)	From 2002	From 2003	From 2004	From 2005	Number of new whales during a year	Number of whales from previous years, not encountered this year	Number of whales in the catalogue
A	B=C+D+E+F+H	C	D	E	F	H	I	G=B+I
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	120(6)*	42	37	15	14	12(6)	27(1)	147(7)*

* *Numbers in parentheses are counts of individuals with temporary identification numbers.*

Photographing all four aspects of whales proved extremely useful not only for creating the pre-catalogue of whales photographed for the first time in 2006, but also for updating the images of those in the final master catalogue: (1) with additional aspects that were not photographed during the 2002-2005 period and (2) with photographs showing any changes in body markings that had occurred during the study years, such as the appearance or disappearance of scars and camouflaging of natural pigmentation by barnacle spots.

Each year we obtain a more comprehensive description of each animal and a more comprehensive catalogue of gray whales of the Korean-Okhotsk population. Such annual updating of the catalogue will aid in streamlining the matching process as the number of known individuals in the catalogue increases each year, and the annual discovery rate of new animals declines.

The capture of all four aspects of each individual (right side, left side, dorsal fluke, and ventral fluke) also increases each year as more photographs are added to the catalogue. Table 6 and Appendix Table A3 present data for all the study years and the total number of aspects captured per individual for all study years.

Table 6. Assessment of photographic coverage of four standard aspects of gray whale sightings identified from 2002-2006.

Year		Photographed aspects				Total
		4	**3**	**2**	**1**	
2002	number	17	3	9	17	**46**[a]
	%	36.96	6.52	19.57	36.96	
2003	number	42	11	21	8	**82**
	%	51.22	13.41	25.61	9.76	
2004	number	52	12	26	6	**96**[b]
	%	54.17	12.50	27.08	6.25	
2005	number	53	13	47	5	**118**[c]
	%	44.92	11.02	39.83	4.24	
2006	number	59	16	40	11	**126**[d]
	%	46.83	12.70	31.75	8.73	
2002-2006	number	101	10	35	8*	**154**[e]
	%	65.58	6.49	22.73	5.19	

[a]One whale photographed in 2002 was a temporary whale for a total of 46 whales sighted with 45 individuals included in the catalogue.
[b]One whale photographed in 2004 was a temporary whale for a total of 96 whales sighted with 95 individuals included in the catalogue.
[c]One whale photographed in 2005 was a temporary whale for a total of 118 whales sighted with 120 individuals included in the catalogue.
[d]Six whales photographed in 2006 were temporary whales for a total of 126 whales sighted with 120 individuals included in the catalogue.
[e]Seven whales photographed from 2002-2006 were temporary whales for a total of 154 whales being sighted during these years and a total of 147 individuals included in the catalogue for these years.
** Of these eight whales in the catalogue that have only one photographed aspect, one individual has received a catalogue number and its right side photo was included in the annual catalogue. The other seven indivudals with description of only one aspect have been assigned temporary numbers because of the lack of a high-quality right side photo. Five of them have only right side photos and two have only left side photos.*

Whales identified only by a left side photo or by a right side photo of poor quality receive temporary identification numbers (TEMP0No.) for subsequent identification. Such whales are not placed in the general catalogue, being included instead in the respective annual catalogue and mentioned in the annual report as sighted individuals. This procedure of assigning temporary identification numbers and classification of whale sides and flukes is common practice among photo-ID specialists worldwide and has been adapted to our methods (Calambokidis et al. 1994, 2002; Clapham et al. 1993; Weller et al. 1999, 2000).

Thus, six whales with temporary numbers from TEMP03 through TEMP08 were identified in 2006. Whale TEMP02 sighted on several occasions in different years but photographed only on the left side, had a photograph taken of his right side in 2006 and was assigned to the catalogue as KOGW135. Whale TEMP01 was photographed in 2002 only once and lacks a right side photo of acceptable quality.

Calves rarely showed their flukes, hence typically only their sides generally were photographed (Yakovlev and Tyurneva 2003). No cow/calf pairs were observed in the Offshore area during any of the study years. It has been noted that whales

feeding in deeper waters show their flukes more frequently than whales in the shallow-water Piltun area.

As a result of photography during the 2002-2006 period, the current IBM catalogue of western gray whales contains 147 fully (with all four aspects) and well (two or three aspects) described identified individuals.

Group Sizes and Distribution

The 2006 studies differed from those conducted in 2004 and 2005 by a significant increase in the percentage of observations in the Offshore area due to the increased use of this area by whales in 2006 (Tables 2 and 3, Appendix Tables A1 and A2). Seven days were spent in the Offshore area during the entire survey period with photographs being taken both from the zodiac (three days) and deck of the mother ship (four days), documenting a total of 56 sightings of individual whales including some repeat sightings.

During the entire survey in the Offshore area, we identified 33 individual whales in the Offshore area, including 14 animals that were only sighted in this area. In the Piltun area, 105 whales were identified, of which 67 were only observed in this area. In an area adjacent to Chayvo Bay (Chayvo Bay area), 28 individuals were identified and seven of them were only observed in this area (Tables 3 and 7, Appendix Tables A4 and A6, Appendix Figure A1).

In 2005, whales were sighted in two areas that were new to us. In the first area, north of the town of Okha, four whales were identified, of which one was new to the catalogue and had been seen earlier in the season in the Piltun area. Two whales from this group were observed in the Piltun area earlier and later in the season and also had been sighted in the Piltun and Offshore feeding areas during previous years. One animal of the group, first identified in 2002, was sighted once in 2005 in the new (northern) area. In the second area, west of Cape Elizabeth in Severny Bay, two whales were sighted, but only one could be photographed and identified. It proved to be new to the catalogue and was not observed in the Piltun or Offshore feeding area in 2005 (Appendix Tables A4 and A6).

In 2006, no gray whales were encountered offshore northern Sakhalin in the areas north of Okha and west of Cape Elizabeth.

Sightings of whales in various areas for all the study years are summarized in Table 7.

Table 7. Whale movements between feeding areas, 2002-2006.

Year	Number of whales identified in Piltun area	Number of whales identified in Offshore area	Number of whales identified in both Piltun and Offshore areas	Number of whales identified in Chayvo area	Number of whales identified in Chayvo /Piltun and Chayvo/ Offshore areas	Number of whales identified in northern areas	Number of whales identified in Chayvo/ Piltun/ Offshore areas
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

[1]*Numbers in parentheses are counts of animals sighted only in this area and never seen in other surveyed areas.*

In 2006, the sizes of observed whale groups were different as compared to previous years. Movements of whales into the Offshore feeding area and in the shallow waters adjacent to Chayvo Bay areas were recorded. The percentage of solitary individuals increased in comparison with 2005 but decreased substantially in comparison with 2002, 2003 and 2004. The percentage of whales observed in groups was lower than in 2005.

Comparative data obtained in studies conducted only from the zodiac are presented in Table 8, Figure 1 and Appendix Table A5.

Table 8. Gray whale group size and encounter rates in known feeding areas, based on photographs taken only from a zodiac, 2003-2006.

Group Size	Groups sighted in 2003	% sighted in 2003	Groups sighted in 2004	% sighted in 2004	Groups sighted in 2005	% sighted in 2005	Groups sighted in 2006	% sighted in 2006
Both areas								
1	58	48.33	55	50.93	52	28.11	43	39.45
2	38	31.67	28	25.93	57	30.81	32	29.36
3	18	15.00	14	12.96	37	20.00	16	14.68
4	4	3.33	7	6.48	25	13.51	11	10.09
5	2	1.67	1	0.93	10	5.41	5	4.59
6	0	0.00	1	0.93	2	1.08	1	0.92
7	0	0.00	1	0.93	1	0.54	0	0.00
8	0	0.00	1	0.93	1	0.54	1	0.92
Total:	120		108		185		109	
Offshore area								
1	33	56.89	4	100	1	50.00	8	50.00
2	13	22.41	0	0 .00	1	50.00	2	12.50
3	10	17.24	0	0 .00	0	0.00	3	18.75
4	2	3.44	0	0 .00	0	0.00	1	6.25
5	0	0.00	0	0 .00	0	0.00	1	6.25
6	0	0	0	0.00	0	0.00	1	6.25
Total:	58		4		2		16	
Piltun area								
1	25	40.32	51	50.00	51	28.02	33	37.93
2	25	40.32	28	26.42	56	30.77	30	34.48
3	8	12.9	14	13.21	37	20.33	13	14.94
4	2	3.22	7	6.73	24	13.19	8	9.20
5	2	3.22	1	0.94	10	5.49	2	2.30
6	0	0.00	1	0.94	2	1.10	0	0.00
7	0	0.00	1	0.94	1	0.55	0	0.00
8	0	0.00	1	0.94	1	0.55	1	1.15
	62		104		182		87	
Cape Elizabeth								
1					1	50.00		
2					1	50.00		
3					0	0.00		
4					0	0.00		
Total:					2			
Northern								
1					0			
2					0			
3					0			
4					4	100		
Total:					0			
Chayvo Bay area								
1							2	33.33
2							0	0.00
3							0	0.00
4							2	33.33
5							2	33.33
Total:							6	

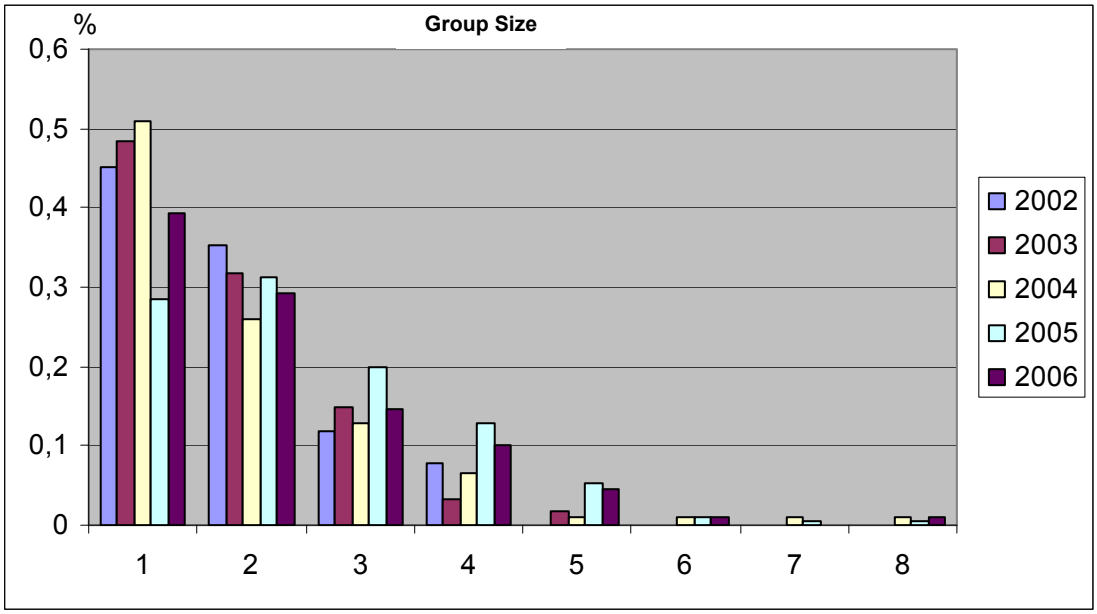


Figure 1. Percentage of animals in groups relative to the total number of whales sighted and photographed, 2002-2006 (field data).

The average depth at locations where whales were photographed was 15.92 m (5-36 m) in the Piltun area, 46.63 m (43-51 m) in the Offshore area and 13.17 m (12-15 m in the Chayvo Bay area (Table 4). The sighting points are shown in Appendix Figure A1.

Whale Movements between Known Feeding Areas Offshore Sakhalin Island

The discovery of a second feeding area offshore off Chayvo Bay in 2001 (Maminov and Yakovlev 2002) allowed us to observe and describe the whale movement patterns between the shallow-water Piltun area and the deep-water Offshore area. The frequency of repeat sightings of identified individuals during the entire survey period is important in determining the intensity of whale traffic between these two areas (see Tables 7 and 8 and Appendix Table A4).

During the five years of photo-ID effort, use of the Offshore area by gray whales varied in intensity. In 2002 and 2003, there were significantly more animals in the area as compared to 2004 and 2005 (Table 7, Appendix Table A6).

In 2006, gray whales began appearing in the Offshore area at the end of August, during which five individuals were identified. By mid-September, the number of sightings increased and we were able to photograph and identify 17 animals.

During the photo-ID surveys in the 2006 season, a total of 56 sightings were recorded in the Offshore area of 33 individual whales, 16 of which were also observed in the Piltun area and one in the Chayvo Bay area. In the Piltun area, 301 gray whale sightings were recorded during the same season of 105 individual whales, of which 67 were sighted in 2006 only in the Piltun area (see Tables 7, 8 and Appendix Table A6).

In the nearshore waters adjacent Chayvo Bay, 33 sightings were recorded of 28 individual whales. Seven of the identified animals were sighted in this area only; 19 animals were also sighted in the Piltun area and one in the Offshore area. Two whales were sighted in all of the three areas during the same season (Tables 7, 8 and Appendix Table A6).

Over all years of effort (2002-2006), 63 whales were sighted in both the Piltun and Offshore areas during one or over several years (Appendix Tables A4 and A6).

A better understanding and statistical substantiation of whale movements both within a single feeding area and between areas, as well as how the feeding areas are used, can be obtained only after accumulation of additional data in further studies and their comparison with benthos data, since use of a particular feeding area by gray whales within a single and between two feeding seasons may have to do with prey preferences (Fadeev 2002, 2003, 2004, 2005, 2006, 2007).

Sightings and Identified Whales

After matching in the laboratory, 105 and 33 individuals encountered in the Piltun and Offshore feeding areas, respectively, were identified in addition to 28 whales encountered in the Chayvo Bay area. Sixteen whales from the Offshore area were also observed in the Piltun area, 19 whales from the Chayvo Bay area were also recorded in the Piltun area and one whale – in the Offshore area. Two whales had been recorded in all three areas. In 2006, none of the identified whales were seen in the more northerly areas where five individuals were recorded in 2005. A total of 147 whales have been identified over the 2002-2006 survey period (Tables 5, 7 and 8; Appendix Tables A4 and A6).

Repeat Sightings, Site Fidelity and Association Patterns

The following repeat sightings of identified whales were noted during the study period in 2006; data are given in Table 9.

Table 9. Frequency of repeat sightings of photo-identified gray whales (IDW) in 2006.

Sighting record No.	Number of repeat sightings	Total IDW sightings
1	31	31
2	23	46
3	29	87
4	20	80
5	9	45
6	8	48
7	2	14
8	1	8
9	1	9
10	1	10
12	1	12
Total	126	390

Analysis of the inter- and intra-year frequency of sightings of identified whales in 2002-2006 is of particular interest; data are given in Table 10 and Appendix Tables A5 and A6.

Table 10. Inter- and intra-year frequency of sightings of identified gray whales (IDW), 2002-2006.

Year	**2002**	**2003**	**2004**	**2005**	**2006**
Number of IDW sightings	66	154	228	384	390
Number of IDW per year*	46	82	96	118	126
Average frequency of IDW sightings	1.43	1.88	2.38	3.25	3.10

*These values include temporary whale sightings.

The presence or absence of whales by years during the 2002-2005 period is shown in Appendix Table A6.

Repeat sightings of whales and photographing of whales over the course of a day, as well as sightings of the same whales over the course of a season, also provide important data on whale movements within their feeding areas and the dynamics of their visits to these areas.

Cow/Calf Pairs

In addition to monitoring the size of this population, it is very important to determine the number of cows with calves and indirectly determine their health status through external physical indicators such as body weight and skin condition.

In 2006, three cow/calf pairs photographed were recorded on 14 August. One of the photo-identified cows was a nursing mother in 2004 (Appendix Table A7).

From 23 August onwards, all calves were observed without their mothers. Two whales that were photographed in 2006 (KOGW144 and KOGW146) looked like first year calves, but were not observed in 2005. We qualified them as “possible” calves (Appendix Tables A6 and A7).

All recorded calves were well fed and did not exhibit any signs of skinniness or poor body condition.

Because of the late start of the photo-ID data collection and inclement weather in August it is very likely that incomplete data on cow/calf pairs has been collected.

In 2005 we identifed four cow/calf pairs, which separated during August and were sighted separately in September (Appendix Tables A6 and A7).

It should be pointed out that of the four cows identified with calves in the Sakhalin area in 2005, three had been recorded as cows with calves in 2003 (Appendix Table A7).

Due to the late start of the photographic surveys in 2004, we managed to identify with certainty only two cow/calf pairs which had not separated by mid-September. Of the two calves identified, neither was sighted in 2005. However, during the 2005 surveys, that at least four yearling calves were observed that were also observed in 2004; but at that time not identified as new calves because they were not sighted together with their mothers. They were identified as yearlings by photographs. They stayed together with adult animals, were distinguished by their small size and exhibited playful behavior, often showing their heads, which resembled the short rostrums of juveniles. At first they were mistaken to be 2005 calves, but it was discovered later that they had been seen for the first time the previous year, in 2004. They all looked healthy and did not display signs of emaciation.

Physical Condition

Body Weight

A hierarchic system for classifying the degree of emaciation of whales was developed based on the classification system of the US-Russian photo-ID team (Weller et al. 2001). A whale is considered to have a deficient body condition if it has one or more of the following features:

- an obvious subdermal protrusion of the scapulae from the body with associated thoracic depressions at the anterior and posterior insertions of the pectoral flipper;
- the presence of noticeable depressions around the blowhole and head with a post-cranial “hump” on the dorsal surface;
- a pronounced ridge of lumbar and caudal vertebrae along the spine giving the body a bell shape (frontal view) with bulging along the lateral flanks; and
- the presence of protruding ribs and vertebrae along the dorsal surface and/or lateral flanks or ribcage.

If any one or more of the above criteria were observed and noted in photographs or video data, the subject animal was classified based on the body condition as of the time of that sighting. The final classification given to a subject animal is the highest class number associated with that animal based on analysis of available photographs for that sighting. The body condition (BC) classes for whales are defined as follows:

class 0: standard body condition whale shows none of the four criteria listed above;

class I: whale shows any of the four criteria listed above to a mild degree, but not more than two criteria;

class II: whale shows any of the four criteria listed above to a moderate degree, but not more than two criteria;

class III: whale shows more then two of the four criteria listed above to a moderate degree or whale shows any of the four criteria listed above to an extreme degree, but not more than two criteria; and

class IV: whale shows more than two of the four criteria listed above to an extreme degree.

The subjective terminology of “mild,” “moderate” and “extreme” degrees of the criteria was agreed upon within the photo-ID team by comparison of photographic and video samples. For calculations of the percentage of underweight whales relative to the total number of observed animals, class II to IV were used because the body condition of class I resembled very closely those of class 0 and hence was considered insignificant.

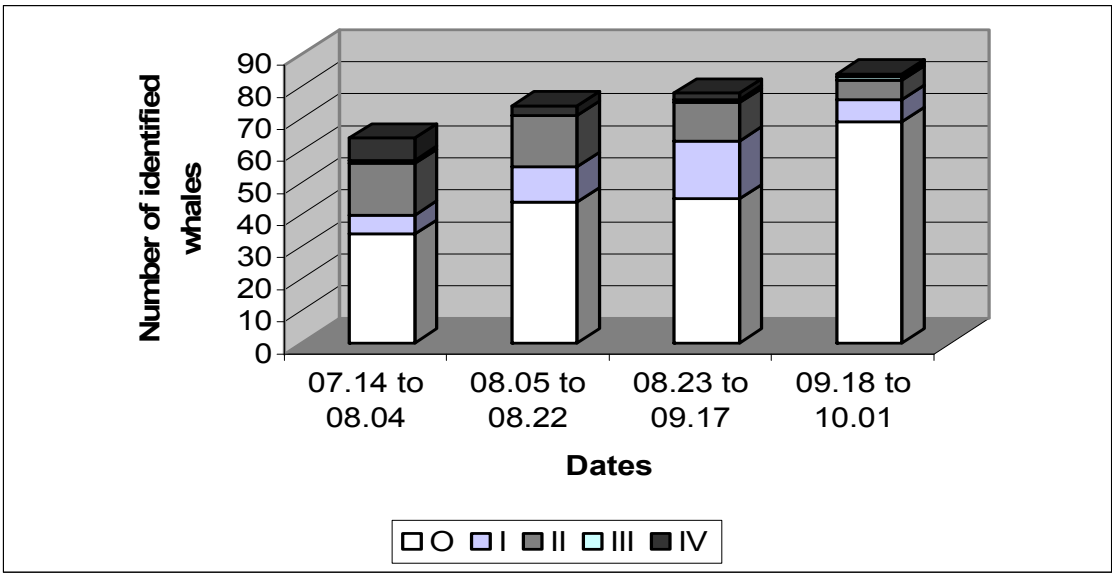
Table 11 shows that there were 15 underweight animals (including nine nursing mothers) in 2003, 11 underweight animals (including two nursing mothers) in 2004, 10 underweight animals (including four nursing mothers) in 2005 and 20 underweight animals (including three nursing mothers) in 2006.

Table 11. Body condition (BC) classes for whales sighted, 2003-2006.

Classes	Number of whales in each BC class in 2003	% ratio of whales in each BC class in 2003	Number of whales in each BC class in 2004	% ratio of whales in each BC class in 2004	Number of whales in each BC class in 2005	% ratio of whales in each BC class in 2005	Number of whales in each BC class in 2006	% ratio of whales in each BC class in 2006
0	61	74.39	70	72.92	100	84.74	88	69.84
1	6	7.32	15	15.63	8	6.78	18	14.29
2	12	14.63	8	8.33	5	4.24	19	15.08
3	2	2.44	3	3.13	2	1.69	1	0.79
4	1	1.22	-	-	3	2.54	0	0.00

Note that temporary whales in the catalogue are included in the number of whales in each body class. Classes 2, 3 and 4, highlighted in grey, correspond to underweight animals

In 2005, we had our first opportunity to observe individual whales with suboptimal body condition over an extended period of time. The body condition in most underweight whales was observed to improve over the course of the season. The 2006 data in Table 11 reflect the situation as of the last sighting of the season or, in other words, if an animal was observed with a higher BC class during the first sightings and the indices improved in subsequent sightings, we used the latest data in calculating the total number of underweight whales. During the period from 14 August to 9 October, 24 animals showed improvements in their BC class (Appendix Tables A6 and A7, Figure 2).



Period (x-axis)	Start	End	All	Emaciated	Index (y-axis)
1	08/14/06	08/24/06	70	20	0.285714
2	08/25/06	09/03/06	17	4	0.235294
3	09/04/06	09/09/06	58	16	0.275862
4	09/11/06	09/16/06	53	9	0.169811
5	09/17/06	09/27/06	57	8	0.140351
6	09/28/06	10/03/06	89	6	0.067416
7	10/10/06	10/09/06	46	3	0.065217

Figure 2. Percentage of photo-identified underweight gray whales relative to the total number of whales sighted offshore Sakhalin Island over 5-day periods during the 2006 field season.

Thus, underweight animals (class II or higher) identified in 2006 accounted for 15.87% of the total number of identified whales (20 out of 126), including three nursing cows. Underweight animals (class II or higher) identified in 2005 accounted for 8.47% of the total number of identified whales (10 out of 118 without taking sightings from the vessel deck into account), including four nursing cows.

Underweight animals (class II or higher) identified in 2004 made up 13.41% of the total number of identified individuals (11 of 82). In 2003, 18.29% of whales were underweight (15 out of 82) (Appendix Table A7). All calves had normal body condition and were assigned to class 0 (Appendix Table A7).

In 2006, we were able to observe the condition of animals that in 2005 were identified as cows with calves. The comparative data are presented in Table 12.

Table 12. Inter-year comparison of the body condition (BC) of cows and calves, 2005-2006.

Cow/calf	Number of cows/calves in 2005	Number of underweight cow/calves in 2005	Number of 2005 cows/calves in 2006	Changes in BC from 2005 to 2006	
				Improvement in BC	Deterioration of BC
Cows	4	4	4	4	0
Calves	4	0	3	0	1

As can be seen from the table, all cows with poor BC in 2005 showed improvement when sighted in 2006 (Appendix Table A7). Of the three 2005 calves that were observed in 2006, one calf showed a decrease in body condition (class 2).

Skin Sloughing

During the processing of photo-ID data for 2003, skin sloughing that had not been observed in 2002 was noted in nine whales (Appendix Table A7). With the exception of one animal, all the whales with various degrees of skin sloughing were observed in the Piltun area. Some whales were encountered over a period of several days. Skin sloughing appeared to begin at the dorsal ridge in two cases. Skin sloughing progressed noticeably on one whale within 24 hours (between 24 and 25 August 2003). A few days later, the whale did not show any sign of skin sloughing. The picture was similar for another whale. Such sloughing or skin-shedding process progressed in stages starting again at the dorsal ridge (m1, or molt stage 1) and progressing downward on the body toward the ventral surface (m2) until all dead or damaged skin was sloughed and the whale was observed with no sign of skin sloughing (m3). Four whales with signs of skin sloughing were classified as “thin” (≥ class II). Individuals with signs of severe skin sloughing were observed most frequently in August (Tyurneva and Yakovlev 2005c).

In 2004, we were able to identify two whales with similar skin sloughing (m1) (Appendix Table A7). One of them proved to be nursing cow KOGW050, which had similar sloughing in 2003, although previously in a more advanced stage (m2). Of the nine whales with skin sloughing sighted in 2003, we were able to re-identify seven during the 2004 season. Of these seven individuals, six showed no deviations from normal skin condition (demonstrated no skin sloughing), and one whale (KOGW050) had skin sloughing as described above (Appendix Table A7).

In 2005, when we were processing photo-ID data, we found four whales with similar skin sloughing (m1-2); however, we were not able to capture the beginning and end of the process. In 2006, four individuals with skin sloughing in stage 1 were found without any signs of further deterioration.

Over many years of observations of animals with such skin sloughing, we could not see any visible changes in their health condition during subsequent sightings. Yet, in 2006, whale KOGW028 identified in 2003 with pronounced skin sloughing (see above) displayed white patches of irregular shape on the body. The exact nature of these patches is not known but they are highly unlikely to be a photography artifact in view of the fact that the whale in question was identified three times on different days and every photograph showed the same patches.

In 2005, whale KOGW128 was seen to display several white patches that did not exist in 2004. However, these patches seem to be somewhat different from those on the body of whale KOGW028. Unfortunately, KOGW128 was not sighted in 2006.

PHOTO-IDENTIFICATION EFFORTS OFFSHORE SOUTH EAST KAMCHATKA

In 2004, two days were spent in the Khalaktyrsky Beach area doing photographic work in July and August. In 2006, three days were dedicated to this activity. During the first day in July, photographs were taken in Vestnik Bay from the deck of the vessel during a scheduled census of marine mammals, and two days in August were devoted exclusively to photo-ID work in Olga Bay.

A total of 16 gray whales were identified throughout the entire survey period offshore Kamchatka. A summary of animals identified and catalogued over two years of the surveys is presented in Table 13.

Table 13. Number of gray whales identified in 2004 and 2006 in different areas offshore Kamchatka.

Whale #	2004	2006	Area
KamGW001	-	+	Olga Bay
KamGW002	-	+	Olga Bay
KamGW003	-	+	Olga Bay
KamGW004	-	+	Olga Bay
KamGW005	-	+	Olga Bay
KamGW006	-	+	Olga Bay
KamGW007	-	+	Olga Bay
KamGW008	-	+	Olga Bay
KamGW009	-	+	Olga Bay
KamGW010	-	+	Olga Bay
KamGW011	-	+	Olga Bay
KamGW012	-	+	Olga Bay
KamGW013	-	+	Vestnik Bay
KamGW014	+	-	Khalaktyrsky Beach
KamGW015	+	-	
KamGW016	+	-	
Total for year	**3**	**13**	
Catalogue total			**16**

Repeat Sightings

Throughout the survey period in 2004 and 2006, no repeat sightings of gray whales were recorded in the three surveyed areas offshore Kamchatka (Table 13).

Sightings and Identified Whales

On 21 and 22 August 2006 (two working days of photo-ID) in Olga Bay, 13 sightings of 12 individual whales were identified.

On 5 July 2006, a single sighting of one gray whale was identified in Vestnik Bay.

In 2004, four sightings were recorded during two days (22 July and 11 August) of surveys in the Khalaktyrsky Beach area with three individuals identified.

A total of 16 individual whales were identified during the field surveys of 2004 and 2006 (Table 13).

Completeness of Photographic Coverage

Photography of four gray whale body aspects has turned out to be highly valuable not only for creating the pre-catalogue of whales for the first time photographed offshore eastern Kamchatka in 2004 and 2006, but also for comparison with previously produced images of gray whales which were incorporated into the catalogue of the western gray whale population under the custody of the Marine Biology Institute, Far East Branch of the Russian Academy of Sciences.

In future years, we may update the description of each animal and expand the catalogue by adding new whales sighted in the survey areas. Yearly updating of the catalogue will make it possible to streamline the process of comparison with previously identified individuals in two catalogues in view of the fact that the number of known catalogued animals is doubled each year. Data on completeness of photographic coverage (four standard aspects) of identified whales are presented in Table 14.

Table 14. Completeness of photographic coverage (four standard aspects) of all known gray whales identified offshore Kamchatka in 2004 and 2006.

Whale #	Aspects				Number of aspects
	RS	LS	DF	VF	
KamGW001	+	+	-	-	2
KamGW002	+	+	-	-	2
KamGW003	+	+	-	-	2
KamGW004	+	+	-	-	2
KamGW005	+	+	-	-	2
KamGW006	+	+	-	-	2
KamGW007	+	+	-	-	2
KamGW008	+	+	-	-	2
KamGW009	+	+	-	-	2
KamGW010	+	+	+	+	4
KamGW011	+	-	-	-	1
KamGW012	+	+	+	+	4
KamGW013	+	+	+	+	4
KamGW014	+	+	+	+	4
KamGW015	+	+	+	+	4
KamGW016	+	+	+	+	4

Whales in Olga Bay seldom displayed their flukes and, therefore, only their sides could be photographed in most cases. In the Khalaktyrsky Beach area with its greater water depth flukes could be photographed as well. It has been noted that

whales feeding in deeper waters show their flukes more frequently than whales in the shallow waters (Yakovlev and Tyurneva 2003). The observation and photography areas are shown in Appendix Figure A2.

Cow/Calf Pairs

During the 2004 and 2006 surveys, no cow/calf pairs were sighted offshore Kamchatka.

MOVEMENTS OF GRAY WHALES BETWEEN WATERS OFFSHORE SE KAMCHATKA AND KNOWN FEEDING AREAS OFFSHORE NE SAKHALIN

Data of the greatest biological interest pertain to whales also identified offshore NE Sakhalin Island because they allow one to draw a more complete and accurate picture of a particular animal and its movements between summer feeding areas.

During photographic surveys in 2004 and 2006, observations offshore Kamchatka revealed six whales that had been identified earlier in feeding areas offshore NE Sakhalin. Four of these whales were sighted in Olga Bay (Kronotsky Reserve) during two days of photo-ID work. The fifth animal was photographed in Vestnik Bay in the SE part of Kamchatka Peninsula from the deck of a vessel performing tasks unrelated to the survey. An additional sixth animal, identified in 2004 near the Khalaktyrsky Beach on Kamchatka Peninsula was also identified in 2006 offshore Sakhalin Island in the Chayvo Bay area. Two whales sighted in 2006 offshore Kamchatka were seen later offshore Sakhalin during the same season (Appendix Tables A4 and A6). One of these whales was for the first time sighted in Vestnik Bay in July 2006, and 50 days later photographed in the Piltun area. The other whale was sighted in Olga Bay in October and 39 days later was sighted again in the Piltun area. Data covering all gray whale sightings offshore Kamchatka in 2004 and 2006 as well as offshore Sakhalin Island from 2002-2006 period summarized in Table 15.

Table 15. Frequency of sighting of photo-identified gray whales offshore Kamchatka (KamGW) in 2004 and 2006 in comparison with sightings offshore Sakhalin Island (KOGW), 2002-2006.

Whale identified offshore Kamchatka	Kamchatka sighting date	Sightings along Sakhalin				Whale identified offshore Sakhalin
		+/-	Sighting year	Number of sightings	Sighting area	
KamGW001	08/21/06	+	2003	1	Piltun	KOGW090
			2005	2	Piltun	
KamGW002	08/21/06	+	2005	1	Piltun	KOGW132
			09/28/06	1	Piltun	
KamGW003	08/22/06	-				
KamGW004	08/22/06	-				
KamGW005	08/22/06	-				
KamGW006	08/22/06	-				
KamGW007	08/22/06	-				
KamGW008	08/22/06	+	2004	6	Piltun	KOGW095
KamGW009	08/22/06	-				
KamGW010	08/22/06	+	2003	1	Piltun	KOGW077
KamGW011	08/22/06	-				
KamGW012	08/22/06	-				
KamGW013	07/05/06	+	2003	2	offshore	KOGW047
			2004	1	offshore	
			2005	4/1	Piltun/offshore	
			08/23/06	1	Piltun	
KamGW014	07/22/04	-				
	08/11/04					
KamGW015	07/22/04	-				
KamGW016	08/11/04	+	09/13/06	1	Chayvo	KOGW136
			09/30/06	1	Piltun	
			10/01/06	1	Piltun	

One of the six whales identified offshore both Kamchatka and Sakhalin, namely KamGW008 (KOGW095) was recorded as a current year's calf in 2004 in the Piltun area and was not sighted offshore Sakhalin in 2005, whereas KamGW010 (KOGW077) was recorded as a calf in 2003 in the Piltun area and was not sighted offshore Sakhalin in 2004 and 2005.

The frequency of sightings over the entire survey period is an important factor in studying whale movements between different areas. A better understanding and statistical substantiation of whale movements as well as the exact way the feeding areas are used can be obtained only after accumulation of additional data in further studies.

Group size and age composition

The results of pilot studies in 2004 in the Khalaktyrsky Beach area and 2006 gray whale sightings in Vestnik Bay do not provide results regarding group sizes because methods were not carried out in accordance with the standard photo-ID protocol.

Observations in Olga Bay yielded some data on whale group size in 2006. Three gray whale groups of two, four and six were recorded. Thus, the average group size was four animals.

Body Condition

Body condition (BC) data for gray whales identified offshore Kamchatka in 2004 and 2006 as well as those identified offshore Sakhalin Island in different years are summarized in Table 16.

Table 16. Body condition classes for whales observed offshore Kamchatka in 2004 and 2006 in comparison with whales observed offshore Sakhalin Island.

Whale identified offshore Kamchatka	Kamchatka sighting year	BC class	Sightings offshore Sakhalin		
			Sighting year	BC class	IBM Catalogue #
KamGW001	2006	1	2003	0	KOGW136
			2005	0	
KamGW002	2006	0	2005	2	KOGW132
			2006	0	
KamGW003	2006	0			
KamGW004	2006	0			
KamGW005	2006	2			
KamGW006	2006	2			
KamGW007	2006	0			
KamGW008	2006	0	2004	0	KOGW095
KamGW009	2006	1			
KamGW010	2006	0	2003		KOGW077
KamGW011	2006	0			
KamGW012	2006	0			
KamGW013	2006	0	2003	0	KOGW047
			2004	0	
			2005	0	
			2006	0	
KamGW014	2004	4			
	2004	2-3			
KamGW015	2004	4			
KamGW016	2004	2	2006	0	KOGW136

For calculations of the percentage of underweight whales relative to the total number of observed animals, class II to IV were used because the body condition of class I resembled very closely those of class 0, and hence was considered as insignificant (Yakovlev and Tyurneva 2003).

Underweight animals (class II) identified in 2006 accounted for 15.38% of the total number of identified whales (2 out of 13). No animals with BC class above II have been encountered (Table 16).

In 2004, three out of three whales identified in the Khalaktyrsky Beach area were underweight (class II or above), which means that 100% of observed animals had suboptimal body condition. One of them, namely KamGW016 (KOGW136), was rated as class II in 2004, yet, when sighted offshore Sakhalin Island in the Chayvo Bay area in 2006, its BC was normal (class 0). Two other individuals, KamGW014 and KamGW015, photographed on 22 July 2004, belonged to class IV. Whale KamGW014 was sighted again on 11 August 2004, in the same area but with improved BC (class II-III) (Table 16).

Skin Sloughing

No skin sloughing cases were recorded offshore Kamchatka in 2004 and 2006.

Total Number of Whales Identified in 2006.

A total of 123 whales were sighted in 2006 out of 147 identified offshore Sakhalin and Kamchatka and entered in the IBM catalogue of gray whales belonging to the western population identified from 2002-2006. (Table 16, Appendix Tables A4 and A6).

DISCUSSION

According to preliminary photo-ID results, 147 individual gray whales were identified during the 2002-2006 period. The final consolidation of the results of five years' work into a single current master catalogue and the development of a protocol for a minimum population count, i.e., a count of only the right or left sides of individuals (Darling 1984; Weller et al. 2001; Weller et al. 2004) have made it possible to achieve higher reliability of least count totals for the current 2002-2006 Master Catalogue. To continue to increase the accuracy of the total population estimate, a comprehensive statistical model incorporating capture-recapture methodologies and a systematic sampling scheme is being incorporated into future work.

As sightings of previously identified whales continues to increase the total count of individuals with each new study season, this improves confidence levels and facilitates the photographic matching process. Newly obtained data on known individuals are valuable to continue monitoring any changes in physical characteristics or markings that may have occurred since the last recorded sighting. Keeping sighting data current also maintains up-to-date site-fidelity records on known whales and whale groups which are important baseline information to compare if future geographical or temporal shifts occur in the whales feeding areas or feeding patterns. The geographical shift of utilization of the Offshore feeding area in 2002, 2003 and 2006 to the Piltun feeding area in 2004 and 2005 demonstrates that continuous monitoring of the whales and their movements is needed to track these spatial patterns.

The results of analysis of the 2002-2006 data point to inter- and intra-year movements of gray whales, both within the Piltun and Offshore areas and between

these areas, and, as discovered in 2005 and 2006, movements into areas farther north and south. As discussed earlier, information about the whales' movement between areas over the course of a single season can only be provided by repeat sightings of individuals recognized during the same season. Single gray whale sightings in one area during a season with subsequent re-sightings of the same animal in the other areas in successive years have also been recorded.

Incorporation of new data into the catalogue on a continous basis makes it possible to keep the information on known individuals and groups of whales up to date, which is an important factor as a baseline for comparative analyses of potential spatial or temporal changes in feeding areas or migration routes in the future.

According to 2004 and 2006 photo-ID data, 16 gray whales have been identified in the surveyed areas offshore SE Kamchatka.

Analysis of data for the same years is indicative of movements of whales identified earlier offshore NE Sakhalin toward shores of Kamchatka Peninsula and there is also evidence of appearance of a single individual identified earlier offshore Kamchatka in an area offshore Sakhalin.

Six out of 16 gray whales identified in different areas offshore Kamchatka in 2004 and 2006 were also photographed offshore Sakhalin in different areas and years.

Two out of six animals identified in both regions were photographed offshore Kamchatka and Sakhalin within the same feeding season in 2006.

The question as to affiliation of the other 10 individuals sighted in the same groups offshore Kamchatka, but not listed in the catalogue of Sakhalin whales, remains open.

The reasons compelling some animals from the extremely small western population of gray whales to leave known feeding areas with likely sufficient prey and migrate north across the Sea of Okhotsk toward areas in direct proximity to the southern boundaries of the range of the eastern (California-Chukchi) population are yet to be discovered.

The current state of both gray whale populations and ranges of their distribution are covered in an exhaustive review (Swartz et al. 2006).

According to historical records, the range of the western population in the Sea of Okhotsk must have included Sakhalin Bay (in the western part of the NW tip of the island), waters offshore NE Sakhalin, Shelikhov Bay, mouths of the Gizhiga and Penzhina Rivers in the farthest NE corner of the sea, as well as waters offshore western Kamchatka (Sleptsov 1955; Krupnik 1984; Yablokov and Bogoslovskaya 1984).

Sokolov and Arseniev (1994) present a map showing the gray whale range encompassing the entire Far Eastern basin where the western population inhabits waters along eastern shores of Asia from the Korean Peninsula all the way to the

Sea of Okhotsk and marking paths of migration of the species toward SE shores of Kamchatka.

The affiliation of whales sighted along Kamchatka shores with one or the other population was never discussed to any significant extent since it was always believed that the vast spaces of the northwestern part of the Pacific separating the Chukchi and Bering seas from the seas of Okhotsk and Japan were sufficient to consider these whale populations as totally separate entities (Vladimirov 1994).

If the western population of gray whales is truly isolated in geographic and genetic terms (LeDuc et al. 2002), significant changes in abundance in one region must be accompanied by proportional changes, albeit in the opposite direction, in the other region. Recent observations of foraging gray whales south of Piltun Bay, near Lunsky Bay (unpublished SEIC data), and identification of individual gray whales in other areas of the Sea of Okhotsk indicate that seasonal changes in gray whale range call for additional studies.

Seasonal changes in whale distribution have been described in numerous studies and are considered to be a response to seasonal variations in the habitats and movements of whale prey (Payne et al. 1986; Calambokidis et al. 1989; Calambokidis and Quan 1997; Weinrich et al. 1997; Wilson et al. 1997; Forney and Barlow 1998; Karczmarski et al. 1999). Eastern gray whales feeding along the west coast of Vancouver Island, Canada, rotate feeding areas and prey types within and between summer feeding seasons as a function of distribution and abundance of their prey (Bass 2000; Dunham and Duffus 2001, 2002; Meier 2003).

The distribution of feeding eastern gray whales along the west coast of North America is variable within and between years with whales utilizing areas from northern California to southeast Alaska from spring to fall involving significant interchange of individuals between areas with variable use of habitat within and between years (Calambokidis et al. 2002).

Recent research has indicated that eastern gray whales are not exclusively benthic foragers but are rather dynamic and selective foragers capable of utilizing a variety of prey types and foraging tactics, switching between prey species and techniques rapidly in order to take advantage of short-term availability of food resources (Dunham and Duffus 2001, 2002; Moore et al. 2003). Eastern gray whales are multi-scale animals that can show site-fidelity at a regional scale (e.g. offshore NE Sakhalin) but also range over a larger area to use smaller sites or “nodes” within the region as a function of distribution and abundance of prey over time.

In addition to their responding to the distribution and abundance of prey, there is some evidence that eastern gray whales, like other apex predators, can significantly influence the distribution and abundance of their prey through foraging (Bowen 1997). These “top-down” effects can alter a prey community to the extent that whales will abandon it for months or years while it recovers to a richness that can be utilized again, thereby influencing the seasonal distribution of the whales. Although western gray whales are genetically isolated from eastern gray whales (LeDuc et al. 2002), it

is likely that the manner in which eastern and western gray whales make foraging decisions in response to the distribution and abundance of prey, even in different ecological contexts, is similar.

There is no question that it is more difficult to conduct photo-ID work in the Offshore area. One possible reason is the greater water depths in the area, which translates to longer diving times for the whales, and more unpredictability in their surface locations than in the Piltun area. This unpredictability often results in whales surfacing farther from the zodiac than in the Piltun area, making them less accessible for photographing. The Offshore area is not sheltered by proximity to the shore or shallows, as is the nearshore Piltun area, and is therefore subject to more pronounced wind and wave effects – conditions unfavorable for photo-ID. Due to the larger size of the Offshore area, it is also more difficult to locate aggregations of whales or solitary individuals in the area from the zodiac or base ship deck. The large size of this area means that the observers may be unaware that the whales have moved into previously surveyed section or vacated the area completely, making survey effort less efficient for whale capture rate than the smaller inshore region.

Our observations support Weller's hypothesis (Weller et al. 2000) that calves make the transition to swimming independently during the period between July and September. According to Bogoslovskaya's data (1966) on gray whales offshore Chukchi Peninsula, age differentiation of the groups begins in July and August, when the calves leave their mothers and gather into groups in the shallowest waters rich in food. Shore-based vehicle surveys conducted in 2005 (Vladimirov 2006) indicate that the separation of mother from calf was completed by early September, with the last mother-calf pair observed from shore on 11 September.

The presence of anomalously emaciated whales remains unexplained. The causes of emaciation in both Pacific gray whale populations are not clear, but a rather extensive body of evidence suggests that over-exploitation of the available food supply and/or a possible large scale climatic/oceanographic regime shift affecting productivity in the North Pacific region have been at least partially responsible for emaciation observed in eastern gray whales.

As the population of eastern gray whales increases to levels estimated to exceed the levels prior to the period of commercial whaling, intraspecific competition pressures in the subarctic feeding grounds may be increasing (LeBoeuf et al. 2000; Moore et al. 2001, 2003).

Other authors believe that changes in the extent and consolidation of sea ice in the Arctic Ocean, triggered by global warming over the past 20 or 30 years, may affect the seasonal distribution and geographic boundaries of habitats, migration paths, body condition or reproductive status of whales (Tynan and DeMaster 1997; Perryman et al. 2002), which has potentially led to more intensive use of sub-Arctic zones.

Grebmeier and Barry (1991) speculate that due to global warming the primary production in surface waters may be inhibited, thereby depleting benthic food resources. LeBoeuf et al. (2000) have assumed that dwindling of food resources as a result of lower productivity in the North Pacific may be a limiting factor as far as feeding of whales in sub-Arctic waters is concerned. It is quite possible that such large-scale climatic and/or oceanographic changes may have affected the entire North Pacific region, thereby impacting both western and eastern gray whale populations at the same time and in a similar way (Brownell and Weller 2001).

However, recent gray whale prey studies have identified the Piltun area and, in particular, the Offshore feeding area as very rich prey sources (Fadeev, 2002, 2003, 2004, 2005, 2006), and it is unlikely that food resources are limited, although this issue requires further study. It is also possible that some other factor(s), such as diseases or man-made impact in the course of winter migration and/or summer feeding may have affected one or both populations simultaneously and to the same extent. Interestingly, some whales that showed signs of emaciation in previous years failed to exhibit such signs in subsequent years. This seasonal ability of 'thin' whales to recover to standard body condition was also previously observed between the 2002 and 2005 seasons (Yakovlev and Tyurneva 2003, 2004, 2005, 2006; Weller et al. 2004). The energetics of gray whale foraging when combined a fasting and feasting life-cycle of migrating, feeding, and breeding, are a dynamic process. The recovery and decline in body condition for both lactating and non-lactating whales does not seem to have any simple explanation. The temporal scale of this process changes with each individual and demographic group, and continued long-term monitoring is needed to form a solid basis for understanding.

In addition to the unexplained appearance of thin individuals, skin sloughing was observed among some of the animals in 2003. When these individuals were re-encountered in 2004-2006, from review of the photographs, it appeared that the skin sloughing recorded in 2003 has had no lasting visible effect on the external physical condition of the whales' skin. In addition, the incidence of skin sloughing had decreased in 2005 compared to 2003-2004. The skin sloughing phenomenon remains unexplained, but may be a result of several factors including bacterial, viral or fungal diseases (Gaydos et al. 2004), internal or external parasites, pollution, or excessive exposure to fresh water. The frequency of tumors and skin lesions among sea mammals has been found to depend on presence of organic pollutants upsetting hormonal metabolism (Béland et al. 1992). Shedding of skin has been observed among blue (Sears et al. 2000) and Greenland whales (Pettis et al. 2004), although it had not been reported previously among eastern or western gray whales.

Our earlier observations suggest that such skin sloughing is similar to natural yearly molting in spite of the fact that until recently it was believed that white whales (belugas) are the only cetacean species that molts on an annual basis (Boily 1995). The yearly molting of belugas is triggered by changes in water temperature and salinity. The documented examples of skin sloughing showed that the skin recovers quickly after sloughing, and no subsequent pathological consequences were observed on the surface of the whales' skin (Tyurneva and Yakovlev 2005c).

This phenomenon continues to require further study to understand the duration and significance of skin sloughing events and before conclusions can be drawn as to the causes of the molting or sloughing process. It is especially important to document any skin sloughing in 2006 for whales recorded with skin sloughing in 2003-2005 to continue to observe the affected group of animals for long-term patterns or change. It is also important to note that the individuals identified in 2002 and exhibiting signs of skin sloughing in 2003 did not show such signs in photogoraphs taken in 2002 or 2004. Additional photographs of whale skin in combination with biological assays of affected skin samples for histological studies and analyses may be required for establishing presence of pathogenic viruses, microbes or fungi.

REFERENCES

Bannister, J.L. 2000. Southern right whales off western Australia. *In*: Individual Recognition of Cetaceans: Use of Photo-ID and Other Techniques to Estimate Population Parameters. P.S. Hammond, S.A. Mizroch, and G.P. Donovan (Eds). Int. Whal. Comm. Special Issue 12. Cambridge. pp. 279-288.

[Бэннистер, Дж. 2000 г. Южные киты на шельфе западной Австралии. *В публикации*:" Распознание отдельных особей китообразных: Использование фотоидентификации и других методов для оценки параметров популяции. П.С. Хамонд, С.А. Мизроч и Г.П. Донован (Ред). Международная китобойная комиссия, спецвыпуск № 12. Кэмбридж. стр. 279-288].

Bass, J. 2000. Variations in gray whale feeding behaviour in the presence of whale-watching vessels in Clayoquot Sound, 1993-1995. Ph.D. Dissertation. Department of Geography, University of Victoria, Victoria, British Columbia, Canada. 156 p.

[Басс, Дж. Изменения в поведенческих реакциях серых китов при кормлении в присутствии судов для наблюдения за китами в зал. Клайокот. 1993-1995 гг. Диссертация на соискание степени доктора философии. Отдел географических исследований, Университет г. Виктория, г. Виктория, Британская Колумбия, Канада, стр. 156].

Béland, P., S. DeGuise and R. Plante. 1992 г. Toxicology and pathology of St. Lawrence marine mammals. Report SLNIW. Montreal: Wildlife Toxicology Fund, Word Wildlife Fund, Canada.

[Беланд, П., С. Де Гиз и Рю Плант. Токсикология и патология морских млекопитающих в заливе Святого Лаврентия. Отчет SLNIW. Монреаль: Фонд токсикологии диких животных, Всемирный фонд охраны дикой природы, Канада].

Best, P., R. Payne, V. Rowntree, J.T. Palazzo and M. Do Carmo Both. 1993. Long-range movements of south Atlantac right whales *Eubalaena australis.* Mar. Mamm. Sci. 9(3): 227-234.

[Бест, П., Р. Пайн, В. Роунтри, Дж. Т. Палаццо и М. До Кармо Бос. 1993 г. Перемещения на длинные расстояния южных гладких китов (*Eubalaena australis)* в Южной Атлантике. Стр. 227-234].

Blokhin, S.A., M.K. Maminov and G.M. Kosygin. 1985. On the Korean-Okhotsk Gray Whale Population. International Whaling Commission Report N 35, pp. 375-376.

[Блохин С.А., Маминов М.Л., Косыгин Г.М. 1985. О корейско-охотской популяции серого кита. Отчет Международной китобойной комиссии, № 35, стр. 375-376].

Blokhin, C.A. 1996. Distribution, abundance and behaviour of the American and Asian gray whale populations (Eschrichtius robustus) in regions of their summer distribution along the Far East coast. Izvestiya of the Pacific Research and Fisheries Centre, Vol. 21, pp. 36-53.

[Блохин С.А. 1996. Распределение, численность и поведение серых китов (Eschrichtius robustus) американской и азиатской популяций в районах их летнего распределения у берегов Дальнего Востока. Известия Тихоокеанского научно-исследовательского рыбохозяйственного центра, Том 121, С. 36- 53.]

Blokhin, S.A., N.V. Doroshenko and I.P. Marchenko. 2003. The abundance, distribution, and movement patterns of gray whales (*Eschrichtius robustus*) in coastal waters off the northeastern Sakhalin Island coast in 2002 based on the aerial survey data. Unpublished contract report by Russian Federations State Committee on Fisheries Federal Unitarian Enterprise TINRO-Center for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. 67 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

[Блохин С.А., Н.В. Дорошенко и И.П. Марченко. 2003 г. " Численность, распределение и перемещение серых китов (*Eschrichtius robustus*) в прибрежных водах на шельфе северо-восточного Сахалина в 2002 г. на основе данных авиаучетов". Неопубликованный отчет по контракту Федерального унитарного предприятия ТИНРО-центр, Государственного комитета рыбного хозяйства Российской Федерации, для компании "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com].

Blokhin, S.A., N. Doroshenko, and S. Yazvenko. 2004. Distribution, abundance, and movement patterns of western gray whales (*Eschrichtius robustus*) in coastal waters of northeastern Sakhalin Island, Russia, in June-December 2003 based on aerial survey data. Unpublished contract report by TINRO-Centre, Vladivostok, for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia.

[Блохин, С.А., Дорошенко, Н. и С. Язвенко. 2004 г. "Распределение, численность и перемещение серых китов западной популяции (*Eschrichtius robustus*) в прибрежных водах северо-восточного Сахалина, Россия, в июне-декабре 2003 г. на основе данных авиаучета". Неопубликованный проект отчета по контракту "ТИНРО-Центра", Владивосток, для компании "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и компании "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия].

Bogoslovskaya, L.C. 1966. Gray whale // Nature ("Priroda" as transliteration), No. 12, P. 47-60.

[Богословская Л.С. 1996 г. "Серые киты". Природа, № 12, стр. 47-60].

Boily, P. 1995. Theoretical heat flux in water and habitat selection of phocid seals and beluga whales during the annual molt. J. theor. Biol. V.72, P.232-244.

[Бойли П. 1995 г. "Теоретический тепловой поток в воде и места обитания ластоногих и белуг в период сезонной линьки или слущивания. Журнал теоретической биологии, т. 72, стр. 232-244].

Bowen, W.D. 1997. Role of marine mammals in aquatic ecosystems. Серия Прогресс "Морская экология" 158: 267-274.

[Боуэн, В.Д. 1997 г. "Роль морских млекопитающих в водной экосистеме. Серия Прогресс "Морская экология" 158: стр. 267-274].

Bradford, A.L. 2003. Population assessment of western north Pacific gray whales (*Eschrichtius robustus*). M.Sc. Thesis, School of Aquatic and Fishery Sciences, University of Washington, 115 p.

[Брадфорд А.Л. 2003 г. "Оценка серых китов (*Eschrichtius robustus*) западной популяции в северной части Тихого океана". Диссертация на соискание степени магистра, Департамент водных и рыбохозяйственных наук, Университет Вашингтона, 115 стр].

Bradford, A.L., D.W. Weller, A.M. Burdin, Yu.V. Ivashchenko and R.L. Brownell, Jr. 2005. Skin sloughingof gray whales *(Eschrichtius robustus)* in the Sea of Ohotsk. Abstract of 16 th Biennial Conference on the Biology of Marine Mammals, San Diego, USA. December 12-16, 2005. P. 42.

Brownell, R.L. and C.I. Chun. 1977. Probable existence of the Korean stock of the gray whale (*Eschrichtius robustus*). J. Mammal. 58:237-239.

[Браунэлл, Р.Л. и Ч. И.Чан. 1977 г. Возможность существования Корейской популяции серых китов (*Eschrichtius robustus*). Журн. "Млекопитающие" № 58: стр. 237-239].

Brownell, R.L. and D.W. Weller. 2001. Is the “Carrying Capacity Hypothesis” a plausible explanation for the “skinny” gray whale phenomenon? Int. Whal. Comm. Sci. Comm. Rep. SC/53/BRG 12. 8 p.(unpublished).

[Браунэлл, Р.Л. и Д.У. Уэллер. 2001 г. "Является ли “гипотеза кормовой продуктивности” правдоподобным объяснением явления потери веса у серых китов"? Научно-коммерческий отчет Международного китобойного комитета SC/53/BRG 12. 8 стр.(неопубликованный)].

Calambokidis, J. and J. Quan. 1997. Gray whales in Washington State: report on research in 1996. Final report to National Marine Mammal Laboratory, Seattle, Washington. 30pp.

Calambokidis, J. and J. Barlow. 2004. Abundance of blue and humpback whales in the eastern North Pacific estimated by capture-recapture and line-transect methods. Mar. Mamm. Sci. 20(1): 63-85.

[Каламбокидис, Дж. и Барлоу. 2004 г. Численность синих китов и горбачей в северо-восточной части Тихого океана, оцененная методами повторной поимки и учета по линейным трансектам. Наука о морских млекопитающих 20(1): 63-85].

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, and P. Bloedel. 1989. Biology of humpback whales in the Gulf of the Farallones, California. Report

to Gulf of Farallones National Marine Sanctuary, San Francisco, California. 93pp.

Calambokidis, J., J.R. Everson, G.H. Steiger, and S.J. Jeffries. 1994. Gray whales of Washington State: natural history and photographic catalog. Cascadia Research Collective, Olympia, Washington. 28p.

Calambokidis, J., J. Quan, L. Schlender, M. Gosho and P. Gearin. 1999. Gray Whale Photographic Identification in 1998: report on research in 1998. Final report by Cascadia Research Collective, Olympia, Washington for the National Marine Mammal Laboratory, Seattle, Washington. 25pp.

[Каламбокидис, Дж., Дж. Куан, Л. Шлендер, М. Гошо, П. Гиарин. 1999 г. Отчет о фотоидентификации серых китов проведенной в 1998 г. Окончательный отчет компании "Каскадия Рисерч Коллектив", Олимпия, шт. Вашингтон для Национальной лаборатории морских млекопитающих, Сиэтл, шт. Вашингтон, стр. 25].

Calambokidis, J., J.D. Darling, V. Deecke, P. Gearin, M. Gosho, W. Megill, C.M. Tombach, D. Goley, C. Toropova and B. Gisborne. 2002. Abundance, range and movements of a feeding aggregation of gray whales (*Eschrichtius robustus*) from California to southeastern Alaska in 1998. J. Cetacean Res. Manage. 4(3):267- 276.

[Каламбокидис, Дж., Дж.Д. Дарлинг, В. Дик, П. Гиарин, М. Гошо, В. Мегилл, К.М. Томбах, Д. Гоули, К. Торопова и Б. Гизборн. 2002 г. Численность, ареал обитания и перемещение кормящихся групп серых китов (*Eschrichtius robustus*) от Калифорнии до юго-восточной Аляски в 1998 г. Журнал "Управление и исследования китообразных" № 4(3): стр. 267- 276].

Cerchio, S. 1998. Estimates of humpback whale abundance off Kauai, 1989 to 1993: evaluation biases associated with sampling the Hawaiian Islands breeding assemblage. Mar. Ecol. Prog. Ser. 1755: 23-34.

[Черкио, С. 1998 г. Оценка численности горбачей у берегов о. Кауаи, 1989 - 1993 гг. Серия Прогресс "Морская экология" №1755, стр. 23-34.]

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Matilla, C.A. Mayo, M.A. Murphy and S. Pittman. 1993. Seasonal occurrence and annual return of humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. Canadian Journal of Zoology. 71, 440-443.

[Клафен П.Д., Л.С. Бараф, С.А. Карлсон, М.А. Христиан, Д.К. Матилла, С.А. Майо, М.А. Мэрфи и С. Питман. 1993г. Сезонные появления и ежегодные возвращения горбачей *Megaptera novaeangliae* на юге залива Мэн. Канадский журнал зоологии, № 71, стр. 440 -433.]

Cooke, J.G., D.W. Weller, A.L. Bradford, A.M. Burdin, and R.L. Brownell, Jr. 2006. Population assessment of western gray whales in 2006. Paper SC/58/BRG 30, presented to the International Whaling Commission, Scientific Committee, 10 p.

Craig, A.S. and L.M. Herman. 1997. Sex differences in site fidelity and migration of humpback whales (*Megaptera novaeangliae*) to the Hawaiian Islands. Canadian Journal of Zoology. 75: 1923-1933.

[Крэйг, А.С. и Л.М. Херман. 1997 г. Привязанность горбачей (*Megaptera novaeangliae*) к местам традиционного обитания и миграции к Гавайским островам в зависимости от их половой принадлежности. Канадский журнал зоологии, № 75, стр. 1923-1933.]

Darling, J.D. 1984. Gray Whales off Vancouver Island, British Columbia. *In*: The Gray Whale *Eschrichtius robustus*. M.L. Jones, S.L. Swartz, S.Leatherwood (Eds). Academic Press, Inc. pp 276-287.

[Дарлинг, Дж.Д. 1984 г. Серые киты у о. Ванкувер, Британская Колумбия. *В публикации*:Серые киты *Eschrichtius robustus*. М.Л. Джоунс, С.Л. Шварц, С. Лэзэрвуд (Ред.).Академик пресс, инк. Стр. 276-287.]

Darling, J.D., J. Calambokidis, K.C. Balcomb, P. Bloedel, K. Flynn, A. Mochizuki, K. Mori, F. Sto, H. Suganuma and M. Yamaguchi M. 1996. Movement of a humpback whale (*Megaptera novaeangliae*) from Japan to British Columbia and return. Mar. Mamm. Sci. 12(2):281-287.

[Дарлинг, Дж.Д., Дж.Каламбокидис, К.С. Балкоум, П. Блодэл, К. Флинн, А. Мочизуки, К. Мори, Ф. Сто, Х. Суганума и М. Ямагучи М. 1996 г. Перемещение горбачей (*Megaptera novaeangliae*) от Японии до Британской Колумбии и обратно. Наука о морских млекопитающих № 12(2): стр. 281-287.]

Dunham, J. S. and D.A. Duffus. 2001. Foraging patterns of gray whales in central Clayoquot Sound, British Columbia. Mar. Ecol. Prog. Ser. 223:299-310.

[Дунам, Дж.С. и Д.А. Дуффус. 2001 г. "Поведение кормящихся серых китов в центральной части зал. Клайокот", Британская Колумбия, Серия Прогресс "Морская экология" № 223: стр.299-310].

Dunham, J.S and D.A. Duffus. 2002. Diet of gray whales (*Eschrichtius robustus*) in Clayoquot Sound, British Columbia, Canada. Mar. Mamm. Sci. 18(2):419-437.

[Дунам, Дж.С. и Д.А. Дуффус. 2002 г. "Пищевой рацион серых китов (*Eschrichtius robustus*) в зал. Клайокот", Британская Колумбия, Серия Прогресс "Морская экология" № 18(2), стр.419-437].

Fadeev, V.I. 2002. SCUBA benthic research in the feeding area of the western gray whale in 2001. Unpublished final report by the Institute of Marine Biology, Far Eastern Branch of the Russian Academy of Science, Vladivostok, Russia, for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. 113p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

[Фадеев В.И., 2003а. "Водолазные исследования бентоса на площади нагула серых китов западной популяции в 2001 г". Неопубликованный отчет по контракту Института морской биологии, Дальневосточное отделение Российской Академии Наук, Владивосток, Россия, для

компаний "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия, стр. 113. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com].

Fadeev, V.I. 2003. Benthos and prey studies in feeding grounds of the Okhotsk-Korean population of gray whales, 2002. Unpublished contract report by Institute of Marine Biology of Far East Branch, Russian Academy of Sciences for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. 118 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

[Фадеев, В.И. 2003b. "Исследования бентоса и кормовой базы в районах нагула серых китов охотско-корейской популяции, 2002 г". Неопубликованный отчет по контракту Института морской биологии, Дальневосточное отделение Российской Академии Наук, Владивосток, Россия, для компаний "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия. Стр. 118. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com/environment/env_whales.asp)].

Fadeev, V.I. 2004. Benthos and prey studies in feeding grounds of the Okhotsk-Korean population of gray whales, 2003. Unpublished contract report by Institute of Marine Biology of Far East Branch, Russian Academy of Sciences for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia.

[Фадеев, В.И. 2004. "Исследования бентоса и кормовой базы в районах нагула серых китов охотско-корейской популяции, 2003 г". Неопубликованный отчет по контракту Института морской биологии, Дальневосточное отделение Российской Академии Наук, Владивосток, Россия, для компаний "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия].

Fadeev, V.I. 2005. Benthos and prey studies in feeding grounds of the Okhotsk-Korean population of gray whales, 2004. Unpublished contract report by Institute of Marine Biology of Far East Branch, Russian Academy of Sciences for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia.

Fadeev, V.I. 2006. Benthos and prey studies in feeding grounds of the Okhotsk-Korean population of gray whales, 2005. Unpublished contract report by Institute of Marine Biology of Far East Branch, Russian Academy of Sciences for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia.[in press]

Forney, K.A. and J. Barlow. 1998. Seasonal patterns in the abundance and distribution of California cetaceans, 1991-1992. Marine Mammal Science 14(3):460-489.

[Форней, К.А. и Барлоу Дж. 1988 г. "Сезонные изменения в численности и распределении китообразных Калифорнии", 1991-1992 гг. Наука о морских млекопитающих №14 (3) стр. 460-489].

Gailey, G., O. Sychenko and B. Würsig. 2004. Western gray whale behavior and movement patterns: shore-based observations off Sakhalin Island, July-September 2003. Unpublished contract report submitted by Texas A&M University and the Kamchatka Institute of Ecology and Nature Management for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. April 2004, 74 pp.

[Гайлей Г., Сыченко О. Вюрсиг В. 2004 г. "Характер поведения и перемещения серых китов западной популяции: береговые наблюдения на шельфе о. Сахалин, июль - сентябрь 2003 г. Неопубликованный отчет по контракту, представленный университетом "Тексас Эй-энд-Эм Юниверсити" и Камчатским институтом экологии и природопользования ДВ РАН для компаниям "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и "Сахалин Энерджи Инвестмент Компани", Южно-Сахалинск, Россия. Апрель 2004, стр. 74.]

Gaydos, J.K., K.C. Balcomb III, R.W. Osborne and L. Dierauf. 2004. Evaluating potential infectious disease threats for southern resident killer whales, *Orcinus orca*: a model for endangered species. Biol. Cons. 117:253-262.

[Гайдос, Дж.К., К.С. Балкомб III, Р.В. Осборн и Л. Диерауф. 2004 г. "Оценка угрозы возможных инфекционных заболеваний касаток *Orcinus orca* в южных районах: модель для видов, находящихся под угрозой исчезновения". Биол. конс. № 117: стр. 253-262.]

Glockner-Ferrari, D.A. and M.J. Ferrari. 2000. Reproduction in the Humpback Whale (*Megaptera novaeangliae*) in Hawaiian waters, 1975-1988: the life history, reproductive rates and behavior of known individuals identified through surface and underwater photography. *In:* Individual Recognition of Cetaceans: Use of Photo-ID and Other Techniques to Estimate Population Parameters. P.S. Hammond, S.A. Mizroch, and G.P. Donovan (Eds). Int. Whal. Comm. Special Issue 12. Cambridge. pp. 161-169.

[Глокнер-Феррари Д.А. и М. Дж. Феррари. 2000. Воспроизводство горбачей (*Megaptera novaeangliae*) в водах Гавайских островов, 1975-1988 гг.: история, скорость воспроизводства и поведение известных особей, идентифицированных посредством фотографирования на поверхности или под водой. *В публикации:* "Распознание отдельных особей китообразных: использование фотоидентификации и других методов для оценки параметров популяции". П.С. Хамонд, С.А. Мизроч и Г.П. Донован (Ред). Международная китобойная комиссия, Спецвыпуск № 12. Кэмбридж. стр.161-169.]

Goldberg, E.D. 1993. Coastal zone space: sites for conflict. The United Nations University Public Forum Series, Lectures No.3, Tokyo, Japan. 12p.

[Гольдберг Е.Д. 1993 г. "Береговая зона: конфликтные территории". Серии общественного форума Университета ООН. Лекции №3, Токио, Япония. Стр. 12.]

Grebmeier, J.M. and J.P. Barry. 1991. The influence of oceanographic processes on pelagic-benthic coupling in polar regions: a benthic perspective. J. of Mar. Syst. 2:495-518.

[ГрэбМейер, Дж. М. и Дж.П. Бэрри. 1991 г. "Влияние океанографических процессов на взаимодействие между бентосом и пелагическими видами в полярных районах: перспективы бентоса". Журнал морских экосистем №2, стр. 495-518.]

Hammond, P.S., S.A. Mizroch and G.P. Donovan. 1990. Individual recognition of cetaceans: use of Photo-ID and other techniques to estimate population parameters. Report of the Int. Whal.Comm.Special Issue 12. 440 p.

[Хамонд П.С., С.А. Мизроч и Г.П. Донован. 1990 г. "Распознание отдельных особей китообразных: использование фотоидентификации и других методов для оценки параметров популяции". Международная китобойная комиссия, спецвыпуск № 12. Стр.440.]

Hilton-Tayler, C. 2000. IUCN Red List of Threatened Species. IUCN/SSC, Gland, Switzerland and Cambridge, U.K.

[Хилтон-Тейлер К. 2000 г. Красная книга исчезающих видов. Комиссия по выживанию видов МСОП, Гланд, Швейцария и Кембридж, Великобритания.]

Johnson, S.R. 2002. Marine mammal mitigation and monitoring program for the 2001 Odoptu 3-D seismic survey, Sakhalin Island Russia: Executive summary. Report from LGL Limited environmental research associates, Sidney, B.C., for Exxon Neftegas Limited., Yuzhno-Sakhalinsk, Russia. 49 p. [available from Exxon Neftegas Limited upon request]. Also available as Working Paper SC/02/WGW/19, Int. Whal. Comm., Western Gray Whale Working Group Meeting, Ulsan, South Korea, 22-25 October 2002. 48 p.

[Джонсон С.Р. 2002 г. "Программа снижения воздействия на морских млекопитающих и мониторинга при проведении трехмерных сейсморазведочных работ на месторождении Одопту в 2001 г., Сахалин, Россия": Пояснительная записка. Отчет компании "ЛГЛ Лимитед Энвайронментал Рисерч Ассошиейтс, Сидней, Британская Колумбия, для компании "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия. Стр. 49. [Предоставляется компанией "Эксон Нефтегаз Лимитед" по запросу] Опубликован также в виде доклада SC/02/WGW/19, Международная китобойная комиссия, Совещание рабочей группы по серым китам западной популяции, Ульсан, Южная Корея, 22-25 октября 2002 г. стр. 48.]

Karczmarski, L, V.G. Cockcroft, and A. McLachlan. 1999. Group size and seasonal pattern of occurrence of humpback dolphins *Sousa chinensis* in Algoa Bay, South Africa. South African Journal of Marine Science 21:89-97.

[Карчмарски Л., В.Г. Кокрофт и А. Маклачлан. 1999 г. "Численность групп и сезонное поведение длинноклювых дельфинов *Sousa chinensis* в заливе Алгоа, Южная Африка". Южноафриканский журнал биологии моря. №21, стр. 89-97].

Krasnaya kniga Rossiiskoi Federatsii (Zhivotnye) [Red Book of Russian Federation (Animals)]. 2000. Izd. AST and Astrel, 862 pp.

[Красная книга Российской Федерации ("Животные"). 2000 г. Изд. АСТ и "Астрел", стр. 862.]

Krupnick, I.I. 1984. Gray whales and the aborigines of the Pacific Northwest: the history of aboriginal whaling. Pages 103-120 In: M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.) The gray whale *Eschrichtius robustus*, Academic Press, Orlando, FL. 600 p.

[Крупник И.И. 1984 г. "Серые и местные виды китов северо-западной части Тихого океана: история местных видов китов. Стр. 103-120. *В публикации*: М.Л. Джонс, С.Л. Шварц и С. Лезервуд (редакторы) "Серые киты *Eschrichtius robustus*", "Академик пресс", Орландо, Флорида, стр. 600.]

LeBoeuf, B.J., H. Perez-Cortes M., U. Urban R., B.R. Mate, and F. Ollervides U. 2000. High gray whale mortality and low recruitment in 1999: potential causes and implications. J. Cet. Res. Manage. 2:85-99.

LeDuc, R.G., D.W. Weller, L. Hyde, A.M. Burdin, P.E. Rosel, R.L. Brownell Jr, B. Würsig and A.E. Dizon. 2002. Genetic differences between western and eastern North Pacific gray whales (*Eschrichtius robustus*). J. of Cet. Manage. 4: 1-6.

[Ледюк, Р.Г., Д.У. Уэллер, Л. Гайд, А.М. Бурдин, П.Е. Роузл, Р.Л. Браунэл мл., Б. Вюрсиг и А.Е. Дизон. 2002 г. "Генетические различия между западной и восточной популяциями серых китов (*Eschrichtius robustus*) северной части Тихого океана.Журнал "Управление и исследования китообразных" №4. Стр. 1-6.]

Lento, G.M., M.L. Dalebout and C.S. Backer. 1998. Species and individual identification of whale and dolphin products for sale in Japan by mtDNA sequences and nuclear microsattelite profiles. For consideration by Scientific committee of The International Whaling commission. Sultanate Oman, (Sc/50/08). 1998. P.1-10.

[Ленто Дж. М. Далебот М.Л. и Бейкер К.С. 1998 г. "Виды и индивидуальная идентификация продаваемых в Японии продуктов из китов и дельфинов методами секвенсирования ДНК митохондриона и клеточного микропрофилирования." Представлена на рассмотрение Научного комитета Международной китобойной комиссии. Оман, (Sc/50/08). 1998 г. Стр.1-10.]

Mamaev, V.G. 2002. Nearshore sightings of cetaceans off the Kommander Islands In: Marine Mammals of Holarctic. Collection of scientific papers of International Conference, Baikal, Russia, 10-15 September, 2002. P.168-170.

[Мамаев В.Г. 2002. Береговые наблюдения китообразных у Командорских островов. В сборнике: Морские млекопитающие Голарктики. Научные труды межународной конференции, Байкал, Россия, 10-15 сентября 2002г., стр.168-170.]

Maminov, M.K. 2003. Abundance, distribution and behaviour of gray whales (*Eschrichtius robustus*) offshore north-eastern Sakhalin Island in 2002. Unpublished contract report by Russian Federations State Committee on Fisheries Federal Unitarian Enterprise TINRO-Center for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. 28 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

[Маминов М.К. 2003 г. "Численность, распределение и поведение серых китов (*Eschrichtius robustus*) на шельфе у северо-восточного Сахалина в 2002 г. Неопубликованный отчет по контракту Федерального унитарного предприятия ТИНРО-центр, Государственного комитета рыбного хозяйства Российской Федерации, для компаний "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com]

Maminov, M.K. 2004. Distribution and Abundance of Western Gray Whales Offshore NE Sakhalin, July - September 2003: Vessel-based Surveys. Unpublished contract report by TINRO-Centre, Vladivostok, for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia.

[Маминов М.К. 2004 г. "Распределение и численность серых китов западной популяции на шельфе у северо-восточного Сахалина в июле - сентябре 2003 г:" Наблюдения с судов. Неопубликованный предварительный отчет по контракту ТИНРО-Центра, Владивосток, для компаний "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия.]

Maminov, M.K. and S.A. Blokhin .2004. Whales (Eschrichtius robustus) in coastal waters of the southern Far East. In book: Marine Mammals in the Holarctic. Collection of scientific papers of International Conference Koktebel, Krimea, Ukraine, October 11-17, 2004. P. 362-368.

[Маминов М.К. и Блохин С.А. 2004. Встречаемость серого кита (Eschrichtius robustus) в прибрежных водах юга Дальнего Востока. В сборнике: Морские млекопитающие Голарктики. Научные труды

международной конференции в Коктебеле, Украина. 11-17 октября 2004г., стр. 362-368.]

Maminov, M.K. and Y.M. Yakovlev. 2002. New Data on the Abundance and Distribution of the Gray Whale Offshore NE Sakhalin. Conference “Marine Mammals of Holarctic” Baikal 11-13 September 2002. P.170-171.

[Маминов М.К., Яковлев Я.М. 2002 г. "Новые данные по численности и распределении серых китов в северо-восточной части сахалинского шельфа". Конференция “Морские млекопитающие голарктики” Байкал 11-13 сентября 2002 г. Р.170-171.]

McConkey, S.D. 1999. Photographic Identification of the New Zealand sea lion: a new technique. New Zealand J. of Mar. and Fresh. Res. 33(1):63-66.

[Макконки, С.Д. 1999 г. "Фотоиндентификация новозеландского сивуча: новая методика". Новая Зеландия, Журнал морских и пресноводных биоресурсов № 33(1): стр. 63-66.]

Meier, S.K. 2003. A multi-scale analysis of habitat use by gray whales (*Eschrichtius robustus)* in Clayoquot Sound, British Columbia, 1997-99. M.Sc. Thesis, Department of Geography, University of Victoria, Victoria, BC. 161 p.

[Мейер, С.К., 2003 г. Многомасштабный анализ использования мест обитания серых китов (*Eschrichtius robustus)* в зал. Клайокот, Британская Колумбия, 1997-99. Тезисы диссертации на соискание ученой степени Магистра наук, Отдел географических исследований, Университет г. Виктория, г. Виктория, Британская Колумбия. Стр. 161.]

Miyashita, T., S. Nishiwaki, V.A. Vladimirov and N.V. Doroshenko. 2001. Paper SC/53/RMP5 presented to the IWC Scientific Committee, July 2001 (unpublished). 12 pp.

[Мирьяшита, Т., С. Нишиваки, В.А. Владимиров и Н.В. Дорошенко. 2001 г. Отчет SC/53/RMP5, представленный в научный комитет МКК, июль 2001 г. (неопубликованный), стр.12.]

Moore, S.E., J.M. Grebmeier and J.R. Davies. 2003. Gray whale distribution relative to forage habitat in the northern Bering Sea: current conditions and retrospective summary. Can. J. of Zool. 81:734-742.

[Мур, С. Е., Дж.М. ГребМейер и Дж.Р. Дэйвис. 2003 г. "Распределение серых китов относительно мест распространения корма в северном секторе Берингова моря: текущее состояние и краткий ретроспективный обзор". Кан. журнал зоологии №81, стр. 734-742.]

Nikulin, V.S., A.M. Burdin, V.N. Burkanov, V.V. Vertyankin, V.V. Fomin and A.M. Mironova. 2004. Observations of large cetaceans in the Kamchatka region (1994-2003). In: The conservation of biodiversity of Kamchatka and adjacent waters. The collection of papers 5-th scientific conference, 14-22 November 2004. Petropavlovsk-Kamchatskii, Russia, pp. 226-229.

[Никулин В.С., Бурдин А.М., Бурканов В.Н., Вертянкин В.В., Фомин В.В., Миронова А.М. 2004. Наблюдения за крупными китообразными в Камчатском регионе (1994-2003гг.). В сборнике: Сохранение

биоразнообразия Камчатки и прилегающих морей. Материалы 5 научной конференции 22-14 ноября 2004г. Петропавловск-Камчатский, С. 226-229.]

Payne, P.M., J.R. Nicolas, L. O'Brien and K.D. Powers. 1986. The distribution of the humpback whale, *Megaptera novaeangliae*, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, *Ammodytes americanus*. Fishery Bulletin 84(2):271-278.

[Пейн, П.М., Дж.Р. Николас, Л. Обрайен и К.Д. Пауэрс. 1986 г. "Распределение горбатых китов (*Megaptera novaeangliae*) в Банке Джорджа и в зал. Мейн в зависимости от плотности песчанки (*Ammodytes americanus*)". Бюллетень рыбного хозяйства № 84 (2): стр. 271-278.]

Perlov, A.S., V. Vladimirov, Z.V. Reviakina, J. Ismail-Zade, S. Yazvenko and S.R. Johnson. 1996. Review of literature/information regarding marine mammals in the vicinity of Sakhalin Island, Sea of Okhotsk, Russia. Unpublished contract report from Pacific Research Institute of Fisheries and Oceanography (TINRO), State Committee for Fisheries and Oceanography, Vladivostok, Russia, and LGL Limited, environmental research associates, Sidney BC., Canada for Marathon Oil Company, Littleton, CO. 32 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

[Перлов, А.С., В. Владимиров, З.В. Ревякина, Дж. Измаил-Заде, С. Язвенко and С.Р. Джонсон. 1996 г. "Обзор литературы/информации о морских млекопитающих в районе о. Сахалин, Охотское море, Россия. Неопубликованный отчет по контракту Тихоокеанского научно-исследовательского института рыбного хозяйства и океанографии (ТИНРО), Государственного комитета рыбного хозяйства и океанографии, Владивосток, Россия, и компании "LGL Limited, environmental research associates", Сидней, Британская Колумбия, Канада, для компании "Марафон Ойл", Литтлтон, Колорадо. Стр. 32. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com]

Perlov, A.S., S.A. Blokhin and M.K. Maminov. 2003. Abundance, distribution, and behavior of gray whales (*Eschrichtius robustus*) offshore northeastern Sakhalin in 2002: vessel-based observations. Unpublished contract report by TINRO Center, Vladivostok, Russia, for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. 28 pp. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

[Перлов А.С., Блохин С.А., Маминов М.К. 2003 г. "Численность, распределение и поведение серых китов (*Eschrichtius robustus*) на северо-восточном шельфе Сахалина в 2002 г.: судовые наблюдения." Неопубликованный отчет по контракту "ТИНРО-Центра", Владивосток, для компании "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия и компании "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия. Стр. 28. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com].

Perryman, W.L. and M.S. Lynn. 2002. Evaluation of nutritive condition and reproductive status of migrating gray whales (*Eschrichtius robustus*) based on analysis of photogrammetric data. J. Cetacean Res. Manage. 4:155-164.

[Перриман, В.Л. и М.С. Линн. 2002 г. "Оценка степени упитанности и способности к воспроизводству мигрирующих серых китов (*Eschrichtius robustus*) по данным анализа фотограмметрического материала". Журнал "Управление и исследования китообразных" №4, стр. 155-164.]

Pettis, H.M., R.M. Rolland, P.K. Hamilton, S. Brault, A.R. Knowlton and S.D. Kraus. 2004. Visual health assessment of North Atlantic right whales (*Eubalaena glacialis*) using photographs. Can. J. Zool. 82:8-19.

[Пэтис, Х.М., Р.М. Роланд, П.Л. Гамильтон, С. Бро, А.Р. Ноултон и С.Д. Краус. 2004 г. "Визуальная оценка состояния здоровья антарктических (южных) китов (*Eubalaena glacialis*) в северных районах Атлантического океана при помощи фотографий". Кан. журнал зоологии. № 82, стр.8-19.]

Rice, D.W. 1998. Marine mammals of the world: Systematics and distribution. Soc. Mar. Mam. Spec. Pub. 4. 231 p.

[Райс, Д.В. 1998 г. "Морские млекопитающие мира: Систематика и распределение". Общество морских млекопитающих. Спецвыпуск №. 4. Стр. 231.]

Rugh, D.J., S.E. Muto, S.E. Moore and D.P. DeMaster. 1999. Status review of the eastern North Pacific stock of gray whales. U.S. Department of Commerce. NOAA Tech. Memo. NMFS-AFC-103. 96p.

[Руг, Д.Дж., С.Е. Муто, С.Е. Мур и Д.П. Демастер. 1999 г. "Обзор состояния стада серых китов в северо-восточной части Тихого океана". Министерство торговли США. Технический меморандум Национального управления океанических и атмосферных исследований США. Национальная служба морского рыболовства-AFC-103. Стр. 96.]

Rugh, D.J., R.C. Hobbs, J.A. Lerczak and J.M. Breitwick. 2005. Estimates of abundance of the eastern North Pacific stock of gray whales (*Eschrichtius robustus*) 1997-2002. Journal of Cetacean Research and Management 7(1): 1-12, 2005.

Salden, D.R., L.M. Herman, M. Yamaguchi and F. Sato. 1999. Multiple visits of individual humpback whales (*Megaptera novaeangliae*) between the Hawaiian and Japanese winter grounds. Can. J. Zool. 77:504-508.

[Сальдэн, Д.Р., Л.М. Герман, М. Ямагучи и Ф. Сато. 1999 г. Многочисленные перемещения отдельных особей горбачей (*Megaptera novaeangliae*) между районами зимовки у Гавайских островов и берегов Японии. Кан. журнал зоологии №77: стр.504-508.]

Sears, R., J.M. Williamson, F.W. Wenzel, M. Bérubé, D.Gendron and P. Jones. 2000. Photographic Identification of the blue whale (*Balaenoptera musculus*) in the Gulf of the St. Lawrence, Canada. *In:* Individual Recognition of Cetaceans: Use of Photo-ID and Other Techniques to Estimate Population Parameters. P.S. Hammond, S.A. Mizroch, and G.P. Donovan (Eds). Int. Whal. Comm. Special Issue 12. Cambridge. pp. 335-342.

[Сирз, Р., Дж.М. Вильямсон, Ф.В. Вензел, М. Берубе, Д.Гендрон и П. Джонс. 2000 г. "Фотоидентификация голубого кита (*Balaenoptera musculus*) в зал. Св. Лаврентия, Канада". *В публикации:* "Распознание отдельных особей китообразных: Использование фотоидентификации и других методов для оценки параметров популяции". П.С. Хамонд, С.А. Мизроч и Г.П. Донован (Ред).Международная китобойная комиссия, Спецвыпуск № 12. Кэмбридж. стр. 335-342.]

Sleptsov, M.M. 1955. Biology and harvest of whales in the Far Eastern seas [of Russia]. Moscow, 63 pp.

Sobolevsky, E.I. 2000. Marine mammal studies offshore northeast Sakhalin, 1999. Unpublished contract report by the Institute of Marine Biology, Far Eastern Branch of Russian Academy of Sciences, Vladivostok, for Sakhalin Energy Investment Company, Yuzhno-Sakhalinsk, Russia. 149 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

[Соболевский, Е. И. 2000 г. "Исследования морских млекопитающих у северо-восточного побережья Сахалина, 1999 г". Отчет по контракту Института биологии моря, Дальневосточное отделение Российской Академии наук, Владивосток, для компании «Сахалин Энерджи Инвестмент Компани», Южно-Сахалинск, Россия.Стр. 149. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com/environment/env_whales.asp).]

Sokolov, V.E., and V.A. Arseniev. 1994. The baleen whales. Moscow: Nauka Press, 208p.

[Соколов В.Е., Арсеньев В.А. 1994. Усатые киты. М: Наука, 208 стр.]

Stevick, P.T., P.J. Palsboll, T.D. Smith, M.V. Bravington and P.S. Hammond. 2001. Errors in identification using natural markings: rates, sources, and effects on capture-recapture estimates of abundance. Can. J. of Fish. and Aquat. Sci. 58(9): 1861-1870.

[Стевик, П.Т., П.Дж. Палсболл, Т.Д. Смит, М.В. Бравингтон и П.С. Хаммонд. 2001 г. "Ошибки идентификации при использовании естественных отличительных признаков: скорость, источники и последствия оценки численности методом повторной поимки". Кан. журнал рыбного хозяйства и водных ресурсов.Can. J. of Fish. and Aquat. Sci. 58(9): Стр. 1861-1870.]

Swartz, S.L., B.L. Taylor and D.J. Rugh. 2006. Gray whale Eschrichtius robustus population and stock identity. Mammal Rev. Vol. 36. N 1. pp. 66-84.

[Шварц С.Л., Тейлор Б.Л. и Руг Д.Дж. 2006 г. Популяция серого кита Eschrichtius robustus и особенность стад. Обзор млекопитающих. Т.36, №1, стр. 66-84.]

Thompson, P.M. and P.S. Hammond. 1992. The use of photography to monitor dermal disease in wild bottlenose dolphins (*Tursiops truncatus*). Ambio 21:135-137.

[Томпсон, Р. и П.С. Хаммонд. 1992 г. "Использование фотографирования для мониторинга кожных заболеваний афалинов (*Tursiops truncatus*)". Амбио № 21: стр.135-137.]

Tynan, C.T. and D.P. DeMaster. 1997. Observations and predictions of Arctic climatic change: Potential effects on marine mammals. Arctic 50(4):308-322.

[Тайнан С.Т. и Д.П. Демастер. 1997 г. "Наблюдение и прогнозирование климатических изменений в Арктике: возможное воздействие на морских млекопитающих". Арктик № 50(4): стр. 308-322.]Tyurneva, O.Y. and Yu. M. Yakovlev. 2005. Skin sloughing of gray whales *(Eschrichtius robustus)* in the Sea of Ohotsk. Abstract of 16 th Biennial Conference on the Biology of Marine Mammals, San Diego, USA. December 12-16, 2005. P. 286-287.

[Тюрнева О.Ю. и Яковлев Ю.М. 2005с. Слущивание кожных покровов у серого кита (Eschrichtius robustus) в Охотском море. Абстракт 16 конференции по биологии морских мекопитающих, Сан Диего, США. 12-16 декабря 2005г., стр. 286-287.]

Tyurneva, O.Yu. and Yakovlev, Yu. M. 2005c. Skin sloughing of gray whales (Eschrichtius robustus) in the Sea of Ohotsk. Abstract of 16 th Biennial Conference on the Biology of Marine Mammals, San Diego, USA. December 12-16, 2005. P. 286-287.

[Тюрнева О.Ю. и Яковлев Ю.М. 2005с. Слущивание кожных покровов у серого кита (Eschrichtius robustus) в Охотском море. Абстракт 16 конференции по биологии морских мекопитающих, Сан Диего, США. 12-16 декабря 2005г., стр. 286-287.]

Tyurneva, O.Yu., M.K. Maminov, E.P. Shvetsov, V.I. Fadeev, N.I. Selin and Yu.M. Yakovlev. 2006. Seasonal movements of gray whales (Eschrichtius robustus) between feeding areas on the northeast shelf of Sakhalin Island. In the book: Marine Mammals in the Holarctic. Collection of scientific papers of International Conference Saint-Peterburg, September 10-14, 2006. P. 530-535.

[Тюрнева О.Ю., Маминов М.К., Швецов Е.П. Фадеев В.И., Селин Н.И. и Яковлев Ю.М. Сезонные перемещения серых китов (Eschrichtius robustus) между нагульными районами на северо-восточном шельфе о.Сахалин. В сборнике: Морские млекопитающие Голарктики. Научные труды международной конференции в Санкт-Петербурге, 10-14 сентября 2006г. стр. 530-535.]

USFWS (U.S. Fish and Wildlife Service). 1997. Endangered and threatened wildlife and plants. U.S. Dep. of Interior, U.S. Government Printing Office, Washington, DC. 52 p.

[Служба США по охране рыбных ресурсов и дикой природы (USFWS) 1997 г. Находящиеся под угрозой исчезновения и уязвимые виды диких животных и растений. Министерство внутренних дел США, Государственная типография США, Вашингтон, ФОК. Стр. 52 р.]

Vertyankin, V.V., V.C. Nikulin, A.M. Bednykh and A.P. Kononov. 2004. Sighting of gray whales (Eschrichtius robustus) near southern Kamchatka. In the book:

Marine Mammals in the Holarctic. Collection of scientific papers of International Conference Koktebel, Krimea, Ukraine, October 11-17, 2004. P. 126-128.

[Вертянкин В.В., Никулин В.С., Бедных А.М. и Кононов А.П. 2004. Наблюдения за серыми китами (Eschrichtius robustus) юго-востока Камчатки. В сборнике: Морские млекопитающие Голарктики. Научные труды международной конференции в Коктебеле, Украина. 11-17 октября 2004г., стр. 126-128.]

Vladimirov, V.L. 1994. The modern distribution and abundance of whales in the seas of the Far East. Russian Journal of Marine Biology. Vol. 20, N 1, pp. 3-13.

[Владимиров В.Л. 1994. Современное распределение и численность китов в дальневосточных морях. Биология моря. Т. 20, № 1, С. 3-13.]

Vladimirov, V.A., S.A. Blokhin, A.V. Vladimirov, V.L. Vladimirov, N.V. Doroshenko, M.K. Maminov. 2005. Distribution and abundance of gray whales of the Okhotsk-Korean population in northeastern Sakhalin waters in July-November, 2004. Report by VNIRO, Moscow and TINRO-Centre, Vladivostok, Russia, for Exxon Neftegas Limited and Sakhalin Energy Investment Company, Yuzhno-Sakhalinsk, Russia – 199 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

Vladimirov, V.A., S.A.Blokhin, A.V.Vladimirov, V.L.Vladimirov, N.V.Doroshenko, M.K.Maminov. 2006. Distribution and abundance of gray whales of the Okhotsk-Korean population in northeastern Sakhalin waters in July-November, 2004. Report by VNIRO, Moscow and TINRO-Centre, Vladivostok, Russia, for Exxon Neftegas Limited and Sakhalin Energy Investment Company, Yuzhno-Sakhalinsk, Russia – [*in press*]

Wang, J. 1998. Save the dolphins! A new age for wildlife conservation in Taiwan. Publ. Sinorama Magazine, Taipei. P.101-119.

[Ванг Дж. 1998 г. Спасите дельфинов! Новый век охраны дикой природы на Тайване". Публикация журнала "Синорама", Тайпей. Стр..101-119.]

Webster, P. 2003. Will oil spell trouble for Western Pacific gray whales? Science. 300:13.

[Вэбстер, П. 2003 г. Будет ли нефть оказывать негативное воздействие на серых китов западной тихоокеанской популяции? Наука № 300: стр.13.]

Weinrich, M., M. Martin, R. Griffiths, J. Bove and M. Schilling. 1997. A shift in distribution of humpback whales, *Megaptera novaeangliae*, in response to prey in the southern Gulf of Maine. Fishery Bulletin 95:826-836.

[Вейнрих, М., М. Мартин, Р. Гриффитс, Дж. Бове и М. Шиллинг. 1997 г. Изменение в распределении горбачей *Megaptera novaeangliae* в зависимости от мест кормления в южной части зал. Мейн. Бюллетень рыбного хозяйства № 95: стр. 826-836.]

Weller, D.W. and R.L. Brownell Jr. 2000. *Eschrichtius robustus* (Asian or Northwest Pacific stock). *In:* Hilton-Tayler (comp.) 2000 IUCN Red List of Threatened Species. IUCN/SSC, Gland, Switzerland and Cambridge, UK.

[Уэллер, Д.У. и Р.Л. Браунэл мл. 2000 г. *Eschrichtius robustus* (Азиатская или северо-западная тихоокеанская популяция).*В публикации:* компании Хилтон-Тейлер 2000 Красная книга исчезающих видов. Комиссия по выживанию видов МСОП, Гланд, Швейцария и Кембридж, Великобритания.]

Weller, D.W., B. Würsig, A.L. Bradford, A.M. Burdin, S.A. Blokhin, H. Minakuchi, and R.L. Brownell, Jr. 1999. Gray whales (*Eschrichtius robustus*) off Sakhalin Island, Russia: Seasonal and annual occurrence patterns. Mar. Mam. Sci. 15:1208-1227.

[Уэллер, Д.У., Б. Вюрсиг, А.Л. Брадфорд, А.М. Бурдин, С.А. Блохин, Н. Минакучи и Р.Л. Браунелл, мл. 1999 г. "Серые киты (*Eschrichtius robustus*) сахалинского шельфа России: Сезонный и годовой характер местонахождения". Наука о морских млекопитающих. № 15: стр.1208-1227.]

Weller, D.W., B.G. Würsig, A.M. Burdin, S. Reeve and A.L. Bradford. 2000. Gray whales summering off Sakhalin Island, Far East Russia: June-October 1999. A joint U.S.-Russian scientific investigation. Unpublished contract report by Texas A&M University, College Station, TX and Kamchatka Institute of Ecology and Nature Management, Russian Academy of Sciences, Kamchatka, Russia, for Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. 69 pp. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com]

[Уэллер, Д. У., Б. Вюрсиг и А.М. Бурдин. 2000 г. "Серые киты, проводящие лето на шельфе о. Сахалин на Дальнем Востоке России: июнь-октябрь 1999 г. Совместное американо-российское научное исследование. Отчет по контракту Техасского университета Эй-энд-Эм, Колледж Стэйшн, штат Техас, и Камчатского института экологии и управления природными ресурсами Российской Академии Наук, Камчатка, Россия, для компании «Сахалин Энерджи Инвестмент Компани Лимитед», Южно-Сахалинск, Россия.69 стр. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com]

Weller, D.W., B. Würsig and A.M. Burdin. 2001. Gray whales off Sakhalin Island, Russia: June-September 2000. A joint U.S.-Russian scientific investigation. Unpublished contract report by Texas A&M University, College Station, TX, and Kamchatka Institute of Ecology and Nature Management, Russian Academy of Sciences, Petropavlosk-Kamchatkii, Russia, for Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia. 24 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

[Уэллер, Д. У., Б. Вюрсиг и А.М. Бурдин. 2001 г. Серые киты на шельфе о. Сахалин, Россия: июнь - сентябрь 2000 г. Совместное американо-российское научное исследование. Неопубликованный окончательный отчет по контракту Техасского университета Эй-энд-Эм, Колледж Стэйшн, штат Техас, и Камчатского института экологии и управления

природными ресурсами Российской Академии Наук, Петропавловск-Камчатский, Россия, для компании «Сахалин Энерджи Инвестмент Компани Лимитед», Южно-Сахалинск, Россия.Стр. 24. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com]

Weller, D.W., A.L. Bradford, A.M. Burdin, T. Miyashita, T. Kariya, A.M. Trushin, S.A. MacLean, V.A. Vladimirov and N.V. Doroshenko. 2002. Photographic recaptures of western gray whales in the Sea of Okhotsk. Report SC/54/BRG presented to the Int. Whal. Comm. Scientific Committee, Russia, 13, 8 p.

[Уэллер, Д. У., А. Л. Брадфорд, А.М. Бурдин, Т. Мияшита, Т. Кария, А.М. Трушин, С.А. Маклеан, В.А. Владимиров и Н.В. Дорошенко. 2002. "Повторная фотоидентификация серых китов западной популяции в Охотском море". Отчет SC/54/BRG, представленный в Международную китобойную комиссию, Научный комитете, Россия, 13, стр. 8 стр.]

Weller, D.W., A.M. Burdin, A.L. Bradford, G.A. Tsidulko, Y.V. Ivashchenko and R.L. Brownell Jr. 2003. Gray whales off Sakhalin Island, Russia: June-September 2001. A joint U.S.-Russian scientific investigation. Unpublished contract report by Texas A&M University, College Station, TX, Kamchatka Institute of Ecology and Nature Management, RAS, Petropavlovsk-Kamchatskii, Russia, and National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, USA for Sakhalin Energy Investment Company, Yuzhno-Sakhalinsk, Russia. 75 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

[Уэллер, Д. У., А.М. Бурдин, А. Л. Брадфорд, Г.А. Цидулко, Ю.В. Иващенко и Р. Л. Браунэл мл. 2003 г. "Серые киты сахалинского шельфа России". Июнь - сентябрь 2001 г. Совместное американо-российское научное исследование. Неопубликованный окончательный отчет по контракту Техасского университета Эй-энд-Эм, Колледж Стэйшн, штат Техас, и Камчатского института экологии и управления природными ресурсами РАН, Петропавловск-Камчатский, Россия, и Национальной службы морского рыбного хозяйства, Юго-западного научного центра рыбного хозяйства, Ла Джола, США для компании «Сахалин Энерджи Инвестмент Компани», Южно-Сахалинск, Россия.Стр.75 (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com].

Weller, D.W., A.M. Burdin, A.L. Bradford, Y.V. Ivashchenko, G.A. Tsidulko, A.R. Lang and R.L. Brownell Jr. 2004. Western gray whales off Sakhalin Island, Russia: A Joint Russia-U.S. Scientific Investigation July-September 2003. Unpublished report for International Fund for Animal Welfare and International Whaling Commission by Southwest Fisheries Science Center, La Jolla, CA, Kamchatka Branch of Pacific Institute of Geography, Petropavlovsk, Russia, and the Alaska Sealife Center, Seward, AK. 41 p.

[Уэллер, Д. У., А.М. Бурдин и Р.Л. Браунелл мл. 2003а. "Серые киты западной популяции сахалинского шельфа России". Промежуточный отчет по исследованиям 2003 г. Подготовлен для Международного

фонда благополучия животных и Международной китобойной комиссии Юго-западным научным центром рыбного хозяйства, Ла-Олла, Калифорния и Камчатским отделением тихоокеанского института географии, Петропавловск, Россия, а также Аляскинским центром морской флоры и фауны, Сивард, Аляска. Стр. 8.]

Weller, D.W., A.M Burdin, A.L. Bradford, Y.V. Ivashchenko, G.A. Tsidulko, A.R. Lang and R.L. Brownell Jr. 2005. Status of western gray whales off northeastern Sakhalin Island, Russia, in 2004. Document SC/57/BRG1, Scientific Committee, International Whaling Commission, Cambridge, UK.

Weller, D.W., Burdin, A.M., Bradford, A.L., Lang, A.R., Tsidulko, G.A., Kim, H.W. and Brownell, R.L. Jr. 2006. Status of western gray whales off northeastern Sakhalin Island, Russia, in 2005. Document SC/58/BRG3, Scientific Committee, International Whaling Commission, Cambridge, UK.

Wells, R.S. and M.D. Scott. 1990. Estimating bottlenose dolphin population parameters from individual identification and capture-release techniques. *In:* Individual Recognition of Cetaceans: Use of Photo-ID and Other Techniques to Estimate Population Parameters. P.S. Hammond, S.A. Mizroch, and G.P Donovan (Eds). Int. Whal. Comm. Special Issue 12. Cambridge. pp.407-415.

[Уэллс, Р.С. и Скотт М.Д. 1990 г. "Определение параметров популяции афалина методами идентификации отдельных особей и повторной поимки". *В публикации:*Распознание отдельных особей китообразных: использование фотоидентификации и других методов для оценки параметров популяции. П.С. Хамонд, С.А. Мизроч и Г.П. Донован (Ред). Международная китобойная комиссия, Спецвыпуск № 12. Кэмбридж. стр.407-415.]

Whitehead, H., J. Christal and S. Dufault. 1997. Past and distant whaling and the rapid decline of sperm whales off the Galapagos Islands. Cons. Biol. 11(6): 1387-1396.

[Уайтхед, Х., Дж. Кристал и С. Дюфо. 1997 г. Прошлый и будущий китобойный промысел и резкое снижение численности кашалотов у Галапагосских островов. Конс. биол. 11(6): стр. 1387-1396.]

Wilson, B., P.M. Thompson, and P.S. Hammond. 1997. Habitat use by bottlenose dolphins: seasonal distribution and stratified movement patterns in the Moray Firth, Scotland. Journal of Applied Ecology 34:1365-1374.

[Уилсон Б., П.М. Томпсон и П.С. Хаммонд. 1997 г. Использование мест обитания афалина: сезонное распределение и характер стратифицированного перемещения в зал. Морай Фирс, Шотландия. Журнал прикладной экологии №34. Стр 1365-1374.]

Würsig, B.G., D.W. Weller, A.M. Burdin, S.H. Reeve, A.L. Bradford, S.A. Blokhin and R.L. Brownell Jr. 1999. Gray whales summering off Sakhalin Island, Far East Russia: July-October 1997. A joint U.S.-Russian scientific investigation. Unpublished contract Report by Texas A&M University, College Station, TX and Kamchatka Institute of Ecology and Nature Management, Russian Academy of Sciences, Kamchatka, Russia, for Sakhalin Energy Investment Company Limited and Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia. 101 p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

[Вюрсиг, Б.Г., Д. У.Уэллер, А.М. Бурдин, С.Х. Рив, А.Л. Брэдфорд, С.А. Блохин и Р.Л. Браунэл мл. 1999 г. "Серые киты, проводящие лето на шельфе о. Сахалин на Дальнем Востоке России":июль-октябрь 1997 г. Совместное американо-российское научное исследование. Неопубликованный окончательный отчет по контракту Техасского университета Эй-энд-Эм, Колледж Стэйшн, штат Техас, и Камчатского института экологии и управления природными ресурсами Российской Академии Наук, Камчатка, Россия, для компаний «Сахалин Энерджи Инвестмент Компани Лимитед» и «Эксон Нефтегаз Лимитед», Южно-Сахалинск, Россия.Стр. 101. (имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com].

Yablokov, A.V., and L.S. Bogoslovskaya. 1984. A review of Russian research on the biology and commercial whaling of the gray whale. Pages 465-485 In: M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.) The gray whale *Eschrichtius robustus*, Academic Press, Orlando, FL.

[Яблоков, А.В., и Л.С. Богословская. 1984 г. "Обзор российских исследований по биологии и промышленному промыслу серого кита". Стр. 465-485 в публикации М.Л. Джонса, С.Л. Шварца и С. Лезервуда (ред.) "Серые киты *Eschrichtius robustus*", Изд. "Академик пресс", Орландо, Флорида.]

Yakovlev, Y.M. and O.Y. Tyurneva. 2003. Photo-ID of the Okhotsk-Korean gray whale (*Eschrichtius robustus*) population in 2002. Unpublished final report for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia, 27p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

[Ю.М. Яковлев и О.Ю. Тюрнева. 2003 г. "Фотоидентификация охотско-корейской популяции серого кита (*Eschrichtius robustus*) в 2002 г." Неопубликованный отчет по контракту для компаний "Эксон Нефтегаз Лимитед", Южно-Сахалинск, Россия, и "Сахалин Энерджи Инвестмент Компани Лимитед", Южно-Сахалинск, Россия.(имеется на сайте компании "Сахалин Энерджи Инвестмент Компани" http://www.sakhalinenergy.com).]

Yakovlev, Y.M. and O.Y. Tyurneva. 2004. Photo-ID of the Okhotsk-Korean gray whale (*Eschrichtius robustus*) population in 2003. Unpublished final report for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia, 52p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

Yakovlev, Yu.M. and O.Y. Tyurneva. 2005a. A Note on Photo-IDentification of the Western Gray Whales *(Eschrichtius robustus)* offshore NE Sakhalin, Russia, 2002-2004. Report SC/57/BRG9 presented to the Int. Whal. Comm. Scientific Committee, Ulsan, Korea, June 2005, (unpublished), 3pp.

[Яковлев Ю.М. и Тюрнева О.Ю. 2005а. Сведения о фотоидентификации западых серых китов (Eschrichtius robustus) на северо-восточном шельфе о. Сахалин, Россия, в 2002-04гг. Отчет SC/57/BRG9, представленный на

научном комитете Международной Китобойной Комиссии в г. Ульсан, Южная Корея, июнь 2005г. (неопубликовано), 3 стр.]

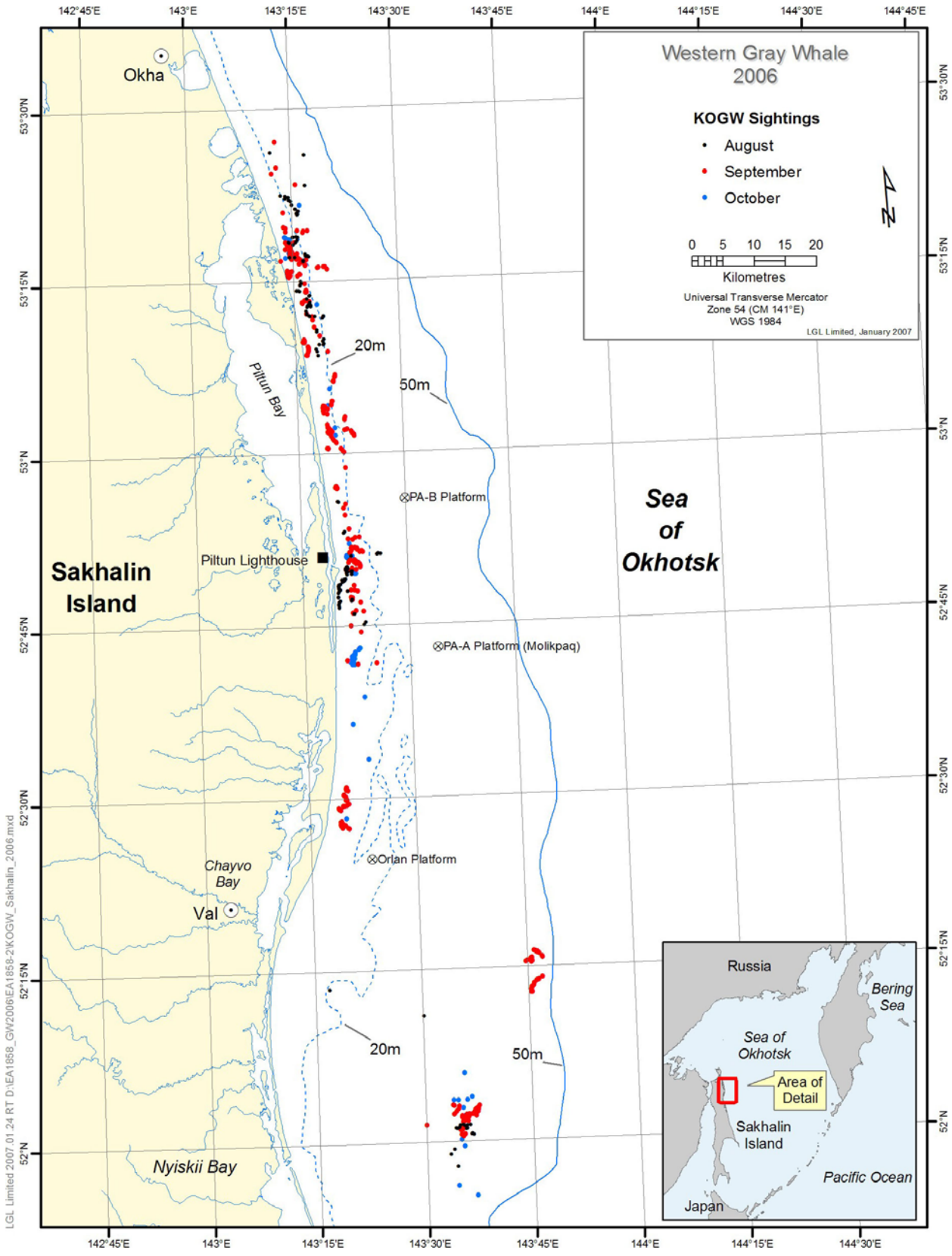
Yakovlev, Yu.M. and O.Y. Tyurneva. 2005b. Photo-identification of the western gray whale (*Eschrichtius robustus)* Offshore NE Sakhalin, Russia, 2002-2004. Abstract of 14 Annual Meeting North Pacific Marine Science Organization (PICES), Vladivostok, September 29 - October 9, 2005. S3-2353, P. 35.

[Яковлев Ю.М. и Тюрнева О.Ю. 2005б. Фотоидентификация западых серых китов (Eschrichtius robustus) на северо-восточном шельфе о. Сахалин, Россия, в 2002-04гг. Абстракт 14 ежегодного совещания Северо-Тихооканской Морской Научной Организации (ПАЙСИС), Владивосток, 29 сентября – 9 ноября 2005г. S3-2353. стр. 35.]

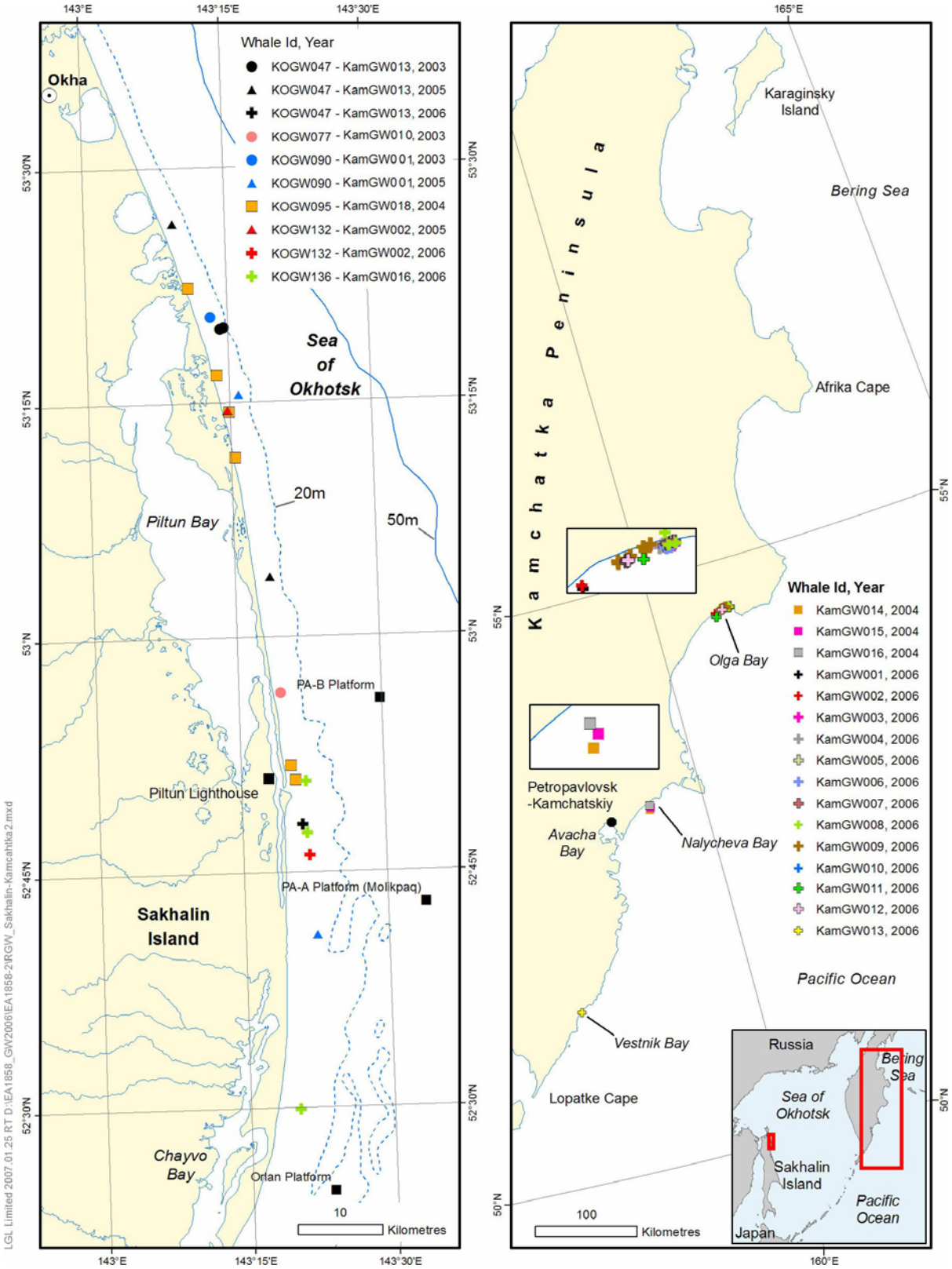
Yakovlev, Y.M. and O.Y. Tyurneva. 2005c. Photo-ID of the Okhotsk-Korean gray whale (*Eschrichtius robustus*) population in 2004. Unpublished final report for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia, 75p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

Yakovlev, Y.M. and O.Yu. Tyurneva. 2006. Photographic identification of the Okhotsk-Korean gray whale (Eschrichtius robustus) along northeast Sakhalin Island, Russia, 2005. Unpublished final report for Exxon Neftegas Limited, Yuzhno-Sakhalinsk, Russia and Sakhalin Energy Investment Company Limited, Yuzhno-Sakhalinsk, Russia, 75p. [available on the Sakhalin Energy Investment Company website http://www.sakhalinenergy.com].

APPENDIX FIGURES



Appendix Figure A1. Gray whale photo-ID sites along the NE coast of Sakhalin Island, 2006.



Appendix Figure A2. Gray whale photo-ID locations along the SE coast of the Kamchatka Peninsula in 2004 and 2006 and locations of encounters with the whales that used the NE coast of Sakhalin Island, 2002 to 2006.

APPENDIX TABLES

Appendix Table A1.Time spent at each gray whale sighting from the zodiac, 2006.

N	Date	Number of missions	Duration of each gray whale sighting (minutes)													
			N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	Âñåãî
1	14.08.2006	1	24	12	2	24	34	10	20							126
2	19.08.2006	1	15	21	8	11	16	27	19	22	8	34	7	17	12	217
3	22.08.2006	1	12	12	34	7	22	21								108
4	24.08.2006	2	6	22	17	12	7	11	10	9						94
5	**26.08.2006**	1	34	62	7											103
6	31.08.2006	1	28													28
7	02.09.2006	1	64	33	10											107
8	04.09.2006	2	20	14	3	26	8	21								92
9	06.09.2006	2	27	16	15	13	7	10	18							106
10	07.09.2006	1	10	11	15	21										57
11	08.09.2006	1	34	16	4											54
12	13.09.2006	1	8	22	16	2	36									84
13	**13.09.2006**	1	26	7	18	8	33	60								152
14	**16.09.2006**	2	62	11	14	14	17	14	43	8	33	49				265
15	**17.09.2006**	1	8	48	6											62
16	27.09.2006	2	15	32	15	16	39	18	41	30						206
17	28.09.2006	2	0	16	30	22										68
18	29.09.2006	1	39	20												59
19	01.10.2006	1	29	16	26	7	27	16	12							133
20	09.10.2006	1	37	36	4	10										87
Total:		26														2208

Highlighted rows (gray) and bold type indicate measurements taken in the Offshore area
Bold type indicate measurements taken in the Chayvo area

Appendix Table A2. Gray whale group size at each sighting in the course of photo-ID efforts from the zodiac during the 2006 expedition.

N	Date	Group size for each sighting (from zodiac)													Total number of whales sighted from zodiac
		N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	
1	14.08.2006	2	3	2	4	2	2	2							17
2	19.08.2006	1	2	1	4	1	3	2	5	2	4	2	1	2	30
3	22.08.2006	1	1	1	2	1	2								8
4	24.08.2006	2	5	3	1	1	1	1	1						15
5	**26.08.2006**	1	4	3											8
6	31.08.2006	2													2
7	02.09.2006	2	1	2											5
8	04.09.2006	1	3	1	2	1	8								16
9	06.09.2006	4	3	3	2	2	2	1							17
10	07.09.2006	2	2	1	1										6
11	08.09.2006	1	1	2											4
12	13.09.2006	1	2	4	1	2									10
13	**13.09.2006**						5	1	4	1	5	4			20
14	**16.09.2006**	1	1	1	1	5	1	2	3	3	2				20
15	**17.09.2006**	1	6	1											8
16	27.09.2006	3	3	1	1	2	1	4	1						16
17	28.09.2006	0	3	3	3										9
18	29.09.2006	2	1												3
19	01.10.2006	4	2	1	1	3	2	1							14
20	09.10.2006	3	4	1	2										10
21	Total:														238

Highlighted rows (gray) and bold type indicate measurements taken in the Offshore area.
Bold type indicate measurements taken in the Chayvo area.

Appendix Table A3. Aspects photographed of gray whale individuals off the NE coast of Sakhalin Island and offshore the Kamchatka Peninsula in 2002-2006.

No. KOGW	No. KamGW	2002					2003					2004					2005					2006					Qas for
		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		02-06
KOGW001		Y	Y	Y	Y	**Y**						Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y			**Y**	4
KOGW002		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	4
KOGW003		Y	Y	Y	Y	**Y**																					4
KOGW004		Y	Y			**Y**	Y	Y	Y	Y	**Y**																4
KOGW005		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y			**Y**	Y	Y	Y	Y	**Y**	4
KOGW006		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	4
KOGW007		Y	Y	Y	Y	**Y**			Y	Y	**Y**		Y	Y		**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	4
KOGW008		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	4
KOGW009		Y	Y	Y	Y	**Y**					**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	4
KOGW010		Y	Y			**Y**						Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y		Y	Y	**Y**	4
KOGW011		Y	Y			**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y			**Y**	4
KOGW012		Y	Y	Y		**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**		Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	4
KOGW013		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	4
KOGW014		Y	Y	Y	Y	**Y**						Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y		Y		**Y**	4
KOGW015		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**						Y	Y	Y	Y	Y	Y	Y	Y	Y	**Y**	4
KOGW016		Y	Y			**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y		**Y**	**Y**	**Y**			**Y**	4
KOGW017			Y			**N**											Y	Y			**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW018		Y	Y	Y	Y	**Y**		Y			**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW019		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW020		Y				**N**	Y	Y	Y		**Y**	Y	Y	Y	Y	**Y**	Y	Y			**Y**	**Y**	**Y**	**Y**		**Y**	4
KOGW021		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**			**Y**	4
KOGW022		Y	Y	Y	Y	**Y**						Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW023		Y	Y			**Y**						Y	Y	Y	Y	**Y**						**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW024		Y				**N**											Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW025		Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y				**Y**	Y	Y	Y		**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW026		Y	Y			**Y**	Y	Y			**Y**						Y	Y			**Y**	**Y**	**Y**			**Y**	2
KOGW027			Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y			**Y**	**Y**	**Y**	**Y**			4
KOGW028		Y	Y	Y		**Y**	Y	Y	Y	Y	**Y**	Y	Y			**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**		**Y**	4
KOGW029		Y	Y			**Y**	Y	Y			**Y**	Y	Y			**Y**	Y	Y				**Y**	**Y**			**Y**	2
KOGW030		Y	Y			**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW031		Y				**N**		Y	Y	Y	**Y**	Y		Y		**Y**						**Y**		**Y**	**Y**	**Y**	4
KOGW032		Y	Y		Y	**Y**	Y	Y	Y		**Y**	Y	Y	Y	Y	**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**		**Y**	**Y**	4
KOGW033		Y	Y			**Y**	Y	Y	Y	Y	**Y**	Y	Y		Y	**Y**	Y	Y			**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW034		Y	Y			**Y**							Y			**Y**	Y	Y			**Y**	**Y**	**Y**			**Y**	2
KOGW035		Y	Y			**Y**	Y	Y	Y	Y	**Y**	Y	Y			**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4
KOGW036		Y				**N**	Y	Y	Y	Y	**Y**	Y	Y	Y		**Y**	Y	Y	Y	Y	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	4

No. KOGW	No. KamGW	2002					2003					2004					2005					2006					Qas for
		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		02-06
KOGW037		Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW038		Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	4
KOGW039		Y				N	Y	Y		Y	Y						Y	Y			Y	Y	Y			Y	3
KOGW040		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y			Y						4
KOGW041		Y	Y			Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y			Y	4
KOGW042		Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW043			Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW044		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y		Y	Y	Y			Y	4
KOGW045		Y	Y	Y		Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	4
KOGW046							Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW047	KamGW013						Y	Y	Y	Y	Y											Y	Y	Y	Y	Y	4
KOGW048							Y	Y			Y	Y	Y		Y	Y	Y	Y			Y	Y	Y			Y	3
KOGW049							Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW050							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	4
KOGW051							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						4
KOGW052							Y	Y			Y																2
KOGW053							Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	Y	Y			Y	4
KOGW054							Y	Y	Y	Y	Y			Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW055							Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	Y		Y	Y	Y	4
KOGW056							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	4
KOGW057							Y	Y	Y	Y	Y											Y	Y	Y	Y	Y	4
KOGW058							Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			Y	4
KOGW059							Y	Y			Y						Y	Y	Y	Y	Y	Y	Y			Y	4
KOGW060							Y	Y	Y	Y	Y	Y	Y			Y	Y	Y			Y	Y	Y			Y	4
KOGW061							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW062							Y	Y			Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	4
KOGW063							Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW064							Y	Y	Y		Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	4
KOGW065							Y	Y			Y																2
KOGW066							Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW067							Y	Y			Y		Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	4
KOGW068							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	4
KOGW069							Y	Y			Y	Y	Y			Y	Y	Y			Y	Y	Y			Y	2
KOGW070							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	4
KOGW071							Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	4
KOGW072							Y	Y			Y	Y	Y			Y	Y	Y			Y		Y			N	2
KOGW073							Y	Y			Y																2
KOGW074							Y	Y	Y	Y	Y			Y		N			Y		Y	Y	Y	Y	Y	Y	4
KOGW075							Y	Y			Y																2
KOGW076							Y	Y			Y	Y	Y			Y	Y	Y			Y	Y	Y	Y	Y	Y	4

No. KOGW	No. KamGW	2002					2003					2004					2005					2006					Qas for
		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		02-06
KOGW077	KamGW010						Y	Y			Y											Y	Y	Y	Y	Y	4
KOGW078							Y	Y			Y	Y	Y	Y		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	4
KOGW079							Y	Y			Y						Y	Y	Y		Y						3
KOGW080							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y		Y	4
KOGW081							Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			4
KOGW082							Y	Y			Y	Y	Y			Y	Y	Y			Y	Y	Y			Y	2
KOGW083							Y	Y			Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y			Y	4
KOGW084							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	4
KOGW085							Y				N	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y			Y	4
KOGW086							Y	Y			Y	Y	Y	Y		Y	Y	Y	Y	Y	Y						4
KOGW087								Y			N	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y				4
KOGW088							Y	Y	Y	Y	Y																4
KOGW089								Y			N											Y	Y			Y	2
KOGW090	KamGW001							Y			N							Y	Y	Y	N	Y	Y			Y	3
KOGW091							Y				N											Y	Y			Y	2
KOGW092								Y			N	Y	Y			Y		Y	Y		Y	Y	Y			Y	2
KOGW093												Y	Y			Y	Y	Y	Y		Y	Y	Y			Y	3
KOGW094												Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	4
KOGW095	KamGW008											Y	Y	Y	Y	Y						Y	Y			Y	4
KOGW096												Y	Y			Y	Y	Y			Y	Y				Y	2
KOGW097												Y		Y	Y	Y											3
KOGW098												Y	Y			Y											2
KOGW099												Y	Y			Y	Y	Y	Y		Y	Y	Y				2
KOGW100												Y	Y			Y											2
KOGW101												Y	Y			Y											2
KOGW102												Y	Y			Y	Y	Y			Y	Y	Y				2
KOGW103												Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	4
KOGW104												Y	Y	Y	Y	Y	Y	Y			Y						4
KOGW105												Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW106												Y	Y			Y	Y	Y			Y	Y	Y			Y	2
KOGW107												Y				N	Y	Y			Y	Y	Y			Y	2
KOGW108												Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW109												Y	Y			Y						Y	Y	Y	Y	Y	4
KOGW110												Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW111												Y	Y	Y	Y	Y	Y	Y			Y						4
KOGW112												Y	Y			Y	Y				Y	Y	Y	Y	Y	Y	4
KOGW113												Y	Y			Y	Y	Y	Y	Y	Y	Y	Y				4
KOGW114												Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW115													Y		Y	N	Y	Y			Y	Y	Y	Y	Y	Y	4
KOGW116													Y		Y	N	Y	Y	Y		Y	Y	Y			Y	4

No. KOGW	No. KamGW	2002					2003					2004					2005					2006					Qas for
		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		RS	LS	DF	VF		02-06
KOGW117																	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW118																	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4
KOGW119																	Y	Y			Y	Y	Y	Y	Y	Y	4
KOGW120																	Y	Y			Y						2
KOGW121																	Y	Y	Y	Y	Y	Y	Y			Y	4
KOGW122																	Y	Y	Y	Y	Y						4
KOGW123																	Y	Y	Y	Y	Y	Y				Y	4
KOGW124																	Y	Y			Y	Y				Y	4
KOGW125																	Y	Y			Y	Y	Y	Y		Y	3
KOGW126																	Y	Y			Y						2
KOGW127																	Y	Y			Y	Y	Y			Y	2
KOGW128																	Y	Y			Y						2
KOGW129																	Y	Y			Y	Y	Y			Y	2
KOGW130																	Y	Y			Y						2
KOGW131																	Y	Y			Y						2
KOGW132	KamGW002																Y	Y			Y	Y	Y				2
KOGW133																	Y	Y			Y	Y	Y	Y			3
KOGW134																	Y	Y			Y						2
KOGW135								Y					Y				Y	Y			N	Y	Y	Y	Y	Y	4
KOGW136	KamGW016											Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	
KOGW137																						Y	Y	Y	Y	Y	4
KOGW138																						Y	Y	Y	Y	Y	4
KOGW139																						Y	Y	N	N	Y	2
KOGW140																						Y	Y	N	Y	Y	3
KOGW141																						Y	Y	N	N	Y	2
KOGW142																						Y	Y	N	N	Y	2
KOGW143																						Y	Y	N	N	Y	2
KOGW144																						Y	Y	Y	N	Y	3
KOGW145																						Y	Y	Y	Y	Y	4
KOGW146																						Y	N	N	N	N	1
KOGW147																						Y	Y	N	N	Y	2
TEMP01		Y																									1
TEMP03																							Y			N	1
TEMP04																						Y				N	1
TEMP05																						Y				N	1
TEMP06																						Y				N	1
TEMP07																						Y				N	1
TEMP08																							Y				1

Observed in two regions during one season

Observed offshore the Kamchatka Peninsula in previous years

Observed offshore the Kamchatka Peninsula in 2006

Observed offshore Sakhalin Island in 2006.

Appendix Table A4. Number of sightings of photo-identified gray whales in different areas during the 2002-2006 expeditions on the NE Sakhalin shelf and on the SE Kamchatka shelf.

No. of whale KOGW	No. of whale KamGW	2002		2003		2004			2005				2006			
		Area		Area		Area			Area				Area			
		Piltun	Offshore	Piltun	Offshore	Piltun	Offshore	Kamchatka	Piltun	Offshore	Northern	Cape Elizaveta	Piltun	Offshore	Chaivo	Kamchatka
KOGW001			1			2	1		**2**				1			
KOGW002			3		4	2			5				2	1		
KOGW003			2													
KOGW004			1		2											
KOGW005			1	2		5			2						3	
KOGW006			2	2		2					1			1		
KOGW007			1		1	1			3				5		1	
KOGW008			2		1	3			1		1		1	1		
KOGW009			2			2			4				5			
KOGW010			1			3			3				1			
KOGW011			2		3	3			7				5			
KOGW012			1		3	3			1				2	2		
KOGW013			1		2	2			2				1	2		
KOGW014			2			1			2				1	1		
KOGW015			3		1				4				6			
KOGW016			2	1		3			2				1	2		
KOGW017			1						3				1	2		
KOGW018		1		1		1			6				10			
KOGW019			3		4	4	2		1					4		
KOGW020			1		2	2			6				1	1	1	
KOGW021			2		4	5			3				2			
KOGW022		1				3			2				4		1	
KOGW023		2				2			2				3		1	
KOGW024		1							4				1		2	
KOGW025		2	1		2	1			1					3		
KOGW026		2		2					4				1			
KOGW027		1		2		1			4						1	
KOGW028			1	3		2			4				3			
KOGW029		1		1		2			4				4			
KOGW030		2		2		3			5				8			
KOGW031		1				1							2			
KOGW032			2	1		2			4				2			
KOGW033			1		2	2			2					1		
KOGW034			2			1			4				4			

No. of whale KOGW	No. of whale KamGW	2002		2003		2004			2005				2006			
		Area		Area		Area			Area				Area			
		Piltun	Offshore	Piltun	Offshore	Piltun	Offshore	Kamchatka	Piltun	Offshore	Northern	Cape Elizaveta	Piltun	Offshore	Chaivo	Kamchatka
KOGW035			1	2	2	3			2				3			
KOGW036			1		3	1			5				1	1		
KOGW037			2	1		3			3				3			
KOGW038			1	2	1	6							4			
KOGW039			1	2					2				2		1	
KOGW040			1	1		1			2							
KOGW041			1			2			3					1		
KOGW042		1				2			4					1		
KOGW043			1	2	2	3			4					1		
KOGW044			1	2		4			6						1	
KOGW045			1		1		1		1						1	
KOGW046					2	1			4	1			2	3		
KOGW047	KamGW013			2					2				1			1
KOGW048				1		2			3				3			
KOGW049				1		1			2		1		1	2		
KOGW050				3		6			1				8			
KOGW051					3	3	1		2							
KOGW052				2												
KOGW053				1					3				4			
KOGW054					1	1			2					3		
KOGW055				1					1				3			
KOGW056				3		2			3				4			
KOGW057					1								2	2		
KOGW058					2	2			3						1	
KOGW059				2	1				4				1	1		
KOGW060				2		2			3				3			
KOGW061				1		3			4						1	
KOGW062				1		1	1		4				1	2		
KOGW063				1		4			3				5			
KOGW064				1		3			4				2			
KOGW065				1												
KOGW066					3	1			2				3		1	
KOGW067				2		1			1				6	1		
KOGW068					1	4			2				6			
KOGW069				2		2			2				2	1	1	
KOGW070					3	2			3				2		3	
KOGW071				1		4			2				1			
KOGW072				4		1			3				1			

No. of whale KOGW	No. of whale KamGW	2002		2003		2004			2005				2006			
		Area		Area		Area			Area				Area			
		Piltun	Offshore	Piltun	Offshore	Piltun	Offshore	Kamchatka	Piltun	Offshore	Northern	Cape Elizaveta	Piltun	Offshore	Chaivo	Kamchatka
KOGW073				1												
KOGW074				3		1			1				5		1	
KOGW075				2												
KOGW076				1		2			1				4	1		
KOGW077	KamGW010			1												1
KOGW078				3		2			5				4			
KOGW079				1					3							
KOGW080				1		4							4		2	
KOGW081				3		2			4				1		1	
KOGW082				3		1			2				2		1	
KOGW083				1		1			4				4			
KOGW084					3	3								2		
KOGW085					2	1			5				1	1		
KOGW086					2	3			2							
KOGW087					1	5			2				1			
KOGW088					1											
KOGW089				1									4		1	
KOGW090	KamGW001			1												1
KOGW091					1								4			
KOGW092					1	4			3				6			
KOGW093						1			2				3		1	
KOGW094						3			2				4			
KOGW095	KamGW008					6										1
KOGW096						4			1				1			
KOGW097						2	1									
KOGW098						1										
KOGW099						1			5				2			
KOGW100						2										
KOGW101						2										
KOGW102						3			5				3			
KOGW103						2			2				1	2		
KOGW104						1	1		1							
KOGW105						1			9				4		1	
KOGW106						2			2				7			
KOGW107						1			3				2			
KOGW108						1			4				1		2	
KOGW109						2							4			

No. of whale KOGW	No. of whale KamGW	2002		2003		2004			2005				2006			
		Area		Area		Area			Area				Area			
		Piltun	Offshore	Piltun	Offshore	Piltun	Offshore	Kamchatka	Piltun	Offshore	Northern	Cape Elizaveta	Piltun	Offshore	Chaivo	Kamchatka
KOGW109						2							4			
KOGW110						4			2	1				3		
KOGW111						1			1							
KOGW112						1			1				4			
KOGW113						2			2				1			
KOGW114						1			3					2		
KOGW115						1			1				3		1	
KOGW116						1			4				1			
KOGW117									2				1		1	
KOGW118									5				1			
KOGW119									3				1	4		
KOGW120										1						
KOGW121									2				2			
KOGW122												2				
KOGW123									1	1				1		
KOGW124									2				2			
KOGW125									6				2			
KOGW126									4							
KOGW127									2				1			
KOGW128									1							
KOGW129									2				3			
KOGW130									2							
KOGW131									2							
KOGW132	KamGW002								1				1			1
KOGW133				1					4				2		1	
KOGW134				1					3							
KOGW135				1		1			3				5			
KOGW136	KamGW016								1				2		1	
KOGW137													12	1		
KOGW138													2			
KOGW139													2			
KOGW140													4			
KOGW141													2			
KOGW142													4			
KOGW143													2			
KOGW144													3			
KOGW145													3			
KOGW146													3			

No. of whale KOGW	No. of whale KamGW	2002		2003		2004			2005				2006			
		Area		Area		Area			Area				Area			
		Piltun	Offshore	Piltun	Offshore	Piltun	Offshore	Kamchatka	Piltun	Offshore	Northern	Cape Elizaveta	Piltun	Offshore	Chaivo	Kamchatka
KOGW147													1			
TEMPGW1		1														
TEMPGW2		LS FOR KOGW135														
TEMPGW3													1			
TEMPGW4															1	
TEMPGW5													1			
TEMPGW6													1			
TEMPGW7													1			
TEMPGW8															1	

Appendix Table A5. Occurrence of photo-identified gray whales on the northeastern Sakhalin shelf, 2002-2006.

No. of whale	Number of whale occurrence days					
	2002	2003	2004	2005	2006	Total 5 yrs
KOGW001	1		3	2	1	7
KOGW002	3	4	2	5	3	17
KOGW003	2					2
KOGW004	1	2				3
KOGW005	2	2	5	2	3	14
KOGW006	2	2	2	1	1	8
KOGW007	1	1	1	1	6	10
KOGW008	1	1	3	2	2	9
KOGW009	3		2	4	5	14
KOGW010	1		3	3	1	8
KOGW011	2	3	3	7	5	20
KOGW012	1	3	3	1	4	12
KOGW013	1	2	2	2	3	10
KOGW014	1		1	2	2	6
KOGW015	3	1		4	6	14
KOGW016	1	1	3	2	3	10
KOGW017	3			3	3	9
KOGW018	1	1	1	6	10	19
KOGW019	1	4	6	1	4	16
KOGW020	2	2	2	6	3	15
KOGW021	1	4	5	3	2	15
KOGW022	1		3	2	5	11
KOGW023	2		2		4	8
KOGW024	1			2	3	6
KOGW025	2	2	1	4	3	12
KOGW026	1	2		1	1	5
KOGW027	2	2	1	4	1	10
KOGW028	2	3	2	4	3	14
KOGW029	2	1	2	4	4	13
KOGW030	2	2	3	5	8	20
KOGW031	1		1		2	4
KOGW032	1	1	2	4	2	10
KOGW033	1	2	2	2	1	8
KOGW034	1		1	4	4	10
KOGW035	1	4	3	2	3	13
KOGW036	1	3	1	5	2	12
KOGW037	1	1	3	3	3	11
KOGW038	1	3	6		4	10
KOGW039	2	2		2	3	9
KOGW040	2	1	1	2		6
KOGW041	1		2	3	1	7
KOGW042	1		2	4	1	8
KOGW043	1	4	3	4	1	13
KOGW044	1	2	4	6	1	14
KOGW045		1	1	1	1	4
KOGW046		2	1	5	5	13
KOGW047		2		2	1	5
KOGW048		1	2	3	3	9
KOGW049		1	1	3	3	8
KOGW050		3	6	1	8	18
KOGW051		2				2
KOGW052		1		3		4
KOGW053		1	1	2	4	8
KOGW054		1		1	3	5
KOGW055		3	2	3	3	11
KOGW056		1			4	4
KOGW057		2	2	3	4	11
KOGW058		3		4	1	8
KOGW059		2	2	3	2	9
KOGW060		1	3	4	3	11
KOGW061		1	2	4	1	8
KOGW062		1	4	3	3	11
KOGW063		1	3	4	5	13
KOGW064		1			2	3
KOGW065		3	1	2		6
KOGW066		2	1	1	4	8
KOGW067		1	4	2	7	14

No. of whale	Number of whale occurrence days					
	2002	2003	2004	2005	2006	Total 5 yrs
KOGW068		2	2	2	6	12
KOGW069		3	2	3	4	12
KOGW070		1	4	2	5	12
KOGW071		4	1	3	1	9
KOGW072		1			1	2
KOGW073		3	1	1		5
KOGW074		2			6	8
KOGW075		1	2	1		4
KOGW076		1			5	6
KOGW077		3	2	5		10
KOGW078		1		3	4	8
KOGW079		1	4			5
KOGW080		3	2	4	6	15
KOGW081		3	1	2	2	8
KOGW082		1	1	4	3	9
KOGW083		3	3		4	10
KOGW084		2	1	5	2	10
KOGW085		2	3	2	2	9
KOGW086		1	5	2		8
KOGW087		1	2		1	4
KOGW088		1	1	8		9
KOGW089		1			5	6
KOGW090		1	1			2
KOGW091		1	4	3	4	8
KOGW092			1	2	6	9
KOGW093			3	2	4	9
KOGW094			6	1	4	10
KOGW095			4	1		5
KOGW096			3		1	4
KOGW097			1			1
KOGW098			1	5		6
KOGW099			2		2	2
KOGW100			2			2
KOGW101			3	5		8
KOGW102			2	2	3	7
KOGW103			2	1	3	6
KOGW104			1	9		10
KOGW105			2	2	5	9
KOGW106			1	3	7	11
KOGW107			1	4	2	7
KOGW108			2		3	5
KOGW109			4	3	4	11
KOGW110			1	1	3	4
KOGW111			1	1		2
KOGW112			2	2	4	8
KOGW113			1	3	1	5
KOGW114			1	1	2	4
KOGW115			1	4	4	9
KOGW116				2	1	3
KOGW117				5	2	7
KOGW118				3	1	4
KOGW119				1	5	6
KOGW120				2		2

No. of whale	Number of whale occurrence days					
	2002	2003	2004	2005	2006	Total 5 yrs
KOGW121				2	2	4
KOGW122				2		2
KOGW123				2	1	3
KOGW124				6	2	8
KOGW125				4	2	6
KOGW126				2		2
KOGW127				1	1	2
KOGW128				2		2
KOGW129				2	3	5
KOGW130				2		2
KOGW131				1		1
KOGW132					1	1
KOGW133					3	3
KOGW134						
KOGW135			1	1	5	5
KOGW136					3	3
KOGW137					13	13
KOGW138					2	2
KOGW139					2	2
KOGW140					4	4
KOGW141					2	2
KOGW142					4	4
KOGW143					2	2
KOGW144					3	3
KOGW145					3	3
KOGW146					3	3
KOGW147					1	1
TEMPGW1	1					1
TEMPGW2	LS FOR KOGW135					
TEMPGW3					1	1
TEMPGW4					1	1
TEMPGW5					1	1
TEMPGW6					1	1
TEMPGW7					1	1
TEMPGW8					1	1
	66	**154**	**219**	**326**	**390**	**1155**

Appendix Table A6. Dates and location where identified gray whales were observed off the NE Sakhalin shelf and SE Kamchatka shelf, 2002-2006.

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW001						2004_09_05	pil	2005_07_14	pil	0	2006_09_07	pil	1
						2004_09_11	pil	2005_08_25	pil	0			
						2004_09_30	off	2005_09_07					
KOGW002		2002_09_11	off	2003_08_27	off	2004_09_11	pil	2005_07_14	pil	2	2006_08_24	pil	1
		2002_09_14	off	2003_08_28	off	2004_09_24	pil	2005_07_17	pil	2	2006_09_04	pil	1
		2002_09_14	off	2003_09_05	off			2005_07_23	pil	2	2006_09_16	off	1
		2002_09_23	off	2003_09_08	off			2005_08_25	pil	1			
								2005_09_25	pil	0			
KOGW003		2002_09_14	off										
		2002_09_24	off										
KOGW004		2002_09_14	off	2003_08_27	off								
				2003_09_06	off								
ROGW005		2002_09_23	off	2003_08_25	pil	2004_09_05	pil	2005_07_26	pil	4	2006_09_13	Chay	
				2003_09_18	pil	2004_09_14	pil	2005_08_08	pil	4	2006_09_25	Chay	
						2004_09_22	pil	2005_09_29			2006_09_06	Chay	
						2004_09_24	pil						
						2004_09_29	pil						
KOGW006		2002_09_16	off	2003_08_24	pil	2004_08_17	pil	2005_09_08	N	0	2006_09_16	off	1
		2002_09_24	off	2003_09_02	pil	2004_09_04	pil	2005_09_19		0			
KOGW007		2002_09_16	off	2003_08_18	off	2004_09_08	pil	2005_08_09	pil	0	2006_08_22	pil	2
								2005_08_20	pil	0	2006_09_02	pil	2
								2005_09_01	pil	0	2006_09_07	pil	3-4
											2006_09_13	Chay	1
											2006_09_28	pil	
											2006_10_01	pil	1
KOGW008		2002_09_16	off	2003_09_18	off	2004_09_05	pil	2005_09_08	N	1	2006_08_19	pil	2
		2002_10_12	off			2004_09_14	pil	2005_09_25	pil	0	2006_09_16	off	2
						2004_09_24	pil						
KOGW009		2002_09_16	off			2004_08_07	pil	2005_07_17	pil	0	2006_09_11	pil	
		2002_09_17	off			2004_09_05	pil	2005_08_20	pil	0	2006_09_28	pil	
		2002_09_23	off					2005_08_25	pil	0	2006_09_29	pil	
								2005_10_01			2006_09_30	pil	
								2005_09_25	pil	0	2006_10_01	pil	

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW010		2002_09_24	off			2004_09_13	pil	2005_08_07	pil	0	2006_08_19	pil	
						2004_09_15	pil	2005_08_21	pil	0			
						2004_09_23	pil	2005_08_23	pil	0			
KOGW011		2002_09_24	off	2003_08_18	off	2004_09_05	pil	2005_07_14	pil	2	2006_09_04	pil	
		2002_10_10	off	2003_08_27	off	2004_09_10	pil	2005_07_26	pil	2	2006_09_06	pil	
				2003_09_07	off	2004_09_23	pil	2005_08_20	pil	2	2006_09_25	pil	
								2005_08_09	pil	2	2006_09_29	pil	
								2005_08_16	pil	1	2006_09_30	pil	
								2005_08_24	pil	0			
								2005_08_25	pil	0			
KOGW012		2002_09_23	off	2003_08_28	off	2004_08_07	pil	2005_08_23	pil	0	2006_08_19	pil	
				2003_09_05	off	2004_09_13	pil	2005_10_01			2006_09_04	pil	
				2003_09_13	off	2004_09_24	pil				2006_10_03	off	
											2006_10_08	off	
KOGW013		2002_09_24	off	2003_09_06	off	2004_08_07	pil	2005_08_20	pil	2	2006_08_26	off	1
				203_09_10	off	2004_09_11	pil	2005_08_25	pil	2	2006_09_25	pil	
								2005_09_29			2006_10_03	off	
KOGW014		2002_09_24	off			2004_09_11	pil	2005_07_26	pil	0	2006_08_24	pil	
		2002_10_11	off					2005_08_20	pil	0	2006_09_17	off	
KOGW015		2002_09_23	off	2003_09_07	off			2005_07_14	pil	0	2006_08_19	pil	
		2002_09_24	off					2005_07_17	pil	0	2006_09_06	pil	
		2002_10_11	off					2005_07_27	pil	0	2006_09_26	pil	
											2006_09_27	pil	
											2006_09_29	pil	
								2005_08_21	pil	0	2006_10_06	pil	
KOGW016		2002_09_24	off	2003_09_04	pil	2004_08_29	pil	2005_08_08	pil	0	2006_08_25	pil	
		2002_10_12	off			2004_09_13	pil	2005_10_01	pil	0	2006_08_26	off	
						2004_09_22	pil	2005_09_07			2006_10_08	off	
KOGW017		2002_09_24	off	2003_08_28	off	2004_09_15	pil	2005_07_17	pil	0	2006_09_04	pil	
				2003_09_05	off	2004_09_24	pil	2005_08_09	pil	0	2006_09_16	off	
						2004_10_01	pil	2005_09_25	pil	0	2006_10_08	off	
KOGW018		2002_09_28	pil	2003_08_25	pil	2004_09_10	pil	2005_07_17	pil	0	2006_08_14	pil	
								2005_07_26	pil	0	2006_08_23	pil	
								2005_08_18	pil	0	2006_09_04	pil	
								2005_08_24	pil	0	2006_09_06	pil	2
								2005_09_25	pil	0	2006_09_07	pil	
								2005_09_01			2006_09_24	pil	
								2005_09_29			2009_09_26	pil	
											2006_09_27	pil	1
											2006_09_29	pil	
								2005_10_01	pil	0	2006_10_01	pil	

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW019		2002_09_17	off	2003_08_07	off	2004_09_05	pil	2005_08_23	pil	3	2006_09_16	off	2
		2002_09_23	off	2003_08_27	off	2004_09_11	pil	2005_09_17			2006_09_17	off	3
		2002_09_24	off	2003_09_05	off	2004_09_14	pil				2006_10_03	off	1
				2003_09_08	off	2004_09_15	pil				2006_10_08	off	2
						2004_09_21	off						
						2004_09_30	off						
KOGW020		2002_09_24	off	2003_08_07	off	2004_09_05	pil	2005_07_17	pil	2	2006_09_06	pil	1
				2003_08_18	off	2004_09_10	pil	2005_07_24	pil	2	2006_09_13	Chay	
								2005_07_27	pil	1-2	2006_10_08	off	
								2005_07_29	pil	1			
								2005_09_22	pil	0			
								2005_09_24	pil	0			
KOGW021		2002_09_24	off	2003_08_27	off	2004_08_07	pil	2005_07_26	pil	1	2006_08_14	pil	3
		2002_10_10	off	2003_08_28	off	2004_09_14	pil	2005_08_07	pil	1	2006_08_24	pil	3
				2003_09_05	off	2004_09_18	pil	2005_09_25	pil	0			
				2003_09_10	off	2004_09_23	pil	2005_07_16					
						2004_10_01	pil						
KOGW022		2002_09_27	pil	2003_08_13	pil	2004_09_10	pil	2005_07_14	pil	0	2006_09_19	pil	
						2004_09_10	pil	2005_08_20	pil	0	2006_09_06	pil	
								2005_07_16			2006_09_13	Chay	
								2005_07_16			2006_09_24	pil	
						2004_09_10	pil	2005_09_29			2006_09_28	pil	
KOGW023		2002_09_28	pil			2004_09_05	pil				2006_08_19	pil	2
		2002_10_07	pil			2004_09_10	pil				2006_09_13	Chay	
											2006_09_28	pil	
											2006_09_30	pil	
KOGW024		2002_09_28	pil					2005_07_17	pil	0	2006_09_25	Chay	
								2005_09_25	pil	0	2006_10_01	pil	
											2006_10_06	Chay	
KOGW025		2002_09_28	pil	2003_09_07	off	2004_09_05	pil	2005_07_17	pil	0	2006_09_16	off	
		2002_10_10	off	2003_09_13	off			2005_08_20	pil	0	2006_10_03	off	
		2002_10_11	off					2005_08_21	pil	0	2006_10_08	off	
								2005_08_31	pil	0			
KOGW026		2002_09_28	pil	2003_08_24	pil			2005_10_01	pil	0	2006_08_19	pil	2
		2002_10_07	pil	2003_08_25	pil			2005_09_22					
KOGW027		2002_10_07	pil	2003_08_25	pil	2004_09_05	pil	2005_07_26	pil	4	2006_09_13	Chay	2
				2003_09_03	pil			2005_07_27	pil	4			
								2005_08_08	pil	4			
								2005_08_24	pil	3-4			
KOGW028		2002_10_11	off	2003_08_24	pil	2004_09_23	pil	2005_08_21	pil	0	2006_09_24	pil	
				2003_08_25	pil	2004_09_24	pil	2005_08_25	pil	0	2006_09_26	pil	2
				2003_09_18	pil			2005_09_22	pil	0	2006_09_29	pil	2
								2005_09_25	pil	0			

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW029		2002_10_07	pil	2003_09_18	pil	2004_09_15	pil	2005_07_14	pil	0	2006_08_19	pil	1
						2004_09_24	pil	2005_07_17	pil	0	2006_09_04	pil	
								2005_07_27	pil	0	2006_09_06	pil	
								2005_09_24	pil	0	2006_09_08	pil	
KOGW030		2002_10_07	pil	2003_08_15	pil	2004_09_05	pil	2005_07_27	pil	0	2006_08_19	pil	
		2002_10_15	pil	2003_09_03	pil	2004_09_11	pil	2005_08_07	pil	0	2006_08_22	pil	
						2004_09_24	pil	2005_08_20	pil	0	2006_09_25	pil	
								2005_09_01	pil	0	2006_09_02	pil	
								2005_09_25	pil	0	2006_09_29	pil	
											2006_09_02	pil	
											2006_10_06	pil	
											2006_10_09	pil	
KOGW031		2002_10_07	pil	2003_08_18	off	2004_09_04	pil				2006_09_29	pil	
											2006_10_01	pil	
KOGW032		2002_09_23	off	2003_08_25	pil	2004_08_17	pil	2005_08_07	pil	2	2006_09_04	pil	
		2002_09_24	off			2004_09_05	pil	2005_09_01	pil	1	2006_09_06	pil	
								2005_09_25	pil	0			
								2005_09_25	pil	0			
KOGW033		2002_09_23	off	2003_09_05	off	2004_09_10	pil	2005_07_26	pil	0	2006_09_16	off	2
				2003_09_09	off	2004_09_23	pil	2005_08_24	pil	0			
KOGW034		2002_09_23	off			2004_09_10	pil	2005_07_27	pil	2	2006_08_19	pil	2
		2002_09_24	off					2005_08_08	pil	2	2006_09_06	pil	
								2005_08_20	pil	2	2006_09_13	pil	
								2005_09_22	pil	0	2006_09_29	pil	
KOGW035		2002_09_23	off	2003_08_15	pil	2004_09_05	pil	2005_07_26	pil	0	2006_08_19	pil	
				2003_09_07	off	2004_09_15	pil	2005_08_25	pil	0	2006_09_28	pil	
				2003_09_13	off	2004_09_22	pil	2005_07_13			2006_10_01	pil	
				2003_09_19	pil			2005_09_19					
KOGW036		2002_09_23	off	2003_09_05	off	2004_09_10	pil	2005_07_26	pil	2	2006_09_06	pil	
				2003_09_07	off			2005_07_27	pil	2	2006_09_16	off	
				2003_09_13	off			2005_08_20	pil	1			
								2005_08_25	pil	1			
								2005_09_01	pil	1			
KOGW037		2002_10_10	off	2003_08_25	pil	2004_09_06	pil	2005_07_26	pil	4	2006_09_25	pil	
		2002_10_12	off			2004_09_22	pil	2005_08_16	pil	4	2006_09_29	pil	2
								2005_09_22	pil	3	2006_10_01		1
						2004_09_24	pil	2005_09_24					
KOGW038		2002_10_10	off	2003_08_24	pil	2004_08_07	pil	2005_09_22			2006_09_02	pil	
				2003_08_25	pil	2004_08_30	pil	2005_10_01			2006_09_04	pil	
				2003_09_08	off	2004_09_05	pil				2006_09_27	pil	
						2004_09_10	pil				2006_10_06	pil	
						2004_09_11	pil						
						2004_09_14	pil						

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW039		2002_10_10	off	2003_08_25	pil			2005_07_14	pil	0	2006_09_07	pil	
				2003_09_19	pil			2005_07_17	pil	0	2006_09_25	Chay	
											2006_09_28	pil	
KOGW040		2002_10_12	off	2003_09_02	pil	2004_09_01	pil	2005_08_21	pil	0			
								2005_09_01	pil	0			
KOGW041		2002_10_12	off			2004_09_05	pil	2005_09_01	pil	2	2006_10_08	off	
						2004_09_14	pil	2005_09_25	pil	1			
								2005_10_01	pil	0			
KOGW042		2002_10_15	pil			2004_09_11	pil	2005_07_14	pil	0	2006_09_16	off	1
						2004_09_23	pil	2005_07_17	pil	0			
								2005_07_26	pil	0			
								2005_07_27	pil	0			
KOGW043		2002_09_24	off	2003_08_23	pil	2004_09_05	pil	2005_08_08	pil	2	2006_08_26	off	1
				2003_08_25	pil	2004_09_15	pil	2005_08_16	pil	2			
				2003_09_05	off	2004_09_24	pil	2005_08_25	pil	1			
				2003_09_08	off			2005_09_07	pil	1			
KOGW044		2002_10_12	off	2003_09_04	pil	2004_08_30	pil	2005_07_17	pil	4	2006_09_13	Chay	
				2003_09_19	pil	2004_09_05	pil	2005_07_24	pil	4			
						2004_09_24	pil	2005_07_26	pil	4			
						2004_10_01	pil	2005_07_27	pil	4			
								2005_08_25	pil	4			
								2005_09_25	pil	3-4			
KOGW045		2002_09_17	off	2003_08_28	off	2004_09_06	off	2005_08_24	pil		2006_09_13	Chay	
KOGW046				2003_08_27	off	2004_09_24	off	2005_07_27	pil	3	2006_08_14	pil	1
				2003_09_05	off			2005_08_08	pil	2	2006_08_25	pil	1
								2005_08_18	pil	2	2006_08_26	off	
								2005_08_24	pil	2	2006_09_15	off	
								2005_09_06	off	1	2006_10_08	off	
KOGW047	KamGW013			2003_08_28	pil			2005_08_25	pil	0	2006_07_05	Kam	
				2003_08_25	pil			2005_09_25	pil	0	2006_08_23	pil	
KOGW048				2003_09_04	pil	2004_09_05	pil	2005_07_26	pil	1	2006_09_06	pil	4
						2004_10_01	pil	2005_08_25	pil	1	2006_09_27	pil	1
								2005_09_25	pil	0	2006_09_29	pil	
KOGW049				2003_09_24	pil	2004_09_11	pil	2005_08_21	pil	1	2006_08_22	pil	
								2005_09_08	N	1	2006_09_17	off	1
								2005_09_25	pil	0	2006_10_08	off	2

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW050				2003_08_13	pil	2004_08_30	pil	2005_09_25	pil	0	2006_08_14	pil	
				2003_08_23	pil	2004_09_05	pil	2005_07_17			2006_08_24	pil	
				2003_08_25	pil	2004_09_13	pil				2006_09_04	pil	2
						2004_09_14	pil				2006_09_08	pil	2
						2004_09_24	pil				2006_09_25	pil	
						2004_10_01	pil				2006_09_29	pil	
											2006_09_30	pil	
											2006_10_01	pil	
KOGW051				2003_08_07	off	2004_09_04	pil	2005_08_20	pil	0			
				2003_08_29	off	2004_09_05	pil	2005_08_25	pil	0			
				2003_09_13	off	2004_09_15	pil	2005_09_05					
						2004_09_30	off						
KOGW052				2003_08_25	pil			2005_08_09	pil	2			
				2003_09_03	pil			2005_08_25	pil	2			
				2003_08_13	pil			2005_09_25	pil	0			
KOGW053				2003_09_03	pil						2006_08_19	pil	1-2
											2006_09_09	pil	
											2006_09_28	pil	
											2006_09_29	pil	
KOGW054				2003_08_27	off	2004_09_11	pil	2005_08_09	pil	1	2006_09_16	off	1
											2006_10_03	off	
								2005_08_21	pil	0	2006_10_08	off	
KOGW055				2003_08_24	pil			2005_09_24	pil	0	2006_08_19	pil	
								2005_07_17			2006_09_13	pil	
								2005_09_11			2006_09_25	pil	
KOGW056				2003_08_24	pil	2004_09_10	pil	2005_08_20	pil	2	2006_09_07	pil	
				2003_09_03	pil	2004_09_23	pil	2005_08_25	pil	2	2006_09_25	pil	
				2003_09_04	pil			2005_10_01	pil	0	2006_09_29	pil	
								2005_09_22			2006_10_01	pil	
KOGW057				2003_08_07	off			2005_09_29			2006_08_19	pil	
											2006_08_22	pil	
											2006_08_31	off	
											2006_09_16	off	
KOGW058				2003_08_07	off	2004_09_14	pil	2005_08_25	pil	2	2006_09_13	Chay	
				2003_09_07	off	2004_09_24	pil	2005_09_25	pil	2			
								2005_09_25	pil	1			
KOGW059				2003_09_03	pil			2005_08_18	pil	2	2006_08_19	pil	1
				2003_09_04	pil			2005_08_23	pil	2	2006_10_08	off	
				2003_09_13	off			2005_08_25	pil	2			
								2005_09_25	pil	0			
KOGW060				2003_08_23	pil	2004_09_10	pil	2005_07_17	pil	0	2006_08_19	pil	2
				2003_08_25	pil	2004_09_23	pil	2005_08_23	pil	0	2006_09_04	pil	
								2005_09_25	pil	0	2006_09_13	pil	1

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW061				2003_08_24	pil	2004_09_04	pil	2005_08_07	pil	1	2006_09_13	Chay	2
						2004_09_11	pil	2005_09_01	pil	0			
						2004_09_24	pil	2005_09_22	pil	0			
								2005_09_25	pil	0			
KOGW062				2003_09_04	pil	2004_09_06	off	2005_07_23	pil	2	2006_09_17	off	
						2004_09_29	pil	2005_09_01	pil	2	2006_09_30	pil	
								2005_09_22	pil	2	2006_10_08	off	
								2005_09_25	pil	2			
KOGW063				2003_08_25	pil	2004_09_10	pil	2005_07_26	pil	0	2006_09_11	pil	
						2004_09_14	pil	2005_07_26	pil	0	2006_09_25	pil	
						2004_09_22	pil	2005_08_20	pil	0	2006_09_28	pil	
						2004_10_01	pil	2005_09_22		0	2006_09_29	pil	
											2006_10_06	pil	
KOGW064				2003_08_25	pil	2004_09_05	pil	2005_07_26	pil	4	2006_08_19	pil	
						2004_09_10	pil	2005_07_26	pil	4	2006_09_25	pil	
						2004_09_23	pil	2005_08_20	pil	2			
								2005_08_25	pil	2			
KOGW065				2003_09_04	pil								
KOGW066				2003_08_18	off	2004_09_13	pil	2005_07_26	pil	0	2006_08_19	pil	1
				2003_08_28	off			2005_08_08	pil	0	2006_09_27	pil	
				2003_09_10	off						2006_09_28	pil	
											2006_10_06	Chay	
KOGW067				2003_09_03	pil	2004_09_13	pil	2005_09_22	pil	0	2006_08_19	pil	
				2003_09_04	pil						2006_09_06	pil	
											2006_09_08	pil	
											2006_09_09	pil	
											2006_09_27	pil	
											2006_09_28	pil	
											2006_10_08	off	
KOGW068				2003_09_18	off	2004_09_05	pil	2005_09_25	pil	2	2006_09_04	pil	1
						2004_09_15	pil	2005_10_01	pil	1	2006_09_08	pil	2
						2004_09_24	pil				2006_09_13	pil	1
						2004_10_01	pil				2006_09_26	pil	
											2006_09_27	pil	2
											2006_09_29	pil	
KOGW069				2003_09_03	pil	2004_08_30	pil	2005_08_11	pil	0	2006_09_06	pil	1
				2003_09_18	pil	2004_09_14	pil	2005_09_22	pil	0	2006_09_13	Chay	
											2006_09_16	off	
											2006_10_01	pil	
KOGW070				2003_08_18	off	2004_09_05	pil	2005_08_08	pil	0	2006_08_19	pil	
				2003_08_28	off	2004_09_10	pil	2005_08_21	pil	0	2006_08_23	pil	
				2003_09_05	off			2005_08_25	pil	0	2006_09_13	Chay	
											2006_09_25	Chay	
											2006_10_06	Chay	
KOGW071				2003_08_15	pil	2004_09_10	pil	2005_08_25	pil	2	2006_09_29	pil	
						2004_09_11	pil	2005_09_22	pil	1			
						2004_09_23	pil						
						2004_09_29	pil						

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW072				2003_08_13	pil	2004_09_05	pil	2005_07_27	pil	2	2006_09_25	pil	
				2003_08_25	pil			2005_08_20	pil	2			
				2003_09_03	pil			2005_08_24	pil	2			
				2003_09_18	pil								
KOGW073				2003_08_25	pil								
KOGW074				2003_08_13	pil	2004_09_05	pil	2005_08_20	pil	0	2006_08_19	pil	
				2003_09_03	pil	2004_09_23	pil	2005_09_25	pil	0	2006_08_22	pil	
				2003_09_04	pil	2004_10_01	pil	2005_10_01	pil	0	2006_09_04	pil	
											2006_09_09	pil	
											2006_09_13	pil	
											2006_10_06	Chay	
KOGW075				2003_08_25	pil								
				2003_09_03	pil								
KOGW076				2003_08_25	pil	2004_09_07	pil	2005_07_14	pil	0	2006_08_14	pil	
						2004_09_05	pil				2006_09_13	pil	1
											2006_09_24	pil	
											2006_09_25	pil	
											2006_10_08	off	
KOGW077	KamGW008			2003_08_25	pil						2006_08_22	Kam	
KOGW078				2003_08_15	pil	2004_09_10	pil	2005_07_26	pil	0	2006_09_13	pil	
				2003_08_25	pil	2004_09_14	pil	2005_08_11	pil	0	2006_09_14	pil	
								2005_09_01	pil	0	2006_09_28	pil	1
				2003_09_03	pil			2005_09_22	pil	0	2006_10_01	pil	
								2005_09_25	pil	0			
KOGW079				2003_08_25	pil			2005_08_18					
KOGW080				2003_08_25	pil	2004_09_04	pil				2006_08_19	pil	
						2004_09_05	pil				2006_09_06	pil	
						2004_09_11	pil				2006_09_25	Chay	
						2004_09_14	pil				2006_09_27	pil	
											2006_09_28	pil	
											2006_10_06	Chay	
KOGW081				2003_08_25	pil	2004_09_14	pil	2005_07_17	pil	0	2006_09_04	pil	2
				2003_09_03	pil	2004_09_24	pil	2005_08_11	pil	0	2006_09_25	Chay	
				2003_09_18	pil			2005_08_21	pil	0			
								2005_09_01	pil	0			
KOGW082				2003_08_25	pil	2004_09_24	pil				2006_09_13	Chay	
				2003_09_03	pil						2006_09_29	pil	
				2003_09_18	pil						2006_10_09	pil	
KOGW083				2003_08_25	pil	2004_09_24	pil	2005_08_21	pil	1	2006_09_24	pil	
								2005_09_01	pil	1	2006_09_27	pil	
								2005_09_22	pil	0	2006_09_29	pil	
								2005_09_25	pil	0	2006_10_09	pil	

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW084				2003_08_14	off	2004_09_05	pil	2005_09_15			2006_09_16	off	2
				2003_08_18	off	2004_09_11	pil				2006_09_17	off	2
				2003_08_28	off	2004_09_13	pil						
KOGW085				2003_08_18	off	2004_09_05	pil	2005_08_07	pil	0	2006_08_25	pil	2
				2003_09_07	off			2005_08_11	pil	0	2006_08_26	off	
								2005_08_24	pil	0			
								2005_09_24	pil	0			
								2005_09_25	pil	0			
KOGW086				2003_09_08	off	2004_09_10	pil	2005_08_24	pil	0			
				2003_09_13	off	2004_09_13	pil	2005_08_25	pil	0			
						2004_09_14	pil						
KOGW087						2004_09_04	pil	2005_07_14	pil	0	2006_09_29	pil	
						2004_09_05	pil	2005_09_22	pil	0			
						2004_09_08	pil	2005_07_13					
						2004_09_11	pil						
						2004_09_18	pil						
KOGW088				2003_08_07	off								
KOGW089				2003_09_18	pil	2004_09_14	pil	2005_07_27	pil	0	2006_08_19	pil	
								2005_08_23	pil	0	2006_09_04	pil	
								2005_09_01	pil	0	2006_09_13	Chay	
								2005_09_01	pil	0	2006_09_30	pil	
											2006_10_01	pil	
KOGW090	KamGW001			2003_08_15	pil			2005_09_25	pil	0	2006_08_21	Kam	1
KOGW091				2003_09_18	off	2004_09_29	pil	2005_07_13			2006_08_19	pil	
											2006_08_31	pil	
											2006_09_06	pil	
											2006_10_01	pil	
KOGW092				2004_08_26	pil	2004_08_26	pil	2005_07_14	pil	0	2006_08_19	pil	
						2004_08_29	pil	2005_07_17	pil	0	2006_08_22	pil	
						2004_09_06	pil	2005_07_17	pil		2006_08_23	pil	
						2004_09_28	pil			0	2006_09_25	pil	
											2006_09_27	pil	
											2006_09_29	pil	
KOGW093						2004_09_10	pil	2005_08_25	pil	0	2006_09_07	pil	
								2005_09_22	pil	0	2006_09_13	Chay	
											2006_10_01	pil	
											2006_10_09	pil	
KOGW094						2004_08_30	pil	2005_07_26	pil	0	2006_09_13	pil	1
						2004_09_18	pil	2005_08_24	pil	0	2006_09_28	pil	
						2004_09_18	pil				2006_09_30	pil	

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW095	KamGW008					2004_08_30	pil				2006_08_22	Kam	
						2004_09_05	pil						
						2004_09_13	pil						
						2004_09_14	pil						
						2004_09_23	pil						
						2004_09_24	pil						
KOGW096						2004_08_30	pil	2005_09_24	pil	0	2006_09_06	pil	
						2004_09_05	pil						
						2004_09_24	pil						
						2004_10_01	pil						
KOGW097						2004_09_08	pil						
						2004_09_10	pil						
						2004_09_20	off						
KOGW098						2004_09_14	pil						
KOGW099						2004_09_05	pil	2005_07_26	pil	2	2006_09_04	pil	
								2005_07_27	pil	2	2006_09_08	pil	
								2005_08_20	pil	2			
								2005_09_01	pil	1			
								2005_09_22	pil	0			
KOGW100						2004_09_14	pil						
						2004_09_15	pil						
KOGW101						2004_09_05	pil						
						2004_09_10	pil						
KOGW102						2004_09_13	pil	2005_08_20	pil	1	2006_09_08	pil	
						2004_09_14	pil	2005_08_23	pil	1	2006_09_25	pil	
						2004_09_24	pil	2005_09_22	pil	0	2006_09_28	pil	
								2005_09_24	pil	0			
								2005_09_01	pil	0			
KOGW103						2004_09_05	pil	2005_08_20	pil	0	2006_08_23	pil	
						2004_09_11	pil	2005_08_25	pil	0	2006_09_16	off	
								2005_09_01			2006_09_17	off	
KOGW104						2004_09_15	pil	2005_08_25	pil	1			
						2004_09_30	off						
KOGW105						2004_09_11	pil	2005_07_14	pil	1	2006_09_13	Chay	1
								2005_07_24	pil	1	2006_09_28	pil	
								2005_07_27	pil	1	2006_09_29	pil	1
								2005_08_23	pil	1	2006_10_01	pil	1
								2005_09_07	pil	1	2006_10_06	pil	
								2005_09_22	pil	1			
								2005_09_24	pil	0			
								2005_09_25	pil	0			
								2005_09_25	pil	0			

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW106						2004_09_13	pil	2005_09_01	pil	0	2006_08_24	pil	
						2004_09_14	pil	2005_09_25	pil	0	2006_09_06	pil	
											2006_09_13	pil	1
											2006_09_25	pil	
											2006_09_29	pil	
											2006_09_30	pil	
											2006_10_09	pil	
KOGW107						2004_09_05	pil	2005_08_25	pil	0	2006_09_06	pil	1
								2005_09_22	pil	0	2006_09_07	pil	
								2005_09_25	pil	0			
KOGW108						2004_09_10	pil	2005_07_14	pil	0	2006_08_14	pil	1
								2005_07_26	pil	0	2006_09_13	Chay	
								2005_08_20	pil	0	2006_09_25	Chay	1
								2005_09_24	pil	0			
KOGW109						2004_09_08	pil	2005_09_19			2006_09_06	pil	
						2004_10_01	pil				2006_09_29	pil	
											2006_09_30	pil	
											2006_10_09	pil	
KOGW110						2004_09_08	pil	2005_07_17	pil	2	2006_09_16	off	
						2004_09_18	pil	2005_07_24	pil	2	2006_09_17	off	
						2004_09_24	pil	2005_09_23	off	0	2006_10_03	off	
						2004_10_01	pil	2005_07_13					
KOGW111						2004_09_05	pil	2005_08_25	pil	0			
KOGW112						2004_09_14	pil	2005_09_22	pil	0	2006_09_03	pil	
											2006_09_06	pil	
											2006_09_29	pil	2
											2006_09_09	pil	
KOGW113						2004_09_23	pil	2005_08_08	pil	0	2006_08_19	pil	
						2004_10_01	pil	2005_08_23	pil	0			
KOGW114						2004_09_29	pil	2005_07_26	pil	0	2006_10_03	off	
								2005_08_20	pil	0	2006_10_08	off	
								2005_08_24	pil	0			
KOGW115						2004_09_05	pil	2005_07_17	pil		2006_09_28	pil	
								2005_09_18			2006_09_29	pil	
											2006_10_01	pil	
											2006_10_06	Chay	
KOGW116						2004_09_13	pil	2005_07_17	pil	2	2006_08_19	pil	
								2005_08_08	pil	1			
								2005_08_25	pil	0			
								2005_09_24	pil	0			
KOGW117								2005_07_24	pil	0	2006_09_13	Chay	
								2005_08_20	pil	0	2006_10_06	pil	

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW118								2005_07_17	pil	0	2006_08_14	pil	1
								2005_07_26	pil	0			
								2005_08_18	pil	0			
								2005_08_20	pil	0			
								2005_08_23	pil	0			
KOGW119								2005_08_08	pil	1	2006_08_22	pil	2
								2005_08_20	pil	1	2006_09_16	off	1
								2005_08_25	pil	1	2006_09_17	off	2
											2006_10_03	off	
											2006_10_08	off	
KOGW120								2005_09_23	off	2			
KOGW121								2005_07_27	pil	0	2006_08_14	pil	2
								2005_08_20	pil	0	2006_08_19	pil	2
KOGW122								2005_09_08	El	1			
									El	1			
KOGW123								2005_08_21	pil	0	2006_10_08	off	
								2005_09_08	N	0			
KOGW124								2005_07_26	pil	0	2006_08_19	pil	
								2005_08_08	pil	0	2006_08_24	pil	
KOGW125								2005_07_26	pil	0	2006_08_24	pil	1
								2005_07_26	pil	0	2006_09_27	pil	1
								2005_07_27	pil	0			
								2005_08_24	pil	0			
								2005_09_16	pil	0			
								2005_09_24	pil	0			
KOGW126								2005_07_26	pil	0			
								2005_07_26	pil	0			
								2005_08_16	pil	0			
								2005_09_22	pil	0			
KOGW127								2005_07_23	pil	0	2006_08_24	pil	2
								2005_09_20	pil	0			
KOGW128								2005_09_25	pil	0			
KOGW129								2005_09_22	pil	0	2006_08_14	pil	
								2005_09_25	pil		2006_08_23	pil	
										0	2006_08_24	pil	
KOGW130								2005_09_22	pil	0			
								2005_09_24	pil	0			
KOGW131								2005_09_25	pil	0			
								2005_10_01	pil	0			
KOGW132	KamGW002							2005_10_01	pil	2	2006_08_21	Kam	1
											2006_09_28	pil	

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW133								2005_08_07	pil	0	2006_09_13	pil	
								2005_08_08	pil	0	2006_10_01	pil	
								2005_08_23	pil	0	2006_10_06	Chay	
								2005_08_25	pil	0			
KOGW134								2005_07_17	pil	0			
								2005_08_20	pil	0			
								2005_09_16	pil	0			
KOGW135		was TEMP2		2003_09_18	off	2004_09_11	pil	2005_09_22	pil	1	2006_09_11	pil	
								2005_09_25	pil	1	2006_09_25	pil	
											2006_09_28	pil	
											2006_09_29	pil	
											2006_10_09	pil	
KOGW136	KamGW016					2004_08_11	Kam				2006_09_13	Chay	1
											2006_09_30	pil	
											2006_10_01	pil	
KOGW137											2006_08_19	pil	
											2006_08_31	off/pil	1
											2006_09_03	pil	1
											2006_09_04	pil	1
											2006_09_06	pil	
											2006_09_13	pil	
											2006_09_14	pil	
											2006_09_24	pil	
											2006_09_25	pil	
											2006_09_29	pil	
											2006_10_06	pil	
											2006_10_09	pil	
KOGW138											2006_08_19	pil	
											2006_09_06	pil	
KOGW139											2006_09_06	pil	
											2006_09_07	pil	
KOGW140											2006_08_24	pil	
											2006_09_29	pil	
											2006_09_30	pil	
											2006_10_09	pil	
KOGW141											2006_08_14	pil	
											2006_08_24	pil	

No. of whale KOGW	No. of whale KamGW	2002	Coastal/ Offshore	2003	Coastal/ Offshore	2004	Coastal/ Offshore	2005	Coastal/ Offshore Northern	PCB Class	2006	Coastal/ Offshore/ Chaivo/ Kamchatka	PCB Class
KOGW142											2006_08_14 2006_08_24 2006_09_27 2006_10_09	pil pil pil pil	
KOGW143											2006_08_14 2006_08_24	pil pil	
KOGW144											2006_08_23 2006_09_27 2006_09_29	pil pil pil	
KOGW145											2006_09_24 2006_09_28 2006_09_29	pil pil pil	
KOGW146											2006_09_27 2006_09_29 2006_10_09	pil pil pil	
KOGW147											2006_09_13	pil	
TEMPGW1		2002_10_07	pil										
TEMPGW2	LS for KOGW135												
TEMPGW3											2006_09_02	pil	
TEMPGW4											2006_09_25	Chay	
TEMPGW5											2006_09_06	pil	
TEMPGW6											2006_09_25	pil	
TEMPGW7											2006_09_06	pil	
TEMPGW8											2006_10_06	Chay	

Appendix Table A7. Occurrence of gray whales offshore Sakhalin Island, encountered cows with calves, physical body condition (PCB) class and skin condition, 2002-2006.

No. of whale	Years		Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state
	2002	2003	Calf	Class		2004	Calf	Class		2005	Calf	Class		2006	Calf	Class	
KOGW001	x			0	0	x		0	0	x		0	0	x		1	
KOGW002	x	x		1	0	x		1	0	x		0	0	x		2	
KOGW003	x																
KOGW004	x	x		0	0												
KOGW005	x	x	cow	2-3	0	x		0	0	x	cow	4	0	x			
KOGW006	x	x		0	0	x		2	0	x		0	0	x		1	
KOGW007	x	x		0	0	x		0	0	x		0	0			1-4	
KOGW008	x	x		3	0	x		0	0	x		0	0	x		2	
KOGW009	x					x		0	0	x		0	0	x			
KOGW010	x					x		1	0	x		1	1	x			
KOGW011	x	x		1	0	x		0	0	x		0	0	x			
KOGW012	x	x		1	0	x		1	0	x		1	0	x			
KOGW013	x	x		2	0	x		0	0	x		2	0	x			
KOGW014	x					x		1	0	x		0	0	x			
KOGW015	x	x		0	0					x		0	0	x			
KOGW016	x	x		0	0	x		0	0	x		0	0	x			
KOGW017	x	x		0	0	x		1	0	x		0	0	x		2-1-0	
KOGW018	x	x	cow	2	0	x		0	0	x		0	0	x		2-1	
KOGW019	x	x		2	0	õ		0	0	õ		3	0	x		3-2	
KOGW020	x	x		0	0	x		0	0	x		0	0	x		1-0	
KOGW021	x	x		0	0	x		2	0	x		0	0	x	cow	2-3	
KOGW022	x				0	x		0	0	x		0	0	x			
KOGW023	x					x		0	0				0	x		2-0	
KOGW024	x									x		0	0	x			
KOGW025	x	x		1	0	x		0	0	x		0	0	x			
KOGW026	x	x	cow	2	2					x		0	0	x		2	
KOGW027	x	x	cow	4	2	x		2	0	x	cow	3-4	0	x		2	
KOGW028	x	x		0	от 1 до 3	x		0	0	x		0	0	x		2	
KOGW029	x	x		0	0	x		1	0	x		0	0	x		1-0	
KOGW030	x	x		0	0	x		0	0	x		0	0	x			
KOGW031	x	x		0	0	x		0	0					x			
KOGW032	x	x	cow?	0	1	x		1	0	x		0	0	x			
KOGW033	x	x		0	0	x		0	0	x		0	0	x		2	
KOGW034	x					x		0	0	x		0	2	x		2-0	
KOGW035	x	x		0	0	x		0	0	x		0	0	x		1	
KOGW036	x	x		0	0	x		0	0	x		1	0	x		2	
KOGW037	x	x	cow	2	0	x		0	0	x	cow	3	0	x		1	
KOGW038	x	x		0	0	x		0	0					x			

No. of whale	Years		Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state
	2002	2003	Calf	degree		2004	Calf	degree		2005	Calf	degree		2006	Calf	degree	
KOGW039	x	x	cow	3	0					x		0	0	x		3-0	
KOGW040	x	x	cow	2	0	x		0	0	x		0	0				
KOGW041	x					x		0	0	x		0	0	x			
KOGW042	x					x		0	1	x		0	1	x		1-0	
KOGW043	x	x		1	0	x		0	0	x		1	0	x		1-0	
KOGW044	x	x		2	0	õ		3	0	õ		4	0	x			
KOGW045	x	x		0	0	õ		0	0	õ		0	0	x			
KOGW046		x		0	0	x		2	0	x		0	0	x	cow	2-1-0	
KOGW047		x		0	1	x		0	0	x		0	0	x			
KOGW048		x		0	0	x		0	0	x		0	0	x		4-1	
KOGW049		x		2	2	x		0	0	x		0	0	x		2	
KOGW050		x		0	2	x	cow	3	1	x		0	0	x	cow	2	
KOGW051		x		0	0	x		2	0	x		0	0	x		2	
KOGW052		x	calf	0	0												
KOGW053		x		0	0					x		0	0	x		1	
KOGW054		x		0	0	x		0	0	x		0	0	x		1-0	
KOGW055		x		0	0					x		0	0	x			
KOGW056		x		0	от1 до 3	x		1	0	x		0-1	0	x		2-0	
KOGW057		x		0	0									x		1	
KOGW058		x		0	0	x		0	0	x		1	0	x			
KOGW059		x		0	0					x		0	0	x		1	
KOGW060		x		0	0	x		0	0	x		0	0	x		2-0	
KOGW061		x		0	0	x		0	0	x		0	0	x		2-0	
KOGW062		x		0	0	x		0	0	x	cow	2	0	x		1-0	
KOGW063		x	cow	2	0	x		1	0	x		0	0	x			
KOGW064		x		0	0	x	cow	2	0	x		2	0	x			
KOGW065		x		0	0												
KOGW066		x		0	0	x		0	0	x		0	0	x		1-0	
KOGW067		x		0	0					x		0	0	x		2-1	
KOGW068		x		2	1	x		0	0	x		0	0	x		2	
KOGW069		x	calf	0	0	x		1	0	x		0	0	x		1-0	
KOGW070		x		2	0	x		1	0	x		0	0	x		1-0	
KOGW071		x		0	0	x		0	0	x		1	0	x			
KOGW072		x		0	0	x		0	0	x		0	0	x			
KOGW073		x	calf	0	0												
KOGW074		x		0	0	x		0	0	x		0	0	x			
KOGW075		x	calf	0	0												
KOGW076		x	calf	0	0	x		0	0	x		0	0	x			

No. of whale	Years		Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state
	2002	2003	Calf	degree		2004	Calf	degree		2005	Calf	degree		2006	Calf	degree	
KOGW077		x	calf	0	0												
KOGW078		x	calf	0	0	x		0	0	x		0	0	x			
KOGW079		x	calf	0	0					x		0	0				
KOGW080		x	calf	0	0	x		1	0					x		1-0	
KOGW081		x	calf	0	0	x		0	0	x		0	0	x		2-0	
KOGW082		x	calf	0	0	x		0	0	x		0	0	x			
KOGW083		x	calf?	0	0	x		0	0	x		0	0	x			
KOGW084		x		1	0	x		0	0					x		2	
KOGW085		x		0	0	x		1	0	x		0	0	x			
KOGW086		x		0	0	x		0	0	x		0	0				
KOGW087		x		0	0	x		0	0	x		0	0	x			
KOGW088		x		0	0			0	0								
KOGW089		x	calf?	0	0	x		0	0	x		0	0	x		2-1-0	
KOGW090		x		0	0			0	0	x		0					
KOGW091		x		0	0	x		0	0					x		1-0	
KOGW092		x		0	0	x		2	0	x			0	x		2	
KOGW093						x		0	0	x		0	0	x		2-0	
KOGW094						x		0	0	x		0	0	x		1-0	
KOGW095						x	calf	0	0								
KOGW096						x		1	0	x		0	0	x			
KOGW097						x		0	0								
KOGW098						x		0	0								
KOGW099						x		0	0	x		0	0	x			
KOGW100						x		3	0								
KOGW101						x	calf	0	0								
KOGW102						x		0	0	x		0	0	x			
KOGW103						x		0	0	x		0	0	x			
KOGW104						x		0	0	x		1	0				
KOGW105						x		0	0	x		0	0	x		1-0	
KOGW106						x		0	0	x		0	0	x		1-0	
KOGW107						x		0	0	x		0	0	x		1	
KOGW108						x		1	0	x		0	0	x		2-1	
KOGW109						x		0	0					x			
KOGW110						x		2	0	x		0	0	x		1-0	
KOGW111						x		0	0	x		0	0				
KOGW112						x		0	0	x		0	0	x		2-1-0	

No. of whale	Years		Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state	Year	Cow	PCB	Skin state
	2002	2003	Calf	degree		2004	Calf	degree		2005	Calf	degree		2006	Calf	degree	
KOGW113						x		0	0	x		0	0	x			
KOGW114						x		0	0	x		0	0	x			
KOGW115						x		0	0	x		0	0	x			
KOGW116						x		0	0	x		0	0	x			
KOGW117										x		0	0	x			
KOGW118										x		0	0	x		1	
KOGW119										x		1	0	x		2-0	
KOGW120										x		2	0				
KOGW121										x		0	0	x		1-2	
KOGW122										x		1	0				
KOGW123										x		0	0	x			
KOGW124										x	calf	0	0	x			
KOGW125										x	calf	0	0	x		1	
KOGW126										x	calf	0	0				
KOGW127										x	calf	0	0	x		2	
KOGW128										x		0	0				
KOGW129										x		0	0	x		1	
KOGW130										x		0	0				
KOGW131										x		0	0				
KOGW132										x		2	0	x			
KOGW133										x		0	0	x			
KOGW134										x		0	0				
KOGW135										x		0	0	x			
KOGW136														x		1-0	
KOGW137														x		1-0	
KOGW138														x		2-0	
KOGW139														x		2	
KOGW140														x		1-0	
KOGW141														x	calf		
KOGW142														x	calf		
KOGW143														x	calf		
KOGW144														x	calf?		
KOGW145														x			
KOGW146														x	calf?		
KOGW147														x		1-2	
TEMP1	x																
TEMP2						x		0	0	x		0	0				

No. of whale	Years		Cow	PCB	Skin state	YEAR	Cow	PCB	Skin state	YEAR	Cow	PCB	Skin state	Year	Cow	PCB	Skin state
	2002	**2003**	Calf	degree		**2004**	Calf	degree		**2005**	Calf	degree		**2006**	Calf	degree	
TEMP3														õ			
TEMP4														õ			
TEMP5														õ			
TEMP6														õ			
TEMP7														õ			
TEMP8														õ			