Application for a Permit to Import Certain Marine Mammals for Public Display under the Marine Mammal Protection Act

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Acronyms and Abbreviations

AMMPA	Alliance of Marine Mammal Parks and Aquarium
AWA	Animal Welfare Act
AZA	Association of Zoos and Aquariums
DFO	Canadian Department of Fisheries and Oceans
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ESA	Endangered Species Act
GAI	Georgia Aquarium Inc.
GPS	Georgia Performance Standards
IATA	International Air Transport Association
IUCN	International Union for the Conservation of Nature
JFK	John F. Kennedy
LAR	International Air Transport Association Live Animal Regulations
IMATA	International Marine Animal Trainer's Association
IWC	International Whaling Commission
NMFS	National Marine Fisheries Service
PBR	Potential Biological Removal
TR	Texas Route
U.S.	United States
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
UMMRS	Utrish Marine Mammal Research Station

I. Title of the Application

Application for a permit to import certain marine mammals for public display under the Marine Mammal Protection Act.

II. Date of the Application

June 15, 2012

III. Applicant

The Applicant and Holder, Georgia Aquarium Inc. (GAI), is a private 501(c)(3) corporation that relies on community support to fund special programs including education and veterinary services. GAI owns and operates aquaria in Atlanta, Georgia and St. Augustine, Florida. All correspondence regarding this application should be directed to the Primary Contact and Responsible Official: Billy Hurley.

Billy Hurley
Sr. Vice President & Chief Zoological Officer
Georgia Aquarium
225 Baker Street
Atlanta, GA 30313
404.581.4308
bhurley@georgiaaquarium.org

IV. Description of the Marine Mammals and the Permit Activity

A. Statement of Work

The purpose of the permit activity is to import 18 beluga whales (*Delphinapterus leucas*) for public display to enhance the North American beluga breeding cooperative by increasing the population base of captive belugas to a self-sustaining level and to promote conservation and education. All 18 beluga whales were collected in Sakhalin Bay of the Sea of Okhotsk in 2006, 2010, and 2011. All are presently at Utrish Marine Mammal Research Station (UMMRS) on the Russian coast of the Black Sea. Whales held at UMMRS will be transferred by land to the Anapa Airport, flown to Liege, Belgium, then imported into the United States (U.S.) on simultaneous flights to Atlanta, Georgia and New York, New York. All whales will be imported and held/owned by GAI. Upon arrival in the U.S., some of the whales will be transferred under breeding loans to Shedd Aquarium, Mystic Aquarium, and Sea World facilities in Orlando, San Antonio, and San Diego. No non-target marine mammals or

Endangered Species Act (ESA)-listed species will be taken as part of any activities associated with this permit. The requested period of the permit is five years.

B. Summary of Marine Mammals to be Taken or Imported

Target Species

This application is for the importation of 18 beluga (or white) whales (*Delphinapterus leucas*). These whales were originally collected in Sakhalin Bay in the Sea of Okhotsk, and are members of the Sakhalin-Amur provisional management stock[1] identified by the International Whaling Commission (2000). Appendix A of this application includes additional information regarding beluga whales in the Sea of Okhotsk. Although a number of other cetacean and pinniped species inhabit the Sea of Okhotsk, no incidental take of other marine wildlife occurred during the collection of the beluga whales that are the subject of this Application, largely because the collection methodology and equipment used were designed to target and collect individual beluga whales only.

Species Status

The beluga whales to be imported were collected from Sakhalin Bay in the Sea of Okhotsk. The International Whaling Commission (IWC) proposed 29 discrete beluga whale management stocks within their global range (see Appendix B that accompanies this application), including three provisional stocks in the Sea of Okhotsk: Shelikov Bay, Sakhalin Bay/Amur River, and Shantar Bay (International Whaling Commission 2000). Lacking genetic or other empirical data, the IWC (2000) used the geographic distinction of summer aggregations as its primary criterion for Sea of Okhotsk stock identification. However, overall genetic and satellite tagging study results suggest that considerable gene flow occurs between the beluga whales that form summer aggregations in the Sakhalin-Amur region and those that form summer aggregations in the Shantar regions in the Sea of Okhotsk (Appendix A). This suggests that the aggregations are genetically homogenous and constitute a single stock of beluga whales. See Appendix A accompanying this permit application for additional details regarding stock assessment for beluga whales in the Sea of Okhotsk.

Whales forming summer aggregations in Sakhalin Bay and the mouth of the Amur River have been the subject of a multi-year study led by Dr. Olga Shpak. The study was designed, in part, to determine the sustainability of the Sakhalin-Amur aggregation to annual live-capture. Results from this study indicate a minimum population of about 3,000 for this area. A panel of beluga whale experts convened by the International Union for the Conservation of Nature (IUCN) in 2011 concluded in their report that the Potential Biological Removal (PBR), i.e., the number of animals that could be removed annually from the area without initiating a population decline, of beluga whales was 29 (Reeves et al. 2011). Subsequently, data pooling approved by the IUCN panel indicated that the appropriate PBR for the Sakhalin-Amur aggregation is 30 (Appendix A).

The Sakhalin-Amur beluga whales are not listed as depleted under the Marine Mammal Protection Act, nor are they listed as threatened or endangered under the ESA. Beluga whales are listed in

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[1] The term "stock" was used by the researchers consulted for this permit application and supporting appendices and is not intended to represent a stock as defined under the Marine Mammal Protection Act. In general, the researchers made no effort to define the term. In nearly all cases they used the term descriptively, to refer to summer breeding aggregations of whales. Observational data suggest that different summer breeding aggregations may represent different populations but, in most cases, it is not known if these populations are genetically distinct. Only in Alaska have beluga stocks been evaluated and designated in the context of United States law.

Appendix II (species not currently considered threatened, but may become so unless trade is regulated) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Additional information regarding the Sea of Okhotsk beluga whale populations, including the Sakhalin-Amur stock, is included in Appendix A of this application.

C. <u>Description of the Permit Activity</u>

1. Dates and Locations

Authorization is requested to import 18 beluga whales into the U.S. The importation of the beluga whales will occur as promptly as possible upon approval of this permit application. All of the whales presently reside at UMMRS, on the Russian coast of the Black Sea. These whales will be transported by land to the Anapa Airport in Russia where they will be immediately loaded onto waiting chartered aircraft and flown to Liege Airport, Belgium. Once at Liege Airport, the whales will be immediately loaded onto two waiting chartered cargo jet aircraft and flown to Atlanta Hartsfield International Airport in Atlanta and John F. Kennedy (JFK) International Airport in New York. Approximately six of the whales landing in Atlanta will immediately be transported to the Georgia Aquarium in downtown Atlanta. The remaining whales arriving in Atlanta as well as the whales arriving in New York will be transported to Sea World Orlando, Sea World San Antonio, Sea World San Diego, Mystic Aquarium, and Shedd Aquarium pursuant to breeding loans. Although the precise numbers and identification of which whales will be transported to each facility is unknown at this time, the final disposition of the whales will be designed to best manage and grow the population of captive beluga whales in North America.

2. Requested Duration of the Permit

The requested duration of the permit is five years.

3. Types of Take

The permit activity is the importation into the U.S. of 18 beluga whales originally collected in Sakhalin Bay in the Sea of Okhotsk. The whales will be imported and owned by GAI and will be loaned to other aquaria that are members of the North American beluga breeding cooperative and named under C.1 above. Table 1 presents the identification number, sex, weight, length, estimated age, year collected, and age at collection of the whales included under this permit. GAI will be taking title to, and assuming custody of, these animals.

Table 1. Beluga Whales Requested for Import

ID No.	Sex	Estimated Weight (kilograms)	Estimated Length (meters)	Estimated Age[1]	Date of Collection	Estimated Age at Collection
5/10	F	500	2.94	7.5	Aug-Sept. 2010	5.5
7/10	M	350	2.74	3.5	Aug-Sept. 2010	1.5
8/10	M	530	2.90	5.5	Aug-Sept. 2010	3.5
11/10	M	520	3.30	7.5	Aug-Sept. 2010	5.5
12/10	M	560	3.22	7.5	Aug-Sept. 2010	5.5
1/10	M	250	2.66	3.5	Aug-Sept. 2010	1.5
2/10	M	310	2.62	3.5	Aug-Sept. 2010	1.5
3/10	M	360	2.73	3.5	Aug-Sept. 2010	1.5
6/10	F	460	3.20	7.5	Aug-Sept. 2010	5.5
9/10	F	180	2.40	3.5	Aug-Sept. 2010	1.5
10/10	F	650	3.52	11.5	Aug-Sept. 2010	9.5
27/11	F	280	2.40	3.5	June 2011	2.5
24/11	F	500	2.92	5.5	June 2011	4.5
21/11	F	300	2.48	3.5	June 2011	2.5
23/11	F	350	2.70	3.5	June 2011	2.5
17/11	M	350	2.74	3.5	June 2011	2.5
75/06	F	880	3.80	11.5	June 2006	5.5
78/06	F	940	3.95	11.5	June 2006	5.5

[1] Estimated ages were current on January 1, 2012.

D. If Marine Mammals are to be Collected from the Wild

The activity under this permit application is the importation of 18 beluga whales. The collection of these whales has already been conducted by a local team working for Utrish Dolphinarium Ltd. in accordance with all applicable laws and regulations of the Russian Federation. Details pertinent to the collection are included in Appendix C and in response to item IV.E.6 of this permit application.

E. If Marine Mammals are to be Imported into the United States

1. Names and Qualifications of the Personnel Accompanying the Animals during Import

The animals will be imported under the direct supervision of GAI professional staff with extensive experience in the transport, medical care, and management of beluga whales. The names, titles, and qualifications of key staff are listed below. However, a number of other personnel highly experienced in cetacean transport will be assembled from colleague institutions and led by the Georgia Aquarium Zoological Team for the transport and handling of the whales during import.

Dr. Greg Bossart, V.M.D., Ph.D, Chief Veterinary Officer & Senior Vice President, Veterinary Services. Dr. Bossart leads all veterinary operations and conservation and research programs at GAI. He has spent the past 29 years practicing domestic, marine mammal, fish and avian medicine and working in pathology on a national and international basis. He has written more than 100 publications focused primarily on the pathological basis of disease in wild animals. Dr. Bossart is an Adjunct Professor in the Department of Pathology at the University of Miami School of Medicine and is on the graduate faculty at the Medical University of South Carolina. His research has been published in dozens of leading journals and his work recognized by prestigious awards.

Dr. Tonya M. Clauss, Chief Veterinarian. Dr. Clauss serves as the head clinical veterinarian at GAI and manages all clinical cases, including the treatment room and surgery suite. Dr. Clauss has received specialized training in numerous areas, ranging from reptile critical care medicine to immunology for aquatic animal clinicians and aquatic invertebrate medicine. Dr. Clauss has taught veterinary courses at various institutions, including the University of Georgia and the University of Florida. Along with several speaking engagements, she is a published author and has participated in many research studies and professional presentations. Dr. Clauss has won various awards, including the 2003 Learner Family Wildlife Conservation Award for excellence in wildlife and zoological medicine. Dr. Clauss is a member of many professional affiliations, including the American Veterinary Medical Association, the Association of Zoos and Aquariums and the Association of Exotic Mammal Veterinarians. She currently serves as a student liaison committee member for the International Association for Aquatic Animal Medicine and is a research committee member at the Georgia Aquarium.

Billy Hurley, Senior Vice President and Chief Zoological Officer. As Chief Animal Officer and Senior Vice President of Zoological Operations, Billy Hurley leads all zoological operations at Georgia Aquarium and is responsible for the entire animal training sector of the Dolphin Expansion project at the Aquarium. Billy Hurley joined GAI from Marineland's Dolphin Conservation Center, where he served as General Manager and Vice President of Animal Management. Prior to this, he served as General Manager of Dolphin Quest, located in Hawaii, before being promoted to Director of Husbandry and Training. Mr. Hurley is heavily involved with the International Marine Animal Trainer's Association (IMATA) and has served as its President. Mr. Hurley is the current President of the Alliance of Marine Mammal Parks and Aquarium (AMMPA). Mr. Hurley has released several posters, papers and presentations, which focus primarily on mammal care and training.

Eric Gaglione, Director of Zoological Operations. Mr. Gaglione is responsible for all activities involving the care of mammal and bird collections for aquarium galleries. He has been working with cetaceans for 25 years, including the daily care and long-term management of whales and dolphins. He has extensive experience transporting marine mammals by land and air.

Dennis Christen, Director of Animal Training and Interactive Programs. Mr. Christen has over 23 years of professional marine mammal management, husbandry, rehabilitation, and training experience with three internationally recognized, not-for-profit organizations. He is experienced with all facets of marine mammal management, care, and welfare including animal acquisition, transport, care, training, housing, life support, water quality, and environmental enrichment.

Cara Lisa Field, DVM, Ph.D., Staff Veterinarian. Dr. Field has been practicing veterinary medicine since 2005 when she earned a Doctorate in Veterinary Medicine and Ph.D in Comparative Pathology. Dr. Field is experienced in marine mammal diagnostics, medical and surgical care, anesthesia, and necropsy. She provides clinical and preventative health care for GAI's marine mammal, fish, avian, reptile, amphibian and invertebrate collection. Her duties include examination, medical and surgical procedures, general anesthesia, and use of standard and advanced diagnostic equipment.

2. Description of the Transport Unit

The beluga whales will be imported into the U.S. in specially designed and constructed transport units that meet or exceed the International Air Transport Association (IATA) Live Animal Regulations (LAR) for transporting cetaceans and will conform to the guidelines and practices outlined in the *CRC Handbook for Marine Mammal Medicine* (Dierauf and Gulland 2001) and the *CITES Guidelines for Transport and Preparation for Shipment of Live Wild Animals*. Each transport unit will contain only one whale. Each container is 5.3 meters long, 2.4 meters wide and 2.3 meter deep (17.5 feet long, 8 feet wide and 7.5 feet deep). The exterior frame will be constructed of welded steel and the interior will be a watertight unit constructed of fiberglassed marine plywood lined with vinyl. Soft stretchers made of ballistic nylon and kodel[2] will be placed inside the containers to support the animals' bodies. Water will be kept in the transport containers to facilitate proper thermoregulation and to provide some buoyancy for the animals. These transport containers will be used in the international flights, domestic flights, and ground transport. Additional details and diagrams of the transport units are included in Appendix D of this application.

The types of aircraft available for flying out of Russia are not compatible with the beluga whale carriers owned by GAI such that GAI's carriers cannot be used on Russian aircraft. Similarly, GAI cannot use the Russian built containers to transport the animals to the U.S. for several reasons. First, the Russian containers have no wheels or rollers allowing them to be moved. The animals are placed in the containers via an overhead trolley system that does not exist on the planes used to transport the animals to the U.S. Second, the containers aboard the Russian aircraft are bolted together into a single unit that is not compatible with the configuration of the planes used to transport the animals to the U.S. The aircraft that will transport the animals to the U.S. is configured for individual containers.

Regarding the transfer of animals between the two carriers, the carriers used by the Russians are assembled inside the aircraft and the animals are loaded via a stretcher and hoist system. Offloading of the animals is achieved in the same manner. This method of offloading the animals is similar to the method used by NMFS for removing animals from the water during health assessments (Brunswick, GA and Barataria, LA, for example). GAI recognizes that switching carriers and aircraft is an added step, but it poses no additional risk, because the methods employed by GAI were created specifically to mitigate any potential challenges. At the airport in Liege, the animals will be moved approximately 30.5 meters (100 feet) between planes using heavy equipment, and at no time will the animals be more than approximately 1.8 meters (6 feet) off the ground. GAI's transportation expertise has been demonstrated many times before. As a matter of detail, the animals will be stretchered while in the Russian containers, hoisted from the carrier itself, and then lowered into GAI transport containers.

3. Mode of Transportation

The whales to be imported under the applicant's permit will be transported to the initial holding facilities in the U.S. directly from UMMRS in Russia. The whales will be accompanied by qualified attendants using equipment and methods in accordance with professionally accepted standards and techniques and in compliance with all applicable regulations, standards, and conditions set forth under the Animal Welfare Act (AWA), MMPA, CITES, U.S. Fish and Wildlife Service (USFWS) regulations, U.S. Department of Agriculture (USDA) regulations, and IATA LAR. The transport will

[2] A heat absorbing material used by hospitals to assist burn patients with thermoregulation.

employ all contemporary and accepted methods outlined in the *CRC Handbook of Marine Mammal Medicine*, Second Edition (Dierauf and Gulland 2001). GAI will take custody of the animals in Belgium. While GAI will have staff observing the transport from UMMRS to Anapa, and subsequently to Belgium, the animals will still be owned by UMMRS until leaving Russian air space. Thus, acceptance begins upon arrival in Belgium.

Prior to their departure from UMMRS, the whales will be examined by a certified veterinarian who will verify that each animal is healthy enough to undergo transport. Assessments will occur in the same manner as are performed in the U.S., within 10 days of transport. Each whale will be examined for any disease or illness that could cause it to be in a compromised state of health. Males and females are being housed separately, except in the case of any immature animals, where breeding is not a risk. Females will be checked to ensure they are not pregnant or lactating.

The journey from UMMRS to GAI facilities in the U.S. will begin with overland travel to the Anapa Airport, approximately 35 kilometers (21.7 miles) to the north. To begin, the whales will be removed from their tanks at the research station in soft nylon net slings using cranes equipped on stake-bed trucks. The containers that will be used to transport the animals from Russia to Belgium will be constructed individually so that they are of adequate length, width, and depth to hold the animals**.** Prior to the whales being placed in the containers, the containers will be loaded and secured on stake-bed trucks and filled with saltwater to a level of approximately 80 centimeters (31.5 inches). The journey to Anapa Airport is expected to take 90 to 120 minutes and will be conducted in the early morning or late evening when air temperatures are cooler.

At Anapa Airport, three Ilyushin IL-76 cargo aircraft will be waiting to fly the whales to Liege Airport in Belgium, approximately 2,450 kilometers (1,500 miles) to the northwest. Travel time to Liege Airport is expected to take approximately 2.7 hours. During the flight, the whales will receive continuous monitoring and care by the UMMRS veterinary and husbandry staff. There will be four attendants per flight, the maximum number that can be accommodated on the plane given its configuration. The attendants will include experienced veterinary and animal care staff. Veterinarians will accompany all flights in all aircraft. Takeoff and descent approaches will be made gradually to keep the orientation of the whale containers as close to level as possible.

Once at Liege Airport, the whales will be offloaded from the Il-76s and placed in GAI-owned ballistic nylon slings and into waiting transport containers secured to cookie sheets[3] on K-loaders. The transfer will be accomplished using heavy equipment with lifting capabilities. Once each whale is secure in its container, the K-loaders will load the containers into two waiting chartered Boeing 747 cargo jets for the flights to Atlanta Hartsfield International Airport and JFK International Airport. This transfer will be done expeditiously. Extra water and ice will be used to keep the whales cool and moist during loading. Prior to the departure, each whale will be examined by GAI's certified veterinarians, Dr. Bossart and Dr. Claus, to ensure it is healthy enough to undergo transport. Females will also be rechecked to ensure they are not pregnant or lactating. Regarding health status, any animal that does not pass its examination will have a delayed transport using the same methods as used for the other animals, except that a smaller aircraft will be used. Regarding pregnancy or lactation, reproduction has been made impossible by the housing management/arrangements of the different sexes.

[3] "Cookie sheets" are flat metal platforms, on which containers are assembled and secured by nets and straps.

The transfer of animals from Il-76 aircraft to Boeing 747 aircraft in Belgium is necessary because the 747s are not allowed to land in Russia. Similarly, the Il-76 aircraft cannot enter the U.S. because Il-76 planes do not meet U.S. air emissions and noise standards. Moreover, there are only two 747 aircraft in the world that are known to be configured in a way that will allow the transport containers and 12 attendants per plane. Other 747 configurations would result in fewer attendants per plane and per animal.

Once aboard the Boeing 747 aircraft, the cookie sheets upon which the containers are placed will be securely locked into the floor to prevent any shifting from occurring while in flight. To minimize total travel time, the transport containers will be loaded almost immediately after the whales arrive at Liege Airport, and the aircraft will depart as soon as possible after containers are aboard. Twelve attendants per flight will provide continuous monitoring during importation into the U.S. During the importation, there will be at least one veterinarian attending for every three to four beluga whales.

The chartered aircraft used to transport the belugas into the U.S. will be pressurized to avoid exposure to air pressures to which the animals may not be accustomed. Takeoff and descent approaches will be made gradually to keep the orientation of the whale containers as close to level as possible, and the animals will be attended to continuously during transport. Air and water temperature will be controlled to ensure they are kept cool. Their position within the transport containers will be monitored and adjustments will be made as needed to keep the animals wet, safe, and comfortable. The whales will begin fasting from solid food 12 hours pre-transport. Conditioning of the animals to eat ice has been addressed (in order to provide hydration), as GAI staff has done when moving other cetaceans. Staff may provide fluids via gastric tubing or small amounts of fish/invertebrates should the need arise. This is the methodology employed on all long distance transports and it complies with the applicable U.S. and international standards.

From Liege Airport, one charter aircraft will fly directly to Atlanta Hartsfield International Airport and the other will fly directly to JFK International Airport in New York. The trip to Atlanta is anticipated to take 7.8 hours and the trip to New York is expected to take approximately 6.5 hours. The steps in the transport process are outlined in Table 2.

Table 2. Transport Mode and Duration for Steps in the Importing Process

Origin & Destination	UMMRS to Anapa Airport	Anapa Airport to Liege Airport	Liege Airport to JFK/Atlanta Hartsfield	JFK/Atlanta Hartsfield to Receiving Facility
Mode of Transport	Overland travel by truck	By air via 3 IL-76 cargo aircraft	By air via 2 Boeing 747 cargo aircraft	Transported by ground and air depending on receiving facility
Time of Transport	90–120 minutes	2.7 hours	6.5 hours to JFK / 7.8 hours to Atlanta	Regardless of facility, transport will not exceed 5 hours

As described in item C.1 above, beluga whales will be transported to Georgia Aquarium and, under breeding loans, to Shedd Aquarium, Mystic Aquarium, Sea World Orlando, Sea World San Antonio, and Sea World San Diego. In all cases, from pool to pool and including loading/unloading times and ground transportation, the total transport time is anticipated to be 26 to 30 hours. Furthermore, all transport activities conducted after importation into Atlanta and New York, regardless of final destination, will be conducted in full compliance with the guidelines of the IATA LAR, the *CRC Handbook for Marine Mammal Medicine* (Dierauf and Gulland 2001), and the *CITES Guidelines for*

Transport and Preparation for Shipment of Live Wild Animals. Applicable regulations, standards, and conditions set forth under the AWA, MMPA, and USFWS regulations, and USDA regulations will also be followed during the transport activities.

For animals transferred to the Georgia Aquarium, upon arrival at Atlanta Hartsfield International Airport, the transport containers containing the animals will be transferred to covered and refrigerated tractor-trailers and transferred to the aquarium facilities (approximately 19 kilometers [12 miles] north of the airport in downtown Atlanta) with a police escort. At the Georgia Aquarium, the tractor-trailers will arrive at the specially designed loading docks. The belugas' stretchers will be connected to hoists that will transfer the whales directly from their containers, lift them from the loading dock level of the facility to the aquarium level, and place them into a pool at the aquarium. Once lowered into the pool, the whales will be able to swim freely out of the stretcher and into the pool. Technically, the whales have been in quarantine while housed in Russia. Regarding quarantine upon arrival at U.S. facilities, all current U.S. holders of beluga whales have quarantine capabilities, and follow all applicable guidelines found in the APHIS regulations as well as those set forth by AMMPA. Any decision to quarantine the animals upon their arrival at facilities in the U.S. will be made by veterinary staff based on the best interests of the animal.

Beluga whales transported to Sea World Orlando, Sea World San Antonio, and Sea World San Diego pursuant to breeding loans will be flown to major airports close to these facilities. Flights will be planned to transport the belugas to major airports with equipment and infrastructure capable of supporting safe and humane loading and offloading located as close to the other aquaria facilities as possible. It is anticipated that these will include Orlando International Airport (Sea World Orlando), San Antonio International Airport (Sea World San Antonio), and San Diego International Airport (Sea World San Diego). Offloading at these airports and ground transport to the other aquaria facilities will be conducted using similar methods and equipment as those used for whales transferred to the Georgia Aquarium described above.

Of the whales imported through New York, some will be loaded into ground transport vehicles (likely covered and refrigerated trucks) and driven to Mystic Aquarium approximately 210 kilometers (130 miles) to the northeast. The whales will be placed at Mystic Aquarium pursuant to a breeding loan. Beluga whales being transported to Shedd Aquarium under a breeding loan will be flown to Chicago, Illinois, and transported by ground to Shedd Aquarium. The transport flight will land at either Chicago O'Hare International Airport or Chicago Midway International Airport. Offloading at either airport and ground transport to the Shedd Aquarium facilities will be conducted using similar methods and equipment as those used for whales transferred to the Georgia Aquarium described above.

Regardless of the destination for the beluga whales, all whales will receive immediate and continuous evaluation and monitoring of medical conditions and behavior immediately upon their arrival at the new facilities to ensure they adjust to their new surroundings. This may include an analysis of blood, gastric, exhale, and fecal samples; frequent weighing and measuring; ultrasounds to assess lung, plural, heart, kidney, and liver condition; oral/dental examinations; and other preventative care procedures.

Appendix D provides additional information regarding the transport of beluga whales, including diagrams of containers, for all legs of transport.

4. Veterinary Certification

Appendix D of this application includes a written certification from the attending veterinarian responsible for the animals during import stating that the transport plan is satisfactory from a veterinary perspective and that the attending veterinarian will assess the condition of the animals prior to transport to assure their suitability for transport and will assess their post-import condition to assure their well-being.

5. Country of Exportation

All 18 beluga whales that will be imported under this permit were originally collected in Russia in the Sea of Okhotsk's Sakhalin Bay. Two whales were collected in 2006, eleven were collected in 2010, and five were collected in 2011. All whales are being held at UMMRS on the Russian coast of the Black Sea. All 18 whales will be imported to the Unites States directly from Russia, with a short stop-over in Belgium to change aircraft.

6. Description of Taking in the Country of Origin

All 18 beluga whales to be imported under this application were collected near Baydukova Island in the Sakhalin-Amur region of the Sea of Okhotsk in 2006, 2010, and 2011. All whales were collected in the summer. The belugas were collected by an experienced team of approximately 12 members of the Marchenko family, led by Dr. Lev Mukhametov, Director of Utrish Dolphinarium, Ltd. The Marchenko family has been collecting belugas from the Sakhalin-Amur area for over 30 years.

To locate whales, the collection team sailed with their equipment from their base at Chkalova Island to a location near the mid-point of Baydukova Island where belugas are known to forage for salmon in shallow water near shore. As the team sailed, it searched for beluga groups swimming in shallow waters (approximately 2 to 4 meters [6.6 to 13.1 feet] deep) using binoculars. The collection team did not chase or drive whales into shallow waters to engage in a collection attempt. Instead, the team would only engage whales that were already located in shallow waters or those that were moving voluntarily in the direction of shallow waters.

When a group of belugas was detected, the collection team conducted an initial visual assessment using binoculars to estimate the number and age of the animals present, and to identify the presence of any newborn calves, mother–calf pairs, or juveniles less than one year old. No action was taken by the team until the initial assessment was completed and it was certain of the composition of the group.

When a suitable group of belugas was located in sufficiently shallow water, the collection team began engaging the whales. The two baidars (traditional motor/sail boats approximately 45 feet long with low freeboards, a flat deck, and a central outboard motor) that had been sailing tied together, separated and encircled the whales by deploying a seine net behind them in a curving trajectory to create a "compass" around the whales. Once the compass was formed, the two ends of the net were tied together to eliminate areas of net overlap where whales might become trapped.

Throughout this process, up to 12 smaller boats—approximately 3 meters (9 feet) long with 40-horsepower outboard motors—positioned around the outside of the compass to watch for entangled whales. These boats moved very slowly (approximately 2.5 miles per hour) during this process to minimize noise. If at any time a beluga contacted the seine net in a manner that could present a threat to the animal, the crew of at least one boat would lift the beluga to the surface using the net and tie a large buoy onto the seine net close to the whale's head. This would maintain the beluga's position at the surface and ensure that it could breathe freely and continuously. If a beluga contacted the net and somehow became entangled in such a way that it was difficult to ensure its safe breathing (e.g., the whale became wrapped in the seine net), the boats were positioned so that they could maneuver close to the beluga and personnel on a boat could pull the whale to the surface by the net, secure it in the water along the side of the boat, and provide continuous supervision until the whale could be disentangled. Once the seine net was closed around the whale group, the team conducted a second visual assessment of the animals swimming inside the seine net.

If the encompassed area did not include newborn calves, mother–calf pairs, large adults, or juveniles less than one year old, one baidar sailed for the nearby beach of Baydukova Island. There, the baidar was beached and the collection team slowly pulled the net into shore by hand. This simultaneously decreased the diameter of the compass while moving the whales into even shallower waters where they could be more easily handled.

As each whale was pulled into shallower waters near the beached baidar, it was removed from the seine net, transferred to a soft-net stretcher, and loosely secured along the sides of the nearby baidar in the water parallel to and facing the bow of the boat. Each beluga was supervised by one or two team members who ensured its safe, unimpeded breathing. With the belugas secured and monitored in this position, the baidars sailed slowly (less than 8 kilometers [5 miles] per hour—within the normal swimming speed for beluga whales) to the Chkalova Island camp.

Once the baidars had slowly motored to the Chkalova Island camp and were in approximately 1 meter of water, a soft fabric tail belt was placed around the tail peduncle of the belugas to help control them. The animals were then moved from alongside the baidar in their net stretchers to shallow water where measurements were taken and their condition was inspected by Dr. Elena Rozanova, the on-site veterinarian. They were also often kept partially covered under a section of the small net that surrounded them to secure their flippers and avoid injury while being examined. Dr. Elena Rozanova from the Utrish Dolphinarium performed a full health assessment of each whale to determine fitness and condition.

After the initial assessments, the whales were guided through the water slowly by hand into a nearby shore-side net-pen and released from their net stretchers. There are four pens at the Chkalova Island camp. Each shore-side net pen measures approximately 40 feet long by 40 feet wide by 8 feet deep and holds approximately six whales.

The procedures used to collect the beluga whales that will be imported under the proposed permit activity closely mimic the collection procedures used by scientific and regulatory organizations such as the National Marine Fisheries Service (NMFS) (Ferraro et al. 2000), the Canadian Department of Fisheries and Oceans (DFO) (Orr et al. 2000), and the Society of Marine Mammalogy (Gales et al. 2009). Techniques used to collect the beluga whales that will be imported as part of the permit activity, like those used by NMFS, DFO, or the Society of Marine Mammalogy, are safe and humane. No beluga whales applied for in this permit received serious injury, and no beluga whales collected in Sakhalin Bay died in any of the years that the whales proposed for import under this permit application were collected.

Appendix C of this application describes in additional detail the procedures, protocol, personnel, and equipment used to collect beluga whales from the Sakhalin-Amur region in the Sea of Okhotsk. Figures of the collection equipment and facilities at Chkalova Island are included in the appendix along with resumes or professional biographies for key staff of Utrish Dolphinarium, Ltd.

7. Statement and Documentation Concerning Current Holding in Compliance with the Laws of the Russian Federation

All beluga whales to be imported were collected by an experienced team of approximately 12 members of the Marchenko family directed by Utrish Dolphinarium, Ltd. This group has been collecting marine mammals in Russia, including beluga whales in the White Sea and in the Sea of Okhotsk, for over 30 years. The collection was conducted in accordance with permits issued by the Russian Federation and there is no evidence that the collections were conducted in violation of any applicable laws and regulations of the Russian Federation.

The beluga whales to be imported are also being held in full compliance with the laws and regulations of the Russian Federation. GAI requested copies of permits or other official documentation relating to the collection and care of the animals subject to this permit application. All correspondence returned to GAI is included in Appendix D of this permit application.

8. Statement on Replacement of the Animals

This importation will not result in the taking of beluga whales from the wild to replace the animals to be imported. The Russian authorities at Rosprirodnadzo (the Russian "Ministry of Fishery"), a department of the Ministry of Nature Protection, issue a maximum number of capture permits each year which has ranged from 40 to 57 (Shpak et al. 2011), but that quota has never been fulfilled during this time. This quota will not change due to the importation of belugas under this permit. Additionally, there is no public display component associated with UMMRS. It is strictly a research facility with significant security.

It is not anticipated that the importation of 18 beluga whales under this permit will result in a greater demand for marine mammals. One of the purposes of the permit activity is to increase the population of reproductively viable beluga whales in the North American beluga breeding cooperative to a level that is self-sustaining. As described in Appendix E, Alternatives Analysis, accompanying this permit application, recent population models have indicated that the present population of whales in the North American beluga breeding cooperative has a 56% probability of declining over the next 30 years if they are not supplemented and continue to be managed as they have been for the last five years. Thus, by supplementing the North American beluga breeding cooperative with the 18 whales proposed for import and enhancing the captive breeding program, the permit activity will reduce the demand for wild-caught beluga whales for public display.

9. Necessity of Import to Protect Welfare of Animals and Alternatives Considered

Beluga whales in the Sea of Okhotsk may face a number of possible threats including human subsistence hunting, vessel strikes, entanglement in fishing equipment, natural disease, and disease or illness resulting from exposure to anthropogenic pollution. However, the 18 whales that will be imported under this permit would not be imported for the purpose of their protection or welfare. Additionally, importation is not necessary to protect these animals as the potential threats mentioned above are not known to directly result in significant mortality of beluga whales in the Sea of Okhotsk. The purpose of the proposed import is to promote conservation and education and to enhance the North American beluga breeding cooperative by increasing the population base of captive belugas to a self-sustaining level.

A number of alternatives to the importation of wild-caught belugas from the Sea of Okhotsk were identified. Consideration was given to breeding loans, acquisition of captive-born belugas, increasing beluga whales through artificial insemination, and capturing wild beluga whales from other populations. In all cases, the identified alternatives were deemed to be undesirable or infeasible compared to importation or did not address the purpose and need of the import action. Appendix E of this application is an alternatives analysis that provides details regarding the nature of each alternative to the permit activity and the reasons each alternative was eliminated from further consideration.

F. Effects of the Permit Activity

(a) Effects on the Individual Animals Concerned

The effects upon beluga whales being imported include short-term effects associated with importation and later effects associated with captivity. The physical process of importation, as noted earlier in this application, will entail removing each animal from holding facilities and transporting them by ground and air to the U.S. in a manner that meets or exceeds all applicable regulations, standards, and conditions set forth under the AWA, MMPA, CITES, USFWS regulations, USDA regulations, IATA LAR, and the *CRC Handbook of Marine Mammal Medicine*, Second Edition (Dierauf and Gulland 2001). The transport will be conducted in a manner designed to minimize the stress on the whales to the maximum extent practicable.

However, the transport process may result in some stress to the affected animals. Schmitt et al. (2010) measured blood concentrations of stress hormones in long-term captive belugas (three whales that had been in captivity for approximately 15 years). They found that in-water physical contact with handlers and aquarium visitors did not cause any increase in stress hormones, but removal from the water for physical examination caused a 2- to 4-fold increase in plasma cortisol and aldosterone concentrations, and a 5- to 10-fold increase in plasma adrenocorticotropic hormone. The proposed transport methodology entails removal from the water and physical examination by a veterinarian sufficient to monitor the animal's health and condition throughout the transport process, and is therefore likely to entail some stress to the animals. This expectation is also consistent with prior studies of handling stress associated with beluga whale collection, e.g., documented suppression of thyroid hormone levels associated with the collection and handling of beluga whales (St. Aubin and Geraci 1988). Other physiological changes shown to be associated with the collection and handling of beluga whales include increased levels of aldosterone, cortisol, glucose, iron, potassium, and the enzymes creatine kinase, aspartate aminotransferase, alanine aminotransferase, and gamma-glutamyltranspeptidase (St. Aubin and Geraci 1989, cited by Curry 1999). However, the same study tracked these variables during a 10-week period of captivity, and most indices were reported to normalize within the first week of captivity. This indicates that the stress response is occasioned by handling and transport, and that effects will cease after whales reach their new home.

The potential effects of participating in a breeding program for the female whales are pregnancy, opportunity to be a surrogate, and mimicry opportunities to enhance maternal skills. Energetically and physiologically, changes in females are listed in peer-reviewed literature. Current science models suggest females may become pregnant beginning at the ages of 6 to 10 years of age. As to frequency of breeding, GAI and partners in the North American beluga breeding cooperative will follow the trends in the wild and the methods that have proven successful for captive animals.

It is difficult to compare the life expectancy of wild belugas to those living in captivity due to high variation in life expectancy estimates for wild belugas. Although dolphinaria historically showed low survivorship rates compared to animals in habitat, this pattern had largely ceased by 1995 (Small and DeMaster 1995) and recent data (PMC 2010) indicate that the current North American captive beluga population has a uniform age distribution of animals up to age 40 years, with a maximum age of 69 years for one animal. In the wild, their lifespan is thought to be 35 to 50 years (NOAA Fisheries Office of Protected Resources 2012). A more detailed analysis by Willis (2012a) contained in Appendix F shows the life spans of captive versus wild belugas to be comparable. There is thus high confidence that health and life expectancy of the imported animals will meet or exceed values for wild animals.

(b) Effects on the Relevant Species or Stock

The beluga whales to be imported were originally collected in Sakhalin Bay in the Sea of Okhotsk, and are members of the putative Sakhalin-Amur stock identified by the IWC (2000). A panel of beluga whale experts was convened by IUCN in 2011 to determine the sustainability of live-capture from this stock. Using aerial survey and population estimation data collected by Dr. Olga Shpak, the panel concluded that the PBR, or the number of animals that could be removed without initiating a population decline, of this stock was 29 individuals per year on average over a 5-year period (Reeves et al. 2011). As described in Appendix A accompanying this permit application, subsequent research and data analysis recommended by the IUCN panel indicate that the appropriate PBR is 30.[4]

However, overall genetic and satellite tagging study results indicate that considerable gene flow occurs between the Sakhalin and Shantar aggregations in the Sea of Okhotsk (Appendix A). This suggests that all five aggregations are genetically homogenous and constitute a single stock of beluga whales. A direct count of the bays in the Shantar region conducted on August 7 and 8, 2010, recorded 3,206 beluga whales by direct count. This direct count approach, (not accounting for animals missed), results in a Shantar-only PBR of 32. The 32 added to the Sakhalin-Amur PBR of 30 results in a combined PBR of 62. However, pooling the Sakhalin-Amur data with data collected from all of the Shantar bays, and using a correction factor for animals missed (either because they were not seen or could not be seen because they were well below the surface), results in a higher population estimate and a PBR of 86 for a Sakhalin-Amur/Shantar aggregation.

With the exception of 2010 and 2011, less than 30 total belugas were collected from Sakhalin Bay during any individual year from 2000 to 2011 (Table 3) and in no years recorded, did the number of belugas collected exceed 33. The average number of belugas collected over the last 5 years is 22.4.

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[4] It should be noted that the PBR of 30 was determined using conservative inputs for the correction factors and recovery rate. Therefore, it is possible, and perhaps likely, that more than 30 beluga whales could be removed from the Sakhalin-Amur stock annually without initiating a population decline.

Table 3. Number of Beluga Whales from Sakhalin-Amur Stock Live-Captured by Year

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Mean
Whales Collected	10	22	10	26	25	31	20	0	25	24	30	33	**21.3**

Source of years 2000–2010: Shpak et al. 2011
Source of year 2011: Mukhametov pers. comm. 2012

The activity under this permit will not include take from the wild. The action is only for importation for public display. The animals to be imported have already been collected and the potential impacts—if any—of their removal from the wild would occur regardless of the proposed permit activity. Therefore, the permit activity would not directly result in effects on the Sakhalin-Amur beluga whale stock.

As described above, the PBR for the Sakhalin-Amur stock was determined—conservatively—to be 30 animals per year on average and could be as high as 62 or 86. The 18 whales that would be imported under this permit were collected over a three-year span, with the greatest number—eleven—taken in 2010. Consequently, any indirect effect of the permit activity on the Sakhalin-Amur beluga whale stock will be negligible. Further, if the whales proposed to be imported to the U.S. were not so imported, it is likely they will be sold by the Russians to Chinese interests.

As illustrated in Table 3 above, the number of belugas collected from Sakhalin Bay varies from year to year. A number of whales were collected in 2006, 2010, and 2011 that would not be imported into the U.S. under this permit. The total combined number of belugas collected (Table 3) includes those that would be imported under this permit as well as others that would not be imported under this permit. The total number of belugas collected combining those that would be imported under this permit in addition to all other belugas collected in 2006, 2010, and 2011 was 83. This is an average collection of 27.7 belugas. Because this is below the lowest possible PBR of 30, the effects of combined takes of beluga whales from this area, including those that would be imported under the permit activity, are not be anticipated to result in adverse impacts on the Sakhalin-Amur stock.

As described above, it is possible that the Sakhalin-Amur aggregation and the Shantar aggregation constitute a single stock of beluga whales. Depending on the method used (outlined above), a PBR of the combined stock would be either 62 or 86. Considering potential effects of removal from a combined Sakhalin-Shantar stock, the anticipated impacts of the removal of all beluga whales collected—including those that would be imported under this permit activity—would be diminished further. While the research completed in the Sea of Okhotsk demonstrates relatedness of aggregations, all animals collected came from Chkalova Island, in the Sakhalin-Amur aggregation.

Because some beluga whales were collected and released during the collection process, these animals were temporarily disturbed. There is no evidence that either these whales or the Sakhalin-Amur stock suffered any long-term consequences from the brief disturbance of these individuals.

(c) Effects on the Human Environment

The importation of 18 beluga whales and their subsequent addition into the North American beluga breeding cooperative will result in a beneficial effect on the human environment. By immediately increasing the number of belugas on display in North America, the importation will increase opportunities for conservation and research that will benefit animals in the wild and opportunities to educate the public about beluga whales and arctic ecosystems. The importation of 18 whales will also increase the sustainability of the North American captive breeding population.

As described in Appendix E that accompanies this permit application, modeling scenarios by Willis (2012) that account for the addition of the specific 18 animals proposed for import indicate that the addition of imported animals will provide the population of the North American beluga breeding cooperative with a greater than 70 percent chance of stability in 30 years. Without the addition of 18 whales, Willis (2012b) estimated a 56 percent probability that the population will decline over the next 30 years. Therefore, the importation of 18 whales will increase the population base of the North American beluga population to a level that will reduce the likely population decline and increase the likelihood of population maintenance and growth. Furthermore, the addition of these whales will enhance the genetic diversity of future offspring. This will lead to more opportunities for public encounters with beluga whales in aquaria across North America over future generations of beluga whales.

(d) Effects on the Marine Ecosystem

For the permit activity of importation, the project action will commence at the export facilities of UMMRS and conclude upon importation into the U.S. through Atlanta Hartsfield International Airport and JFK International Airport. Subsequent to importation, the beluga whales would be transferred to the Georgia Aquarium and, under breeding loans, to a number of other facilities (identified in the Statement of Work in application item IV.A, above). The facilities at UMMRS include fully enclosed aquarium tanks, sea pens, and a 2.3-hectare (5.7-acre) lagoon that is filled with sea water from the Black Sea through a pump system (see Appendix D accompanying this application). No additional holding areas will be constructed as a result of the permit activity, nor are the beluga whales allowed to leave the enclosures. Therefore, there will be no direct effects on the marine ecosystem in the vicinity of UMMRS.

By virtue of being situated in upland locations and by being limited to human-constructed facilities (i.e., no natural lagoons, pools, or sea pens) where natural marine ecosystems are not present, importation of 18 beluga whales to the Georgia Aquarium and other North American facilities will not result in any effects on marine ecosystems.

The original source of the whales was the Sakhalin Bay, in the Sea of Okhotsk. Background information on the oceanography and marine ecosystems of the Sea of Okhotsk is provided in Appendix G. Techniques used to collect whales in habitat are described in response to item IV.E.6 of this application and in Appendix C. Collection techniques involve the use of small motored craft and personnel wading in shallow water where collections occur. Substrate in these areas is clean sand regularly turbated by wave and current action. The mesh used in the nets is too coarse to have a potential for bycatch of most marine organisms, and no bycatch of any kind has been reported. Accordingly, collection techniques have negligible potential to affect the marine ecosystem, and no impacts have been reported.

Other beluga collections are performed in this location by the same local collection team, using the same techniques and equipment as described above. As described in response to application item IV.E.8 above, Russian authorities typically set the maximum number of belugas allowable for collection from Sakhalin Bay between 40 and 57 animals (Shpak et al. 2011)—though the number of whales collected averages 21.3 per year since 2000. Even if the maximum number is collected, no effects on the local marine environment would be anticipated—largely because of the innocuous nature of the collection techniques. Therefore, the effects of other collections, when combined with the effects of the collection of whales associated with this permit application, are negligible.

1. Impacts Considered Experimental or Controversial

The activities associated with the proposed importation of 18 beluga whales are not considered new or untested, nor are the impacts associated with them unknown or uncertain. There is no serious scientific debate about the process and procedures used to transport animals. GAI will use standard and accepted procedures developed and/or endorsed by the IATA, CITES, Association of Zoos, and Aquariums (AZA), AMMPA, and *CRC Handbook of* Marine Mammal *Medicine*, Second Edition (Dierauf and Gulland 2001). Practices, procedures, and equipment used as part of the proposed import will also be in compliance with all applicable regulations set forth under the AWA, MMPA, USFWS regulations, and USDA regulations. The proposed permit activity will not involve experimentation with new or untested transport processes or procedures.

Although the collection of whales in Sakhalin Bay is not part of the proposed permit activity, it should be noted that the procedures used to collect the beluga whales to be imported under the proposed permit activity closely mimic the collection procedures used by scientific and regulatory organizations such as NMFS (Ferraro et al. 2000), the DFO (Orr et al. 2000), and the Society of Marine Mammalogy (Gales et al. 2009). Techniques used to collect the beluga whales that will be imported as part of the permit activity, like those used by NMFS, DFO, and the Society of Marine Mammalogy, are safe and humane.

The activities associated with the proposed importation will not result in effects that are considered highly controversial. Although there likely will be opposition to the importation and public display of beluga whales, controversy does not exist solely because some groups are highly agitated about, vigorously opposed to, or have raised questions about an activity. Instead, controversy is constituted by a significant dispute about the size or nature of the impacts, rather than the existence of opposition to an activity. Furthermore, the existence of conflicting views among experts is not considered de facto controversy. When specialists express conflicting views, permitting agencies have the discretion to rely on the reasonable opinions of their own experts. Under these criteria, the effects associated with transport of the animals are not considered controversial. The controversy associated with public display of belugas is largely based on philosophical beliefs and is not based on scientific controversy regarding the impacts of holding whales in captivity.

2. Public Health and Human Safety

All beluga whales to be imported under this permit will undergo several examinations and will be in the care of veterinary staff between their initial collection and their import to the U.S. The whales will be checked and treated for diseases, illnesses, parasites, and other conditions necessary to confirm their good health. To date, there has been no record of disease transmission between beluga whales and humans, or vice versa.

3. Geography and Physical Environment

Areas where project activities occur will consist of the exporting facilities of UMMRS, the importing facility of the Georgia Aquarium, and five other North American aquaria where whales will be transferred under breeding loans after their importation into the U.S. Activities taking place in the exporting facilities, the Georgia Aquarium, and the other aquaria facilities will have no effect on unique geographic areas such as state or national marine sanctuaries, marine-protected areas, parks or wilderness areas, wildlife refuges, wild and scenic rivers, designated critical habitat for endangered or threatened species, or essential fish habitat.

Detailed information regarding UMMRS is provided in Appendix D. Detailed information regarding facilities at the Georgia Aquarium is provided in Appendix H. Detailed information regarding the North American facilities where belugas will be transferred under breeding loans is included in Appendix I.

4. Cultural Resources

The proposed importation of 18 beluga whales under this permit will have no impact on important scientific, cultural, or historic resources.

5. Invasive Species

The importation of belugas is not an activity that is suspected of spreading invasive species because the whales are not prone to host external parasitic organisms. During their housing at UMMRS, all animals were inspected for parasites. To date this has been a non-issue. At the time of importation, all 18 whales will have been held in quarantine at the UMMRS facility for one to several years. Importation efforts will not provide for the potential transfer of invasive species in Russian seawater, as the whales will be removed from the Russian transport containers and placed into clean containers prior to departing for the U.S. Water will be disposed of in compliance with all applicable regulations in the locations where the disposal may occur. The clean water used will be tested for water quality and temperature as appropriate. Should, for example, temperature adjustments be deemed necessary, ice or tepid water will be used.

V. Export Requirements

This application is for the activity of importation only. Therefore, the requirements related to export are not addressed.

VI. General Requirements for Public Display

A. The Facilities at which the Marine Mammals Will be Maintained

The beluga whales imported under this permit will be maintained at the Georgia Aquarium, Shedd Aquarium, Mystic Aquarium, Sea World Orlando, Sea World San Antonio, and Sea World San Diego.

The Georgia Aquarium is located at 225 Baker Street, Atlanta, Georgia, 30313. The aquarium is open to the public 365 days a year. Except for limited exceptions and extended hours, its regular operating hours are 10:00 a.m. to 5:00 p.m. Sunday through Friday, and 9:00 a.m. to 6:00 p.m. on Saturday. During the summer (May 27 through August), the aquarium is open for extended hours. General admission tickets are $29.95 for adults, $23.95 for children ages 3 to 12, and $25.95 for seniors age 65 and up. Tickets for shows and special attractions at the aquarium are available for an additional charge. Discounts are provided for group sales and member tickets. Annual passes are also available. Additional details about this information are provided in Appendix H of this application.

In addition, a number of whales would be transported to other facilities under breeding loans. These facilities are described below. Further information regarding these facilities is included in Appendix I accompanying this permit application.

The Shedd Aquarium is located at 1200 South Lake Shore Drive, Chicago, Illinois. It is situated on the Lake Michigan shoreline adjacent to the Field Museum. The regular fall and winter hours at Shedd Aquarium are 9:00 a.m. to 5:00 p.m. Monday through Friday, and 9:00 a.m. to 6:00 p.m. Saturday and Sunday. In the spring and summer, the hours at Shedd Aquarium are 9:00 a.m. to 6:00 p.m. daily. Shedd Aquarium is open every day of the year except for Christmas Day. General admission is $8.00 for adults and $6.00 for children. The cost for a "Total Experience Pass" that includes admission to the 4-D Experience and the aquatic show is $34.95 for adults and $25.95 for children.

Mystic Aquarium is located in Mystic, Connecticut at 55 Coogan Boulevard, adjacent to Interstate 95 immediately east of the Mystic River estuary. December through February, Mystic Aquarium is open 10:00 a.m. to 4:00 p.m. daily. In March, the aquarium is open 9:00 a.m. to 4:00 p.m. daily. From April through October, Mystic Aquarium's hours are 9:00 a.m. to 5:00 p.m. daily. In November, the aquarium is open from 9:00 a.m. to 4:00 p.m. daily. Mystic Aquarium is open every day of the year except for Thanksgiving and Christmas. General admission is $29 for adults 18 to 59, $21 for children 3 to 17, $26 for seniors 60 or older, and free for children ages 2 and under.

Sea World Orlando is located at 7007 Sea World Drive, Orlando, Florida, adjacent to Interstate 4 and the Central Florida Parkway. Regular hours are 9:00 a.m. to 6:00 p.m. in January and 9:00 a.m. to 7:00 p.m. February through mid-March. From May to December, the aquarium opens at 9:00 a.m. and closes anytime from 7:00 p.m. to 10:00 p.m. Sea World Orlando is open 365 days per year. General admission prices range from $63.99 for children's tickets purchased online, to $81.99 for adult tickets purchased at the gate.

Sea World San Antonio is located at 10500 SeaWorld Drive, San Antonio, Texas. The park is located in the western suburbs of the city between Texas Route (TR) 151 and TR 1604. Hours of admission range from 9:00 a.m. to 10:00 p.m. depending on the time of year and the day of the week. Sea World Antonio is open every day of the year.

Sea World San Diego is located at 500 SeaWorld Drive, San Diego, California, between the southern shore of Mission Bay and the San Diego River. Hours of admission range from 9:00 a.m. to 11:00 p.m. depending on the time of year and day of the week. Single day admissions to Sea World San Diego costs $65.00 for children and $73.00 for adults.

B. <u>APHIS License</u>

The Georgia Aquarium
APHIS license information:
APHIS Class C Exhibitor license # 57-C-0220

Please see Appendix H accompanying this application for a copy of the license identified above.

C. <u>Education and Conservation Program</u>

Education

Since opening in 2006, approximately 460,000 people have participated in Georgia Aquarium's educational programs. More than 200,000 of these participants have been enrolled in instructor-led programs. On average, the aquarium hosts approximately 85,000 students per year for the instructor-led and self-guided programs. In 2011, the Georgia Aquarium had 126,640 students, chaperones, campers, and teachers participate in the educational programs.

The aim of the Georgia Aquarium Education Department is to make the education experience at the aquarium an extension of the classroom. Educational programs are innovative, interdisciplinary, and interactive, and are designed for students of all ages including pre-K through 12th grade, home school programs, and college-aged students. Educational programming is based on the professional standards established by the AZA and AMMPA along with objectives that are aligned with Georgia Performance Standards (GPS) at each grade level. These programs are designed to help students meet the educational objectives of the Georgia curriculum as well as national curriculum standards. As part of the education program, students are engaged in animal encounters, interactive activities, and research applicable to real-world situations.

The education programs at the Georgia Aquarium are unique in that they have an assessment component that ties them to the GPS, as well as to national curriculum standards. Having an assessment tool aligned with the formal education curriculum of the state of Georgia is valuable, as the Georgia Department of Education has placed a heavy emphasis of student improvement on standardized tests. Aquaria throughout the country offer a wide range of educational programming from tours to aquatic lab programs, yet most do not address student needs relative to performance on standardized testing as is the case at Georgia Aquarium. In each program, students take an on-line pre-assessment test prior to their visit to the Georgia Aquarium. After their visit, students participate in a post visit assessment and their gains are compiled in an education database.

The Georgia Aquarium currently has several program options designed for the educational experience of student guests. Curriculum experts and advisors have worked to develop a model for each of the programs. Each age group curriculum is designed for an instructor-led or self-guided program, which includes a downloadable Teacher Guide describing lesson overviews and activities. Students visit galleries to discover the characteristics of unique animals, to be exposed to aquarium-related careers, research efforts, and conservation programs, to learn how the aquarium meets the diverse needs of the animals, and to discover the world behind the scenes including the husbandry staff attending to the animals, aquaria life support systems, and exhibit maintenance. A list of all programs currently offered by the Georgia Aquarium is included in Appendix H that accompanies this permit application.

A number of the self-guided and instructor-led programs include content and lessons specific to beluga whales. Appendix H identifies the specific programs that address beluga whales and summarizes the content of each. For example, in *Sea Life Safari*, students learn the four basic needs of belugas, specifically focusing on their ability to survive in cold-water habitats. In *Discovery Labs*, students learn about the status of beluga populations around the world, and examine hypothetical wildlife management decisions involving beluga populations by identifying factors that can affect population size.

In addition to the student programs listed above, the Georgia Aquarium offers a wide range of educational experiences for all aquarium guests to aid in their understanding of beluga whales and their current ecological status. The programs focus primarily on helping guests in understanding the natural history of beluga whales, as well as current research, conservation, rehabilitation, and rescue efforts for these animals. The educational programs focus on helping guests understand the unique arctic ecosystem where beluga whales are found and the many obstacles they face in an effort to thrive in their natural environment. One aspect of the public programs includes regularly scheduled presentations by trained aquarium staff members who discuss beluga whales and their natural environment. Presentation topics include the status of beluga whales in the wild and information about the conservation organizations that are playing an active role conserving belugas. Research efforts into beluga whale migration and other forms of animal behavior research are also included as presentation topics. The program also reviews how these animals are successfully cared for and trained to thrive in an aquarium setting.

The Georgia Aquarium is home to the Correll Center for Aquatic Animal Health, a state-of-the-art animal health facility with more than 10,500 square feet designed by 12 world-renowned veterinary and conservation professionals for the purpose of caring for the animals at Georgia Aquarium, conducting research, and teaching aquatic medicine. Currently, the Georgia Aquarium is the only facility with a program that is an integration of an aquarium and a veterinary teaching hospital in the specialty fields of wildlife medicine and veterinary pathology. The partnership with the University of Georgia Veterinary Teaching Hospital allows the Georgia Aquarium to provide a complete aquatic animal pathology and clinical medicine program while training veterinary residents, interns, and students.

Conservation

In addition to providing educational opportunities for students and the general public, the Georgia Aquarium is dedicated to the research and conservation of marine life. The Georgia Aquarium is a leading facility for aquatic animal conservation and research. The Georgia Aquarium conducts research to improve husbandry methods, develop innovative and exciting new exhibits, contribute to the understanding of the underwater world, and apply new discoveries to the conservation of aquatic life. The Aquarium's 4R Program supports and funds efforts in the areas of rescue, rehabilitation, research, and responsibility. The Aquarium conducts research to improve husbandry methods, develop innovative and exciting new exhibits, contribute to the understanding of the underwater world, and apply new discoveries to the conservation of aquatic life. Research is shared with conservation organizations throughout the world, allowing better understanding and protection of many of the species located at the Georgia Aquarium.

With its NMFS partners, Georgia Aquarium helped pioneer health assessments for beluga whales in Alaska in 2008, using methods developed in the aquarium setting. Georgia Aquarium has also placed a focus on research on whales in Bristol Bay relative to the population in Cook Inlet, which was recently listed as endangered. For an upcoming program in Bristol Bay, researchers will run comprehensive health assessments, examine beluga whale diets based on stable isotopes in their blood and biopsies, as well as test for any exposure to pollution. Georgia Aquarium has also performed a pilot study to compare fertility potential in beluga whales from a presumed-healthy population (Bristol Bay) and the recently listed population in Cook Inlet, and is assessing the fertility potential of beluga whales as a species. In addition to research on whales in Alaskan populations, Georgia Aquarium has also researched beluga migration patterns and genetic relationships in the Sea of Okhotsk. The Georgia Aquarium will continue to support research in the 2012 field season to further examine beluga stock presence and movements in the area. Research will include health assessments, documentation of reproductive status, and observation of movement and location patterns. Researchers will focus on determining beluga presence in the lower Amur estuary and Tartar Straight, Chkalov and Baydukova Islands, and Academy Bay and Tugursky Bay.

The Aquarium's research efforts extend beyond beluga whales and, as an example, include field research on whale sharks, manatees, and the northern right whale. Details regarding these programs are included in Appendix H accompanying this permit application.

VII. Previous Permits

A. Outstanding Reports Associated with Previous Permits

In 2005, GAI applied for and was granted a permit (Permit No. 1078-1796) for the importation of two beluga whales from Grupo Empresarial Chapultepec, S.A. DE C.V., a Mexican corporation headquartered in Mexico City, Mexico. There are no outstanding reports associated with this permit. In 2010, GAI applied for and was granted a permit (Permit No. 15500) to import two male captive-born Atlantic bottlenose dolphins (*Tursiops truncates)* from Dolphin Experience, Ltd., Freeport, Grand Bahama Island, The Bahamas, and three female captive-born Atlantic bottlenose dolphins from Dolphin Quest Bermuda, Hamilton, Bermuda, to the Georgia Aquarium, Atlanta, Georgia. There are no outstanding reports associated with this permit. No other previous permits for taking or import of marine mammals were sought by or issued to GAI.

B. Cooperating Institutions and Individuals that Previously Held Permits

For the purpose of this permit activity, there are no cooperating institutions or individuals that previously held applicable permits.

C. Other Permits or Authorizations

CITES export permits have been issued for the transport of beluga whales from Russia to the U.S. The CITES export permits are included in Appendix D of this application. Permits for the original collection of the beluga whales were issued prior to their collection in the Sea of Okhotsk, and are included in Appendix C of this application. No other permits are being sought in association with this request. To date, no paperwork is required when transitioning animals from aircraft to aircraft, as long as the location where transitioning occurs is not the permanent destination. However, we will continue to consult with Belgian authorities to make certain we are in compliance with any requirements which come to exist. All required reports, including marine mammal data sheets for the National Marine Mammal Inventory, will be completed.

VIII. Certification and Signature

I hereby certify that the foregoing information is complete, true, and correct to the best of my knowledge and belief. I understand that this information is submitted for the purpose of obtaining a permit under the following statute and the regulations promulgated thereunder, as indicated in section I. of this application: the Marine Mammal Protection Act of 1972 (16 U.S.C. 1361 et seq.) and regulations (50 CFR Part 216). I also understand that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties provided under the Marine Mammal Protection Act of 1972.

Billy Hurley
Sr. Vice President & Chief Zoological Officer
Georgia Aquarium, Inc.

JUNE 15, 2012
Date

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APPENDIX A
SEA OF OKHOTSK BELUGA POPULATIONS

Contents

Tables

Figures

Acronyms and Abbreviations

ECV	error coefficient of variation
ESA	U.S. Endangered Species Act
ESU	Evolutionary Significant Unit
IUCN	International Union for the Conservation of Nature
IWC	International Whaling Commission
km	kilometers
mtDNA	Mitochondrial DNA
MMPA	Marine Mammal Protection Act
MU	Management Unit
NMFS	National Marine Fisheries Service
PBR	Potential Biological Removal

Chapter 1
Introduction

The beluga (or white) whale (*Delphinapterus leucas*) is a medium-sized toothed whale present in the Arctic and sub-Arctic waters of North America and Eurasia (Stewart and Stewart 1989) including the Sea of Okhotsk (Melnikov 1999). Collectively, the beluga whales inhabiting the Sea of Okhotsk are geographically isolated (Melnikov 1999) and genetically distinct (Meschersky et al. 2008) from nearby Bering Sea and Arctic Ocean stocks, and may have been separated from other beluga whale populations since the last glacial maximum (O'Corry-Crowe et al. 2002). Known Sea of Okhotsk wintering grounds identified by Shpak et al. (2010) are over 1,750 kilometers (km) from the Bering Sea (and probably much farther from actual Alaska beluga wintering grounds). Genetic studies show that the Sea of Okhotsk belugas have been separated from the Bering Sea belugas long enough to develop unique haplotypes (O'Corry-Crowe et al. 2002; Meschersky et al. 2008), while some Sea of Okhotsk individuals do not possess haplotypes universal to populations that winter in the Bering Sea (O'Corry-Crowe et al. 1997).

The International Whaling Commission (IWC) proposed 29 discrete beluga whale management stocks within their global range, including three provisional stocks in the Sea of Okhotsk: Shelikov Bay, Sakhalin Bay/Amur River, and Shantar Bay (International Whaling Commission 2000). Lacking genetic or other empirical data, the IWC (2000) used the geographic distinction of summer aggregations as its primary criterion for Sea of Okhotsk stock identification (a topic reviewed in Appendix B, Rangewide Beluga Assessment).

Sea of Okhotsk belugas appear to display matrilineal-directed philopatry to specific summer estuaries, a behavior common to nearly all beluga populations (Brennin 2007). This behavior can influence the population gene structure, especially within mitochondrial DNA, which is maternally inherited (O'Corry-Crowe et al. 2002). However, mating occurs during the spring (Brodie 1971; Braham 1984; O'Corry-Crowe et al. 2002) when belugas from multiple aggregations are often in shared wintering grounds (Frost and Lowry 1990; Matishov and Ognetov 2006; Shpak et al. 2010). Thus, regardless of their "stock" (summer aggregation) affiliation, male belugas may breed with females from other aggregations, resulting in gene flow between groups. For this reason, some authors (Kleinenberg et al. 1964; Melnikov 1999) have asserted that only a single beluga stock inhabits the Sea of Okhotsk.

The question of stock status is important because this is the population entity or unit used in proactive management of marine mammals (Eagle et al. 2008), including management of harvest and live capture. This document details the current knowledge of Sea of Okhotsk beluga whales and the environment they inhabit, and investigates existing data regarding the stock status of the three summer aggregations.

Chapter 2
Beluga Whale Ecology

Beluga whales are well adapted for life in the ice fields (Kleinenberg et al. 1964). They are capable of breaking through up to 8 centimeters of ice to breathe (Kleinenberg et al. 1964; St. Aubin et al. 1989), and they use echo-location to find open breathing holes (Gurevich 1980; O'Corry-Crowe 2002). Still, ice entrapment can be a significant mortality factor (Mymrin et al. 1999; Heide-Jorgensen et al. 2002) with some events involving hundreds of whales (Ivashin and Sherlyagin 1987; Brennin 2007).

Polar bears (*Ursus maritimus*) often prey on belugas that are trapped by ice or stranded during low tide events (Freeman 1973; Lowry et al. 1987a), but polar bears are absent from the Sea of Okhotsk. Killer whales (*Orcina orca*) also prey on beluga whales (Lowry et al. 1987b; Frost et al. 1992; George and Suydam 1998; Shelden et al. 2003) and are numerous in the Sea of Okhotsk, although most of the sightings have been of the resident fish-eating type (Burdin et al. 2007). Still, killer whales have been observed in the Sakhalin area where beluga whales concentrate during the summer (Doroshenko 2002), and the beluga whale behavior of concentrating in shallow-water estuaries has been suggested as a means to avoid killer whale predation during critical life stages (e.g., calving) (Brodie 1971; Finley et al. 1990 cited in Lydersen et al. 2001).

Like most beluga whales, Sea of Okhotsk belugas summer in shallow estuaries and winter in deep-water ice fields. Beluga whale females probably return each summer to the estuaries in which they were born (Brennin 2007). This strong philopatry has allowed humans to exploit beluga populations for centuries (McGee 1974; Heide-Jorgensen 1990).

Beluga whales are strongly attracted to shallow-water estuaries because 1) the warmer waters provide a thermal advantage for newborn calves (Sergeant 1973; Fraker et al. 1979); 2) shallow-water gravels provide rubbing substrate for belugas to remove molting skin, and the warm water stimulates new skin growth (St. Aubin et al. 1990); 3) shallow water depths allow belugas to avoid killer whales during calving (Brodie 1971); and 4) foraging opportunity is enhanced by congregations of anadromous fish like salmon (*Oncorhynchus* spp.) and Arctic char (*Salvelinus alpinus*) (Hazard 1988; Frost and Lowry 1990). Salmon is an extremely important summer food source for Sea of Okhotsk belugas (Sobolevskii 1983).

Sea of Okhotsk belugas winter in the sea's deep central waters (Shpak et al. 2010) where animals from all three putative stocks may intermix (Kleinenberg et al. 1964; Melnikov 1999). Mating occurs in the wintering grounds generally during April and May (Brodie 1971; Heide-Jorgensen and Teilmann 1994), and females can ovulate twice in a season (Robeck et al. 2005). Calving occurs June to August following a 14- to 15-month gestation, and the calving interval is generally 3 years (Brodie 1971; Sergeant 1973; Suydam 2009).

Beluga whales are highly opportunistic foragers and have been recorded to eat over 100 hundred different food items (Kleinenberg et al. 1964). They will bottom-forage to depths of 600 meters or more (Martin and Smith 1992), and in the winter they take fish like Arctic cod (*Arctogadus glacialis*), polar cod (*Boreogadus saida*), and Greenland halibut (*Reinhardtius hippoglossoides*) (Seaman et al. 1982; Bluhm and Gradinger 2008). Specific to the Sea of Okhotsk, major forage fish include saffron cod (*Eleginus gracilis*), walleye pollock (*Theragra chalcogramma*), rainbow smelt (*Osmerus mordax*), Pacific herring (*Clupea pallasii*), Greenland halibut, and other flounders (Kuznetsov et al. 1993;

Melnikov 1999), all of which are important beluga prey items. Shpak et al. (2010) found satellite-tagged belugas in the Sea of Okhotsk near the 200-meter isobath from January to March—areas where concentrations of Greenland halibut are found (Kuznetsov et al. 1993). Important nearshore summer prey includes salmon, char, smelt, and herring (Sobolevskii 1983; Melnikov 1999).

Chapter 3
Beluga Whale Populations

Sea of Okhotsk beluga whales form summer aggregations at three general locations: Shelikov Bay (or Gulf), Sakhalin Bay/Amur River (or Firth), and Shantar Bay (or Sea) (Figure 1). A fourth location, Tauy Bay (Magadan) southwest of Shelikov Bay, was subject to intense commercial harvest and is no longer used (Melnikov 1999). Details of the three present aggregations follow.

Shelikov Bay

Shelikov Bay is located in the northern extreme of the Sea of Okhotsk (Figure 2) where it extends deep into Chukotka. The bay itself is divided into two smaller embayments—Ghizhiga and Penzhina Bays—both used extensively by summering belugas. Berzin and Vladimirov (1989) estimated that approximately 10,000 summering beluga whales begin arriving in Shelikov Bay in May to feed on spawning herring. By mid-July, these whales begin to form feeding aggregations of 2,500 to 3,000 whales exploiting pink salmon (*Oncorhynchus gorbuscha*) runs (Berzin et al. 1988). As salmon runs end in mid-September, these belugas disperse in search of food, eventually migrating south into coastal polynyas or central ice fields to overwinter (Melnikov 1999).

Sakhalin Bay/Amur River

Belugas arrive in Sakhalin Bay and the mouth of the Amur River (Figure 3) in May where they first feed on early Amur smelt runs. Soon thereafter, they apparently switch to feeding on spawning herring, and then to mid-summer runs of pink salmon (Melnikov 1999). Berzin and Vladimirov (1989) stated that aggregations of 7,000 to 10,000 whales would form here, the largest group anywhere in the Sea of Okhotsk. This summer aggregation has been the subject of multiple studies by Shpak et al. (2010, 2011).

Shantar Bay

The Shantar Bay (Shantar Sea) summer population congregates in Udskaya, Tugursky, Ulbansky, and Nikolaya bays (Figure 4), where they apparently arrive late (mid-June) compared to other summer populations, possibly a result of a later ice breakup in Shantar Bay (Melnikov 1999). Shantar belugas feed first on smelt runs, followed by herring and salmon. Tugursky Bay appears to be the most consistently used. Commercial fisheries were established there and in Udskaya Bay in the 1950s following the "collapse" of the beluga harvest at Sakhalin-Amur (Melnikov 1999). Bay use appears to be somewhat inconsistent as whales move about the Shantar Bay region in response to varying tides, ice conditions, and prey concentrations (Melnikov 1999). This is not an isolated circumstance. Kuznetsova et al. (2010) confirmed that tides influence local movements of Shelikov and Sakhalin belugas as well, and O'Corry-Crowe et al. (2002) stated that prey distribution and prevailing ice conditions influence summer movement patterns of Alaska belugas. Berzin et al. (1988) estimated in 1988 that 3,000 to 5,000 whales summered annually in the Shantar Bay area.

Figure 1
Sea of Okhotsk

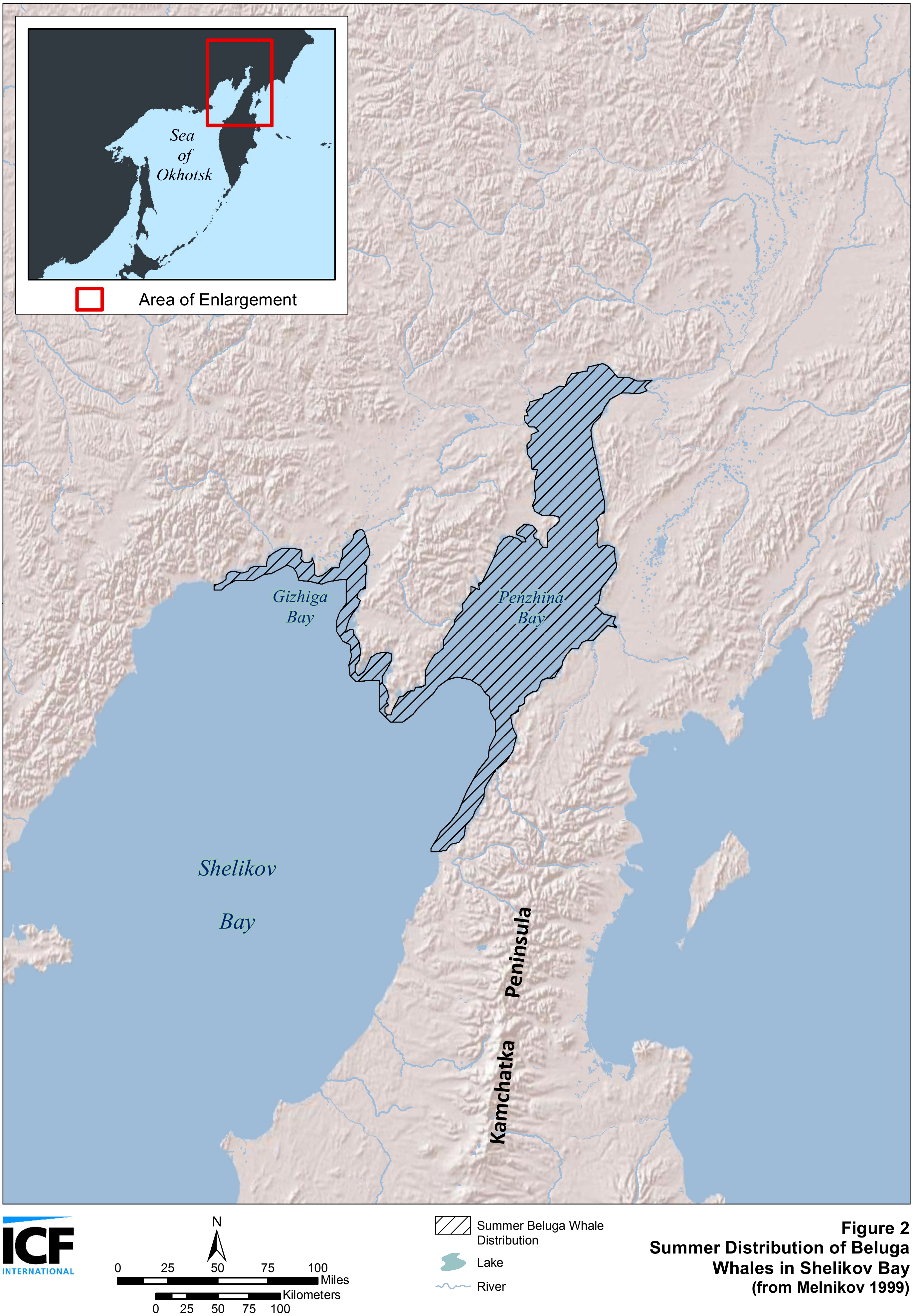


Figure 2
Summer Distribution of Beluga Whales in Shelikov Bay
(from Melnikov 1999)

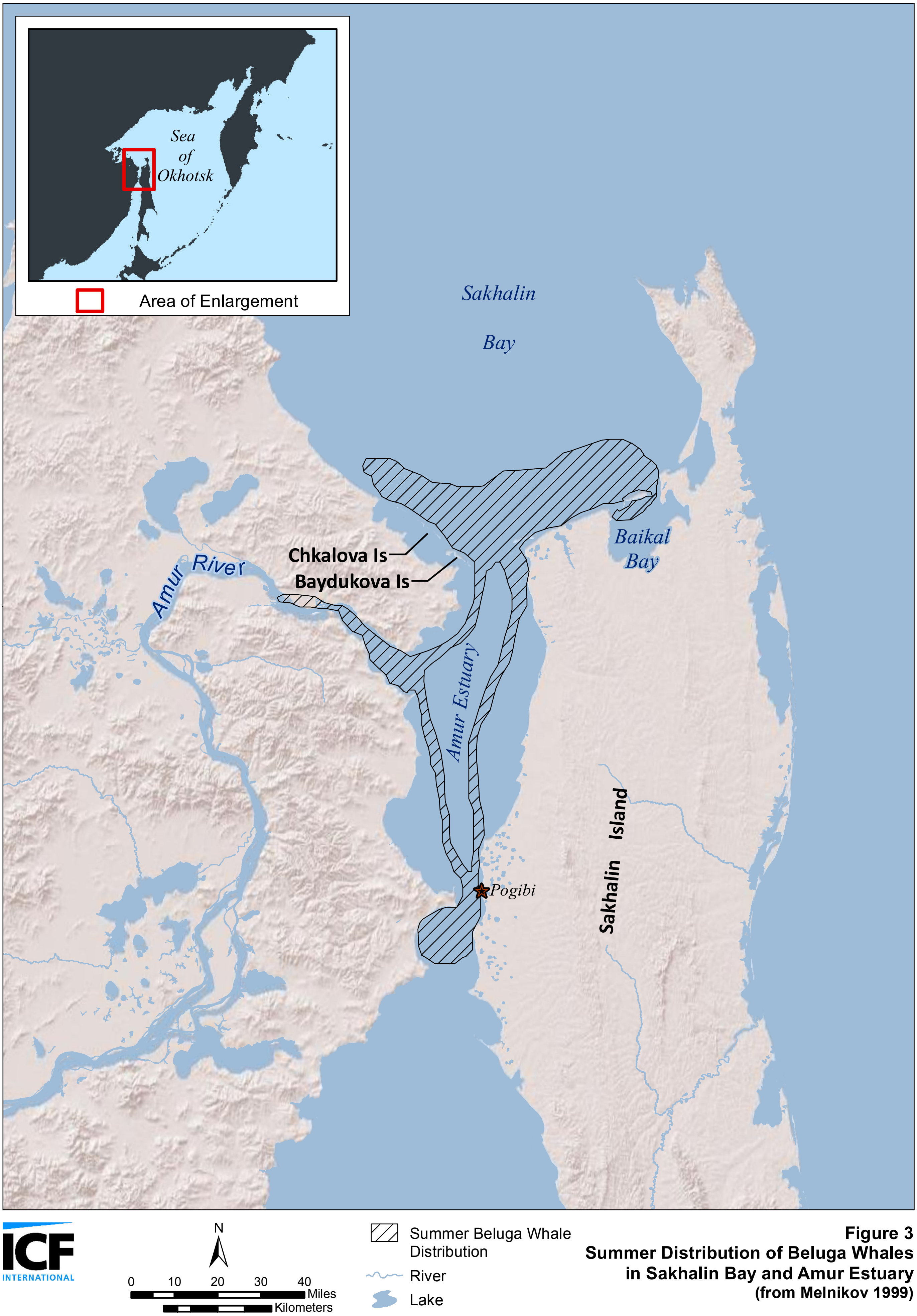
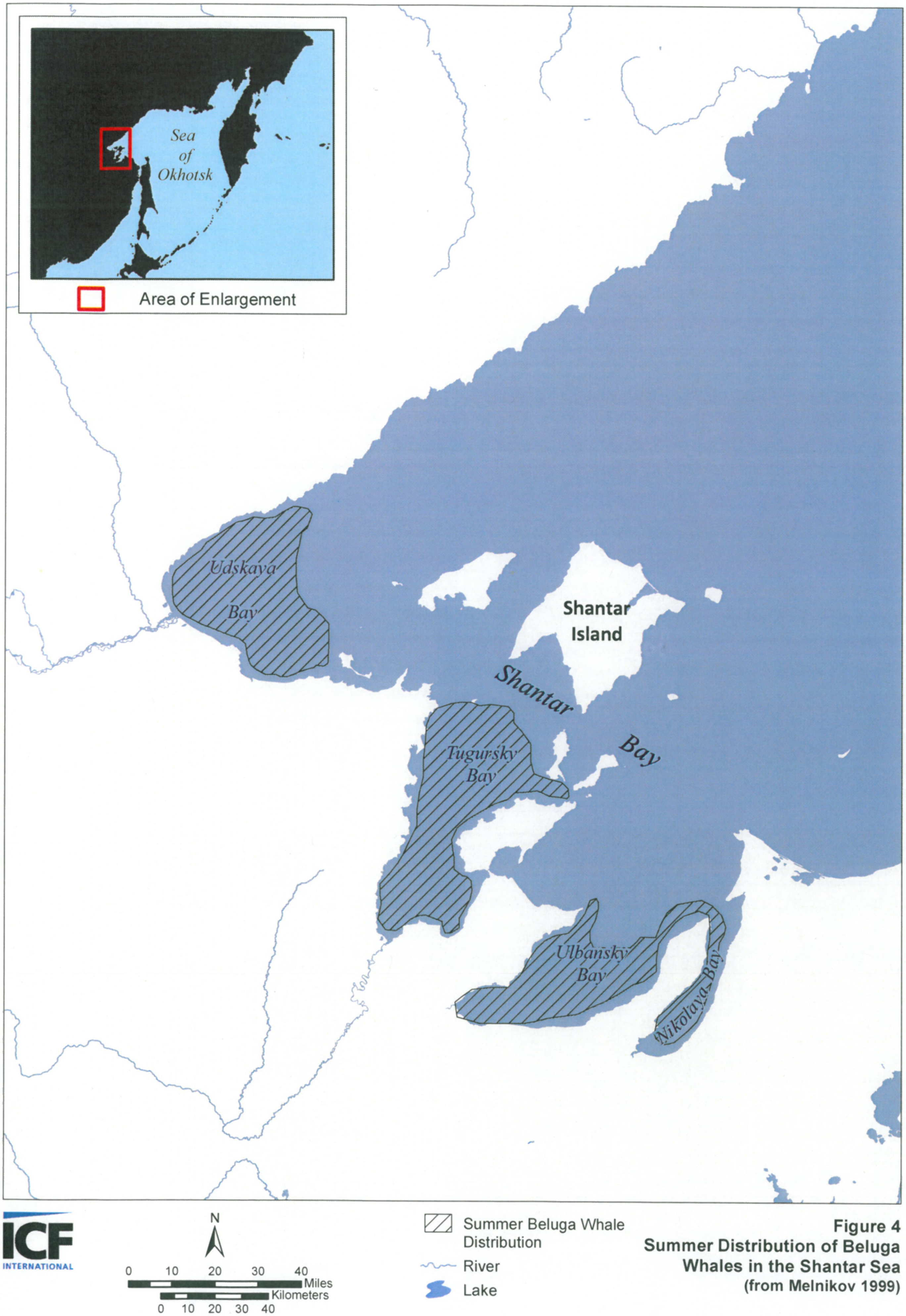


Figure 3
Summer Distribution of Beluga Whales in Sakhalin Bay and Amur Estuary
(from Melnikov 1999)



ICF INTERNATIONAL

Figure 4
Summer Distribution of Beluga Whales in the Shantar Sea (from Melnikov 1999)

Chapter 4
Current Population Estimates

Berzin and Vladimirov (1989) estimated in 1989 that 18,000 to 20,000 beluga whales inhabited the Sea of Okhotsk, which is slightly lower than the 20,000 to 25,000 derived by summing their separate estimates for the Shelikov, Sakhalin-Amur, and Shantar summer aggregations. Moreover, these estimates were calculated using a correction factor of 12x recommended by Belkovich (1960) for animals missed or below the surface and unavailable for survey. Shpak et al. (2011) notes that this correction factor is probably far from valid.

In 2009 and 2010, Shpak et al. (2011) surveyed beluga populations in the Shantar and Sakhalin-Amur areas using both line-transect and direct count methods and derived several population estimates depending on survey type (line-transect or direct count), the month or year of the survey, whether software (i.e., Belukha 2) was used to correct for effective viewing distance, and what correction factors were applied. Correction factors considered were 2x (Kingsley and Gauthier 2002; based on the results of multiple Canadian studies), 2.27x (Shpak et al. 2011; based on flyovers of holding pens of known numbers of belugas), and 12x (Belkovich 1960). The latter correction factor was applied by Shpak et al. (2011) simply as a basis for comparing against past population estimates that were based on this correction factor.

An International Union for the Conservation of Nature (IUCN) scientific panel of beluga experts (Reeves et al. 2011) examined Shpak et al.'s population estimates and concluded that the best population estimates were those that were analyzed using the Belukha 2 software, the Kingsley and Gauthier (2002) 2x correction factor (Shpak et al. 2011: Appendix 1, Table 18), and averaged over the two or three population surveys conducted in each area (Shantar: 6,814 and 6,508 belugas; Sakhalin-Amur: 4,602, 3,154, and 4,128 belugas). Thus, the best population estimate for the Sakhalin-Amur area is 3,961 and for the Shantar area is 6,661 (Reeves et al. 2011). The minimum population estimate—the average of the lower 20th percentile of each of the three survey estimates (Barlow et al. 1995)—was determined to be 2,891 for the Sakhalin-Amur population (Reeves et al. 2011). The IUCN scientific panel also noted that the minimum population estimate parameters could be refined, including reducing the error coefficient of variation (ECV) by pooling the survey data across area and years. This suggestion was met resulting in increasing the minimum population estimate slightly to 2,972 (Chelintsev and Shpak 2011).

The Shantar bays were not conducive to line-transect survey methods. Animals were directly counted and bay populations estimated by multiplying count numbers with a 2x correction factor for animals missed. The highest direct count of 3,206 animals for the combined summering aggregations for the Shantar region occurred during an August 7 and 8, 2010, survey. This uncorrected number also serves as the population minimum following the recommendation from Wade and Angliss (1997) for direct count data, while doubling (applying the 2x correction factor) the estimate to 6,412 serves as the population estimate.

Chapter 5
Harvest/Incidental Mortality

Local natives were harvesting belugas when the German zoologist and explorer Georg Steller visited the Sea of Okhotsk in the 1740s. During the early part of the twentieth century, belugas were commercially harvested at Tauy Bay (Magadan), Gizhiga Bay (Shelikov), Udskaya and Tugursky Bays (Shantar), and Sakhalin Bay and the Amur estuary (Borisov 1930; Dorofeev and Klumov 1935). Most harvest occurred at Sakhalin Bay and the mouth of the Amur River, but harvest was intense enough at Tauy Bay that it was shut down because of recognized impacts on the local population (Klumov 1939). Significant beluga use of Tauy Bay has not been seen since (Melnikov 1999).

Large-scale harvest began in Sakhalin Bay in 1915 and eventually spread to the Shantar region as Sakhalin beluga numbers declined. Harvest at Sakhalin-Amur peaked in 1933 at 2,817 whales, and averaged about 1,000 animals annually between 1927 and 1937. At Shantar, less than 100 belugas were killed annually in the mid-1930s (Klumov 1939), probably because the catching teams were poorly qualified (Arsenyev 1936). Commercial harvest began again during World War II and ended in 1963 when the whaling industry shifted its activity to larger baleen whales (Melnikov 1984). During this period, harvest focused in the Shantar Bay area where annual takes were between 800 and 1,000 animals (Kleinenberg et al. 1964). In the 1980s, Melnikov (1984) was promoting a resumption of the annual harvest stating that the Sakhalin-Shantar population, estimated at 20,000 to 25,000 whales, could support an annual take of 1,000 animals. Attempts to revive commercial beluga whaling in the Sea of Okhotsk since then have failed.

Some subsistence, bycatch, or illegal harvest of belugas may exist today, but if so, at very low and unknown numbers. Shpak et al. (2011) reported that annual take levels were probably 1 to 3 per village, but did not specify how many villages were involved or where they were located. Shpak later stated she had no quantifiable basis for her numbers. Further, follow up attempts in 2011 to determine incidental human-caused mortality in the Sakhalin and Shantar regions yielded virtually no accounts. The primary human mortality risks to Sea of Okhotsk beluga whales are probably entanglement in fishing gear and vessel strike. However, beluga entanglement in salmon and sturgeon fishing nets or traps is very rare, and belugas are exceptional among cetaceans in their ability to avoid entanglement (Reeves et al. 2011). Vessel traffic in Sakhalin and Shantar bays is limited primarily to small fishing vessels, and Shpak could find no evidence of any of these vessels striking belugas. Human-caused mortality is not currently a significant factor in Sakhalin and Shantar beluga population dynamics.

Chapter 6

Live Capture

Live captures of belugas for public display or research began at Sakhalin Bay in 1986, but the number of animals removed between 1986 and 1999 is unknown. The most recent live-capture program operating from Sakhalin Bay has averaged 21.3 whale removals per year (Table 1) dating back to the year 2000, and 22.4 per year over the past five years (2008–2012). The annual quota authorized by the Russian government of between 40 and 57 animals (Shpak et al. 2011) has never been fulfilled during this time.

Table 1. Live-Capture Removals from Sakhalin Bay (2000–2010)

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Animals removed	10	22	10	26	25	31	20	0	25	24	30	33

Source of years 2000-2010: Shpak et al. (2011).
Source of year 2011: Mukhametov pers. comm. 2012

Chapter 7
Stock Assessment

Management of beluga whale populations in the Sea of Okhotsk requires a clear understanding of population structure. Stock recognition has a direct bearing on the number of animals that can be sustainably removed from the population by harvest or live-capture. Sustainable removal is the fraction of the population that could be annually removed for human uses *without initiating a population decline*. For small populations, few if any animals could be sustainably removed, while for larger populations more animals could be removed. Splitting a regional population (such as the Sea of Okhotsk population) into separate stocks may not affect the overall available regional sustainable removal, but it does affect the sustainable removal at a given location since that location would be represented by only a local stock designation, not the collective regional population. Thus, management of beluga whale removals at a single location is greatly influenced by stock recognition.

Prior to the availability of genetic analyses, Arsenyev (1939) and Berzin et al. (1986, 1988, 1990) argued that the geographical separation of summer aggregations proved the existence of three separate stocks (Shelikov, Shantar, and Sakhalin-Amur). However, Kleinenberg et al. (1964) and Melnikov (1999) pointed out that because belugas from all summer aggregations were found in proximity during the winter mating season, males were not limited to breeding with females from the same summer aggregation and, therefore, argued for only one stock for the Sea of Okhotsk. None of these authorities, though, had any way to determine how much interbreeding between summer aggregations was actually occurring, or whether there was any annual population interchange between aggregations.

The IWC (2000) supported the contention of three separate beluga whale stocks inhabiting the Sea of Okhotsk based primarily upon the separation of summer aggregations, a criterion which the IWC applied rangewide. These stock designations were also made under an IWC agreed principle that "management units should be established with the goal of maintaining white whales (belugas) throughout the full extent of their historical range," which would be achieved by adopting "the smallest reasonable population units" (International Whaling Commission 2000). Thus, in the absence of convincing data otherwise, the IWC identified the three summer aggregations (Shelikov, Shantar, and Sakhalin-Amur) as separate management stocks rather than recognizing the Sea of Okhotsk regional population as members of a single stock.

Until recently, neither argument (single or multiple stocks) was supported by substantial empirical data, and inconsistencies in stock definition have confounded the issue. Even today, the U.S. Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA) use different terminology. The MMPA speaks in terms of population stocks while the ESA focuses on species. Thus, the MMPA states "The term 'population stock' or 'stock' means a group of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature." 16 U.S.C. §1361(11). The ESA does not define the term "stock" but rather defines the term "species" as including "any subspecies of fish or wildlife or plants, and any distinct population of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. §1532(16). Thus, the two statutes use different terms to define the population groupings to which each Act applies.

Moritz (1994) proposed a genetic approach to stock identification using two terms: Evolutionary Significant Unit (ESU) and Management Unit (MU). According to Moritz (1994), recognition of an

ESU requires entities to have significant difference or divergence at *both* the mitochondrial DNA and nuclear DNA allele frequencies, while recognition of an MU (i.e., management stock) requires differences at *either* DNA site. Although Moritz's approach is limited to genetic evidence, Dizon et al. (1997) concluded that for marine mammal conservation goals, mitochondrial DNA evidence alone is sufficient for designating management stocks.

Recognizing the need to look at a suite of criteria, especially if genetic data is unavailable, Dizon et al. (1992) developed a phylogeographic concept for stock identification that uses a hierarchical classification scheme. This approach has been used by the National Marine Fisheries Service (NMFS) to classify marine mammal stocks, including Alaskan beluga whales (Allen and Angliss 2010). If the Dizon et al. (1992) analytical framework is used, then because the three putative Sea of Okhotsk stocks are not geographically separated, they fall within either Category II (genetically, but not geographically, separate) or Category IV (neither genetically nor geographically separated). Dizon et al.'s (1992) approach looks at the evidence regarding population distribution (including geographic distribution, contaminant loads, parasite loads, and dietary differences), population responses (e.g., timing of breeding, growth rates), phenotypic data (morphology), and genotypic data (both mitochondrial and nuclear DNA), and determines whether the preponderance of evidence leans toward "lumping" or "splitting" nearby populations. This approach is only effective if adequate data exists to permit comparing lines of evidence. The adequacy of current data to reach a viable conclusion on the stock discreteness for Sea of Okhotsk populations, using Dizon et al.'s (1992) approach, follows.

Distribution

Geographic Distribution and Abundance Data

For populations that are not separated by any geographic barrier, evidence for stock separation is supported if adjacent populations do not occupy the same area. The determination of three IWC provisional stocks was based on the observation that Sea of Okhotsk beluga whales form summer aggregations at three general locations. During the summer, the Shelikov Bay aggregations are separated from the Shantar and Sakhalin-Amur aggregations by over 1,800 km, while the latter two aggregation areas are separated from each other by about 300 km. If beluga females always return to calve at the same location where they were born, then it is likely that summer aggregations do not intermix. If intermixing does not occur on the summer or winter grounds, then genetic separation can occur over time.

During the fall and winter, the geographic separation between the Shantar and Sakhalin-Amur aggregations appears to break down. Shpak et al. (2010) placed satellite tags on four females captured in Sakhalin Bay in August 2007 and tracked their movements for up to 9.5 months. These whales traveled to the western half of the Shantar Sea where they spent the autumn months in Nikolaya and Ulbansky Bays before heading north to winter in deeper waters. Because Nikolaya and Ulbansky Bays represent calving areas for the putative Shantar stock, Shpak et al. (2010) surmised that it was possible that the western Shantar and Sakhalin-Amur groups spend the fall and winter months together (much like the winter intermixing of separate stocks that appears to occur in the Bering and Barents seas). If true, this has an important implication because beluga whales generally mate while in the wintering grounds (Brodie 1971). Thus, if members from separate summer aggregations intermix in the wintering grounds, genetic exchange (mating) between aggregations could still be occurring regardless of where they calve (as surmised by Kleinenberg et al. [1964]). Reeves et al. 2011 stated that this data "implies that contact and interbreeding among belugas from different summering areas may occur." Unfortunately, Shpak et al.'s (2010) observations were limited to whales tagged in Sakhalin Bay only and, therefore, cannot confirm intermixing of Sakhalin and Shantar whales during the spring mating period or actual mating between the two groups.

Still, most of the whales tagged by Shpak et al. (2010, 2011) in Sakhalin Bay (Chkalova Island) did travel to Nikolaya and Ulbansky Bays in the Shantar area and spent the entire fall (early September through November) there before moving north to wintering grounds. Whales that summered in Nikolaya Bay were believed to still be present in the bay when the Sakhalin-Amur whales arrived in early September, and quite probably intermixed given the small size (5 to 12 km wide) of the bay (although that was not confirmed).

However, actual summer interchange occurred when two of the Sakhalin Bay tagged female whales were photographed in Nikolaya Bay during summer 2009, and one again in Nikolaya Bay in summer 2010. These observations confirm that intermixing between Sakhalin-Amur and Shantar populations does occur, and because female belugas are usually members of tight social groups, such as primary family groups or clans (Belkovich 2010), they should represent aggregation area interchange of groups, not just individuals.

Still, these observations do not necessarily mean demographically independent summer aggregations do not occur (Reeves et al. 2011), especially since there was no evidence based on the tagging data currently available of Sakhalin-Amur whales intermixing with whales summering in Udskaya and Tugursky Bays. To better define the stock boundaries in the western Sea of Okhotsk, the IUCN scientific review panel (Reeves et al. 2011) recommended further genetic sampling of these populations with the objective of obtaining a sample size sufficient to provide scientifically supportable results.

The current IWC classification of Sea of Okhotsk "stocks" (Shelikov, Sakhalin-Amur, and Shantar; Figure 1) was based largely on the geographical separation of summer aggregation areas. Clearly, the 1,800-km distance between the Shelikov summer aggregations in the northern Sea of Okhotsk and the Sakhalin-Amur and Shantar populations in the western Sea of Okhotsk represents a geographical separation during the summer. However, the Shantar area is actually comprised of five separate embayments (Figure 4), four of which support summer aggregations of belugas (Melnikov 1999). The primary beluga aggregation area of each is separated from those in its neighboring bays by marine travel distances of between 160 and 200 km. The shortest travel distance between the western most bay (Udskaya) and the eastern most bay (Nikolaya), the breadth of this "stock," is about 300 km.

The Sakhalin-Amur aggregation concentrates primarily at the Amur Estuary confluence with Sakhalin Bay, but they range between Baikal Bay and Chkalova Island in the north to just south of Cape Lasarev (Melnikov 1999; Figure 3), a distance of about 200 km. The distance between the head of Nikolaya Bay (Shantar) and the top of the Amur Estuary is about 325 km, while the closest distance between secondary aggregation areas at Sakhalin-Amur (Chkalova Island) and Shantar (the mouth of Nikolaya Bay) is only 225 km. (Compare to the Alaskan stocks where the nearest-neighbor distances between the Bristol Bay, Norton Sound, East Chukchi Sea, and East Beaufort Sea summer aggregations area all approximate 1,000 km.) Therefore, while the Sakhalin-Amur population technically aggregates in the Sakhalin Bay area, and the Shantar populations within the embayments of Shantar Bay (sometimes called Shantar Sea), two geographical areas separated by Cape

Aleksandra, the distances between the nearest Sakhalin-Amur and Shantar populations are not greatly different than distances between aggregations within the Shantar region, and are a third of the distances that separate the Alaskan stocks. Thus, the IWC's (2000) classification of Sakhalin-Amur and Shantar populations as separate stocks on the basis of geographical separation do not take into account that aggregations within Shantar Bay are almost as geographically separate from each other as Chkalova Island (Sakhalin) is from Nikolaya Bay (Shantar). There is either one collection of five or more aggregations occurring between Udskaya Bay and Amur Estuary, or each aggregation is a geographically separate "stock". Since there is no definition on how far apart two aggregations need be to achieve separate stock status, a geographic separation approach to stock definition could support the possibility of five "stocks" (Udskaya, Tugursky, Ulbansky, Nikolaya, Sakhalin-Amur) as much as two (Shantar and Sakhalin-Amur). (A similar situation occurs in the White Sea, Russia, which is addressed later.)

Abundance data can also provide information on movements between populations (Dizon et al. 1992). Areas of zero abundance may indicate there are barriers to movements or interchange. Evidence that the Sea of Okhotsk calving aggregations represent separate summer subpopulations has already been established (and is the basis for the multiple-stock hypothesis). Winter abundance and distribution provides a better indication of whether putative stocks are intermixing during the critical breeding season. Unfortunately, winter abundance and distribution data are insufficient to draw any conclusions regarding population interactions.

Contaminant Loads

Differences in contaminant loads have been used as a supportive basis for stock identification in other cetacean populations (Dizon et al. 1992), including beluga whales in Canada (Department of Fisheries and Oceans 2010). Varied contaminant loads may indicate differences in dietary behavior as well as feeding location (Dizon et al. 1992). However, no contaminant load studies have been done on Sea of Okhotsk belugas.

Parasite Loads

Variations in external parasite loads have been used to surmise separations in feeding grounds of Antarctic whales (Ohsumi et al. 1970). However, there is very little information on external parasites of beluga whales, possibly because they are relatively free of these parasites (Klinkhart 1966), and internal parasite examination requires killing the animal. There is no information on parasite loading in Sea of Okhotsk beluga whales.

Dietary Differences

It is possible that summer diets vary among the Shelikov, Shantar, and Sakhalin-Amur populations given their varied locations (and possible variations in salmon runs). However, analytical seasonal diet studies of Sea of Okhotsk belugas have not been conducted, and the available data (presented above in "Beluga Whale Populations") show that all three stocks perform spring/summer shifts from smelt to herring, to salmon-based foraging before returning to deepwater marine fish diets in the winter. Thus, there appear to be no major dietary differences that might indicate clear stock separation.

Population Response

Differences in the timing of breeding and migration, and in growth rates, may indicate differing population responses to the local marine environment, further indicating a differing population structure, which itself can be used to indicate stock distinction. Studies by Shpak et al. (2011) provide limited population response information on the Sakhalin-Amur aggregation, but there is no comparable information from the Shantar and Shelikov aggregations with which to draw comparisons, other than whales generally enter Udskaya Bay later than other whales enter other aggregation bays, which is probably a function of unique ice conditions (Kirby 1971; Melnikov 1999). Consequently, there is little population response information with which to investigate stock identity in the Sea of Okhotsk.

Phenotypic Data

Adult body size in beluga whales varies geographically, with smaller whales found in less productive and more isolated Arctic waters, and larger whales found where oceanic influence (higher productivity and fewer barriers to genetic interchange) is more direct (Sergeant and Brodie 1969). Morphological differences have been used as a basis for separation of beluga stocks in Canada (Department of Fisheries and Oceans 2010). However, no data are available with which to determine whether significant morphological differences occur between the three populations in the Sea of Okhotsk. Shpak et al. (2011) examined commercial whaling data from the 1920s and 1930s for the Shantar and Sakhalin-Amur regions, but found little data on morphology other than gender and age class.

Genotypic Data

Because genetic separation is the ultimate basis for stock identity, direct genetic analysis provides the best means for examining population discreteness. Genetic sampling of Sakhalin Bay whales began in 2004 and 2005 when Meschersky et al. (2008) collected tissue from 28 whales live-captured near Chkalova and Baydukova islands and compared their mitochondrial DNA (mtDNA) with North American populations (concluding that Sea of Okhotsk whales were genetically different from beluga whales in Alaska and Canada). Additional samples were subsequently collected such that by 2010, Meschersky (2011, in Shpak et al. 2011) was able to compare genetic samples from 83 beluga whales from the Sakhalin-Amur aggregation with 64 samples from the Shantar region. He concluded then that while nuclear DNA samples were derived from a common homogenous gene pool, mitochondrial DNA samples were found to have enough difference in haplotype frequencies (presumably due to matrilineal philopatry [O'Corry-Crowe et al. 1997]) to lead him to retract his earlier belief that the Shantar and Sakhalin-Amur populations, at least, represented a single stock (Meschersky et al. 2010).

Meschersky also found that populations inhabiting Nikolaya and Ulbansky Bays in the eastern Shantar Sea were more closely related to Sakhalin-Amur whales than western Shantar (Tugursky and Udskaya bays) whales, supporting the satellite tag results (Shpak et al. 2011) that suggested that at least the two eastern Shantar groups and the Sakhalin-Amur whales are all part of a common population.

Meschersky concluded that while nuclear DNA homogeneity indicated that Shantar and Sakhalin-Amur populations shared the same genetic pool, there were clear mitochondrial DNA separations between, at least, the western Shantar belugas and Sakhalin-Amur whales. Meschersky's data further indicate that, since there has been no measurable separation of nuclear DNA between groups, gene flow between populations likely occurs via mating of Shantar males with Sakhalin-Amur females, and/or vice-versa. The data are not sufficient to determine the prevalence of such matings within either group.

The IUCN panel of beluga whale experts (Reeves et al. 2011) reviewed the genetic analysis conducted by Meschersky, and concluded that, while the nuclear DNA results implied that interbreeding between summer aggregations may occur, they had some reservations about the sampling design, sample size, the number of genetic markers used, and the way the statistical analyses were conducted. Furthermore, they stated that “differences in nuclear markers are not necessary for there to be demographically independent summering aggregations,” and that the 2010 mitochondrial DNA results support recognition of stock separation. This supports the view that populations with limited female geographic dispersal are demographically independent groups (i.e., stocks) regardless of the gene contribution of dispersing males (Moritz 1994; Avise 1995; Dizon et al. 1997). They also stated that genetic analysis should be continued with a stated goal of increasing sample size, especially from western Shantar populations.

At the IUCN panel’s recommendation, additional genetic samples were collected from across the western Sea of Okhotsk region in 2011 bringing the mtDNA control region sample set to 225 beluga whales, and the nDNA (19 microsatellite loci) database to 211 whales. These data were analyzed by Meschersky and Yazykova (2012) using the fixation index (F_{st}) of population subdivision. They concluded that mtDNA haplotype frequencies differed among all five of the populations (Sakhalin, Nikolaya, Ulbansky, Tugursky, and Udskaya bays) except between Nikolaya and Sakhalin (Chkalova) and between Udskaya and Tugursky, but that the nDNA allele frequencies were not genetically differentiated among the populations. The lack of mtDNA differentiation between Nikolaya Bay and Sakhalin (recognizing the small sample size for Nikolaya Bay) supports Meschersky’s earlier analysis that genetic interchange is occurring between Sakhalin-Amur and the eastern Shantar (but perhaps not between the eastern and the western Shantar), which is further supported by Shpak et al.’s (2010, 2011) satellite tagging data. Meschersky and Yazykova’s conclusions that haplotype frequencies differed among most aggregations again suggests that maternally directed philopatry to seasonal calving sites has influenced variation in mtDNA structure.

Cronin (2012) conducted additional analyses on Meschersky and Yazykova’s (2012) genetic dataset. Using the methodology of Nei (1972), Cronin calculated the genetic distances of the nDNA data, and confirmed Meschersky and Yazykova’s (2012) results that the nDNA differentiation among the various aggregations was very slight. In fact, there was less differentiation between Sakhalin and the combined Shantar groups (average 0.021) than among each of the four Shantar groups (average 0.037). Cronin (2012) also noted that differentiation at the mtDNA level was higher among the Shantar aggregations than between Sakhalin and the individual Shantar aggregations. This lack of a geographic pattern in genetic differentiation could be due to either some level of population interchange between aggregations (as noted in Shpak et al.’s [2011] tagging studies), or a lack of geographic pattern in male genetic contribution (females are breeding with males from other summer aggregations).

Cronin further noted that while there were differences in haplotype frequencies among the aggregations, all aggregations shared the most common mtDNA haplotypes indicating a shared maternal lineage. Finally, when Cronin (2012) compared Meschersky and Yazykova's (2012) F_{st} values with those he earlier calculated for Alaska populations (Cronin 2007) he found the Sakhalin and Shantar populations to be much less differentiated at both the nDNA and mtDNA levels.

Cronin (2012) also used Meschersky and Yazykova's data to calculate $N_{ef}m$, an estimator of the level of female gene flow between populations. Cronin's results showed substantial gene flow (on average much greater than 124 females per generation exchange between aggregations) at the nDNA loci. At the mtDNA site, the overall average gene flow was 10.1 "females per generation" with flows highest between Sakhalin and Nikolaya (15.6) and between Udskaya and Tugursky (62.5), which is not unexpected because the aggregation pairs are adjacent. The lowest average gene flow was between adjacent Nikolaya and Ulbansky bays (0.9), which may reflect a sample size anomaly (only eight samples collected at Nikolaya Bay) given the average gene flow between Ulbansky and Sakhalin Bay (on either side of Nikolaya Bay) was 3.0. Still, the next lowest average $N_{ef}m$ values were between Ulbansky and Tugursky (1.8), and Ulbansky and Udskaya (1.9), again indicating less gene flow among most of the Shantar groups (average $N_{ef}m$ = 2.1 excluding the Udskaya-Tugursky pair) than between Sakhalin and the Shantar aggregations (average $N_{ef}m$ = 7.0). Again, there does not appear to be a geographic pattern in the genetic differentiation of the summer aggregations, indicating that Sakhalin-Amur belugas are no more genetically separate from Shantar aggregations than the four Shantar aggregations are separate among themselves.

In conclusion, both Meschersky and Yazykova (2012) and Cronin (2012) agree that at the microsatellite (nDNA) loci there is very little genetic differentiation among the western Sea of Okhotsk beluga aggregations. At these loci, they collectively form a single genetic population. However, Meschersky and Yazykova (2012) found significant differences in haplotype (mtDNA) frequencies between many of the aggregations leading them to conclude that each aggregation formed a deme, or subpopulation. Cronin (2012) agreed that Meschersky and Yazykova's results indicated significant differences in haplotype frequencies, but his further analyses indicated that 1) there was more differentiation among Shantar populations than there is between Shantar and Sakhalin; 2) despite differences in haplotype frequencies, all aggregations shared the most common haplotypes; 3) genetic distances were much less than found between Alaskan stocks; and 4) the overall interpretation would need to conclude that either Sakhalin and Shantar form a single stock (based on genetic distances at 19 microsatellite loci) or each of the five aggregations is a separate stock (based on haplotype frequencies). His overall conclusion was that the combined genetic data indicate a single genetic stock.

Comparison with the White Sea Beluga Populations

The beluga populations of the Russian White Sea offer a comparison. The White Sea is actually a large southern embayment of the Barents Sea, and is roughly equivalent in size to Shantar Bay, Sakhalin Bay, and Amur Estuary combined. As with Sakhalin-Shantar, beluga whales form summer aggregations in multiple locations. The IWC (2000) recognized three stocks inhabiting the White Sea: Onezhsky, Dvinsky, and Mezensky Bays. A footnote in the IWC paper cites Belkovich (1995) that there are actually five isolated stocks in White Sea, while Belkovich et al. (2002) later mentions that there are eight aggregations, which he even later calls local herds (Belkovich 2010). Nearest neighbor distances between aggregation areas range between 70 and 350 km.

Earlier work focused not on stock status, but whether the collective and/or southern White Sea population was actually an isolated species (Klumov 1939) or subspecies (Ostoumov 1935; Tomilin

1971) of beluga based on morphometric and migration pattern differences compared to the Kara Sea population. Ostroumov (1935) believed there were three stocks in the region: the Kara Sea stock that sometimes wintered in the White Sea; the Western stock that summered in Dvinsky Bay (White Sea), but wintered elsewhere, including the Barents Sea; and the White Seas stock that summered in Onega Bay and wintered in nearby Kandalakshsky Bay. The marine travel distance between Dvinsky and Onega Bays is approximately 350 km. In contrast, Klumov (1939) reported that the southern White Sea belugas left the White Sea altogether and wintered annually in the Barents Sea. Belkovich et al. (2001) also supported separate stock status for the southern White Sea aggregations but with an intermediate wintering conclusion: females in White Sea "stock" were largely non-migratory, but that most of the males inhabited the Barents and Kara Seas during both the summer and winter.

After conducting several years of research in the White Sea, and reanalyzing many of the earlier data sets, Matishov and Ognetov (2006) refuted much of Ostroumov's and Belkovich's contentions. They found no morphometric differences in White, Kara, and Barent Sea populations to support Belkovich's southern White Sea stock theory, and concluded one population occupied the White, Kara, and Barent Seas. Matishov and Ognetov (2006) determined that "Firstly, the animals that have moved into the southern part of the White Sea are not isolated from other individuals; secondly, the animals stay here for a short period of time and do not exhibit any constancy in choosing their grounds; thirdly, the animals make constant movements." They found a five-fold annual variation in the number of animals that use the White Sea.

Although Matishov and Ognetov's (2006) considered the White, Kara, and Barents Sea populations as a single genetic population, they did recognize that mtDNA differentiation does occur in beluga populations. But Matishov and Ognetov's observations in the White Sea and Shpak et al.'s (2011) tagging studies in the Okhotsk Sea suggest that in these smaller sea populations, individuals and groups move among aggregations areas, and philopatry to a specific aggregation area may not be as strong as in, for example, Alaska where distances between aggregation areas is about 1,000 km, and use of White Sea aggregation areas were not as constant as expected with strong philopatry. Thus, mtDNA differentiation in the western Sea of Okhotsk as reported by Meschersky and Yazykova (2012) may be as much as function of fidelity to a social group as philopatry to a specific breeding location, at least at the smaller scale of the White Sea and western Sea of Okhotsk breeding areas. Belkovich's (2010) reporting of distinct family and clan groups within specific herds underscores the tight social structure of beluga whales, and Lyrholm and Gyllensten (1998) suggested that fidelity to social groups accounted for the mtDNA differentiation in global populations of sperm whales (*Physeter macrocephalum*). If a similar situation occurred in the western Sea of Okhotsk, mtDNA differentiation would be evident among social groups regardless of where the social groups were located at the time of sampling. This would confound managing beluga populations at the aggregation site scale since the management would be of the geographic location, rather than of reoccurring group of individuals. Social group use at a given aggregation site may vary annually.

Comparison with the Alaskan Beluga Populations

The stronger differentiation among Alaskan stocks as compared with western Sea of Okhotsk aggregations (Cronin 2012) may be due to a combination of three mechanisms for mtDNA evolution identified for marine mammals (Avise 2000): philopatry to calving areas, fidelity to social groups, and isolation by distance. The average distance between Alaskan stocks is relatively great (1,000 km) and there is little direct evidence of population interchange among stocks. There is also a geographic pattern in the differentiation of Alaskan stocks with adjacent more closely related than distant stocks. In contrast, in the western Sea of Okhotsk (and the White Sea) the geographical distance between aggregations is much shorter, and there is evidence of annual female (and probably group) interchange between aggregations. There is also no real geographic pattern in differentiation among the aggregations. Mitochondrial DNA differences are greater among Shantar aggregations than between Shantar aggregations and Sakhalin-Amur. A lack of pattern may suggest that Meschersky and Yazykova's mtDNA differentiation results are as much a result of group separation (fidelity to a social group) as geographic separation (philopatry to a calving ground). Sampling between different groups will always reveal mtDNA differentiation regardless of where the groups are located at the time of sampling.

Stock identity at the aggregation level may suffice in Alaska and elsewhere where geographic distances between aggregations are great and philopatry to aggregations are most evident. However, where multiple aggregations occur in relatively close vicinity and there appears to be inter-annual movement of females between aggregation areas, stock identity at the super-aggregation (a collection of aggregations) scale may be more meaningful. The IWC (2000) classification of Shantar Bay as a separate stock recognizes super-aggregation stock identity given Shantar is composed of four separate aggregations. However, separation of the Shantar group from the Sakhalin-Amur group is not supported by geographic distance, annual population separation, or genetics. The distances between the Shantar and Sakhalin aggregation areas are relatively short, females move between summer aggregation areas, and Sakhalin whales are genetically more closely related to Shantar whales then the Shantar aggregations are related amongst themselves. Thus, either the Shantar and Sakhalin-Amur groups comprise a single stock based upon the previous argument, or all four Shantar aggregations (including the small Nikolaya Bay group) warrant stock status based entirely on Meschersky and Yazykova's mtDNA results and presuming that the observed differentiation is due almost entirely to philopatry, rather than group fidelity.

Evidence for Multiple Stocks in the Western Sea of Okhotsk

The IWC (2000) recognized two beluga whale stocks in the western Sea of Okhotsk: Sakhalin-Amur and Shantar. Curiously, the IWC cites Melnikov (1999), an advocate for a single stock in the Sea of Okhotsk, as the reference source. That Sakhalin-Amur and Shantar are separate stocks is first mentioned by Arsenyev (1939) at a time when individual Soviet collective farms had harvest duties for specific aggregations, indicating that harvest centers may have influenced stock designations. Still, years later Berzin et al. (1990), Vladimirov (1995), and Doroshenko and Doroshenko (1996) were still contending that Sakhalin-Amur and Shantar were different stocks (as opposed to Kleinenberg et al. [1964] and Melnikov [1999] who favored a single stock hypothesis).

As mentioned earlier in Chapter 7, there is little information on many of the criteria used in stock identity (Dizon et al. 1992). There is basically no information on contaminant loads, parasite loads, dietary differences, population responses, and phenotypes. The argument for geographic separation is weak as the distance between Sakhalin Bay and Nikolaya Bay (Shantar) is not much greater than the inter-bay distances within the Shantar region.

The most compelling evidence for multiple stocks is the mtDNA analysis by Meschersky and Yazykova (2012). They found a significant difference in the haplotype distribution between Sakhalin Bay and each of the Shantar aggregations except the closest bay, Nikolaya. Moritz (1994), Dizon et al. (1997), and Clapham (2008) argue that differentiation of mtDNA demonstrates demographical independence and is alone sufficient for stock identity. Under this approach, Sakhalin-Amur whales would be genetically distinct from Shantar Bay populations.

However, Meschersky and Yazykova's results also showed that mtDNA differentiation among the four Shantar Bays was even greater. Considering mtDNA differentiation sufficient for stock designation would require classifying each of the four Shantar Bays as separate stocks. Thus, the mtDNA results (Meschersky and Yazykova 2012) do not support the possibility of two stocks (Sakhalin and Shantar) but rather only the possibility of at least five stocks (Udskaya, Tugursky, Ulbansky, Nikolaya, and Sakhalin-Amur) over the western Sea of Okhotsk.

Evidence for a Single Stock in the Western Sea of Okhotsk

As mentioned above, the most compelling evidence for multiple stocks in the western Sea of Okhotsk is subpopulation structuring at the mtDNA level discovered by Meschersky and Yazykova (2012). However, support for a single stock can be found with the Meschersky and Yazykova's nDNA results, which showed population homogeneity, supporting a single stock concept (Cronin 2012).

There are two reasons for the observed nDNA homogeneity in the Sakhalin and Shantar population: females are breeding with males from multiple aggregations, or they share a common ancestry and there has not been enough time for the nDNA, which evolves more slowly than mtDNA, to differentiate. Differentiation of beluga mtDNA has been described as a function of philopatry (O'Corry-Crowe 1997; Brennin 2007), which simply means returning every year to the place of birth. If beluga females return every year to the estuary where they were born, then they are more likely to be much more related to the other belugas at that location than belugas that return to another estuary. Eventually, differences in the female-meditated mitochondria appear, and it is highly likely that philopatry has played a role in the mtDNA differentiation observed among the Sakhalin and Shantar aggregations.

However, it may not be the only role. The reason that philopatry causes differentiation is because it geographically separates groups, thereby limiting contact and, therefore, chances for inter-relation. However, you see the same discordant difference in sperm whales, which has less to do with geography and more to do with group fidelity (Lyrholm and Gyllensten 1998). Groups of these animals do not intermix with other groups for behavioral, not geographical, reasons.

Beluga whales form very tight social structures from female-offspring, to family, to clan (or yuro), to herd (or school) (Matishov and Ognetov 2006; Belkovich 2010). Genetic sampling between clans or herds is likely to reveal mtDNA separation regardless of the location of where those animals were sampled. The difference is between groups, which may or may not have a direct connection with philopatry.

In Alaska, where aggregation areas are 1,000 km apart, philopatry is probably significant. Animals born at one location may not even be aware of the other aggregation areas. Thus, they keep going back to the same area and, over time, the mtDNA differences between aggregation areas increase. But in the much smaller White Sea and western Sea of Okhotsk, we see whales moving about constantly (White Sea; Matishov and Ognetov 2006) or between aggregation areas both seasonally and inter-annually (Sakhalin and Shantar; Shpak et al. 2010, 2011). It is important to again note that the females tagged in Sakhalin that were subsequently observed in following years in the Shantar were not likely strays. Because beluga females form tight groups (Matishov and Ognetov 2006), these females more likely represent inter-annual movements of whole groups (at perhaps the family or clan level).

Also, some of annual differences in aerial survey numbers between bays may reflect movements. Beluga whale numbers in the Shantar area were relatively the same between 2009 and 2010 (6,814 and 6,508), but the number of whales in Udskaya Bay in 2010 (1,232) were half that in 2009 (2,431), while whale numbers in Tugursky (313 versus 753), Ulbansky (601 versus 1167), and Nikolaya (42 versus 102) Bays doubled, implying that over a thousand whales switched from Udskaya Bay in 2009 to the other Shantar bays 2010. Melnikov (1999) implied that ice conditions may influence at least the timing of Udskaya Bay similar to the White Sea where annual sea ice concentrations is known to influence summer distribution patterns (Matishov and Ognetov 2006). During spring break up, shorefast and sea ice will pile up in Udskaya Bay and often not clear until later in the summer (Kirby 1971). During years of extensive ice belugas may choose to wait until later in the summer to enter Udskaya, or move to other Shantar bays that are more protected from ice buildup by the Shantar Islands.

Thus, it appears whales in the Sakhalin and Shantar areas are familiar with multiple aggregation areas, and use multiple areas both seasonally and inter-annually, probably in response to prey densities and/or ice conditions. As in the White Sea population, there appears to be considerable movement.

The implication is that philopatry in beluga populations is a matter of scale. In large seas with great distances between suitable calving sites, the great majority of the population returns each year to the estuary where they were born. In smaller seas with several suitable calving areas with short inter-area distances, beluga groups may use multiple aggregations over the years, depending on available resources (e.g., prey, open water). Because these movements would be of groups, not individuals, inter-aggregation mtDNA comparisons would always be between groups or collections of groups, and would reflect the mtDNA differences between these groups regardless of geography.

Thus, the evidence for a single stock includes the following.

- Genetic results from Meschersky and Yazykova (2012) confirm homogeneity at the nDNA level.
- Wintering occurs in the central Sea of Okhotsk (Shpak et al. 2010) where females are free to associate with breeding males born at different calving sites.
- MtDNA differentiation (Meschersky and Yazykova 2012) may be due as much to group fidelity as site fidelity (philopatry).
- MtDNA genetic distances are not as great as found in Alaska, and did indicate population interchange was, at least mathematically, occurring (Cronin 2012).
- Satellite tagging studies (Shpak et al. 2010, 2011) revealed both seasonal and inter-annual movements of female belugas between Sakhalin and Shantar.
- Aerial survey results (Shpak et al. 2011) suggest beluga shifted from Udskaya Bay in 2009 to Tugursky, Ulbansky, and Nikolaya bays in 2010.

Collectively, these analyses support Kleinenberg et al.'s (1964) and others contention that Sakhalin-Amur and Shantar beluga populations, at least, form a single stock that can freely associate during the winter/spring mating season, and will use multiple summering areas over a lifetime.

Chapter 8
PBR Calculations

The Potential Biological Removal level (PBR), as defined under the MMPA, is "the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population." Essentially, the PBR is the number of animals in a stock that could be purposely or incidentally removed by human activities without prohibiting the stock's growth or recovery. Removal can include incidental mortality in fisheries or live-capture for display.

PBR is the product of 1) the minimum population estimate of the stock, 2) one-half the maximum theoretical or estimated net productivity rate of the stock, and 3) a recovery factor of between 0.1 and 1.0 (Wade and Angliss 1997). For beluga whales, the estimated net productivity rate is 0.04, and the recovery factor for a stock of unknown recovery status is 0.5 (Wade and Angliss 1997). The latter applies to the Sea of Okhotsk beluga whales for, although they are not listed as threatened or endangered, the populations have been depleted, and their recovery trajectory is unknown. Thus, the PBR for Sea of Okhotsk belugas becomes 0.01 times the stock population minimum. In turn, the stock population minimum is defined as the 20th percentile of an abundance estimate or as a maximum direct count of a stock (Wade and Angliss 1997).

During the summers of 2009 and 2010, Shpak et al. (2011) conducted aerial surveys in Sakhalin and Shantar Bays to calculate population estimates for these regions. Shpak et al. (2011) took the average of three aerial surveys and calculated an estimated 20th percentile population minimum of 2,927 animals for the Sakhalin-Amur population that resulted in a PBR of 29 animals for the putative Sakhalin-Amur stock. An IUCN independent scientific panel (Reeves et al. 2011) reviewed Shpak et al.'s data and, although they came up with a slightly lower population minimum of 2,891 animals in their recalculation, their estimated PBR was also 29 animals. The panel also stated that the minimum population estimate could be improved by pooling the ECVs across the data sets. This was done (Chelintsev and Shpak 2011) resulting in a slight minimum population estimate increase to 2,972 and a PBR increase to 30 animals.

Population estimates were also calculated for the Shantar region. However, the Shantar embayments were not surveyed using line transects methods. Instead, direct counts of shoreline concentrations were made. Thus, there are no ECVs needed to determine the 20th percentile minimum population estimate. To account for undetected whales, however, Chelintsev and Shpak (2011) estimated the ECV based on an assumed 50% probability of detection using the following formula: $ECV = \sqrt{(1 - 0.5)/N_{det}}$, where N_{det} is the number of belugas actually detected and 0.5 the probability each animal can be detected. This would then become the correction factor for animals missed (either because they were not seen or could not be seen because they were well below the surface). This method provides relatively smaller ECVs than do extrapolated line transect data.

A second method for estimating a minimum population is to simply presume that the number animals actually detected during a survey is the population minimum (Wade and Angliss 1997). This is a much more conservative estimate because it does not take into account those animals missed and the values are less disputable because they were not analytically generated.

Both methods are used to calculate the PBRs for both alternative stock classifications (single or multiple) below.

Sakhalin-Amur

The annual live-capture removals of belugas occur at Chkalova Island within Sakhalin Bay. As addressed above, the calculated PBR for the Sakhalin-Amur aggregation alone—which presumes Sakhalin-Amur whales are genetically distinct from Shantar whales—is 30, based on a minimum population estimate of 2,972 (Table 2).

Table 2. Sakhalin-Amur Population Estimate and PBR Calculation

Survey Date	Region	Estimated Number of Belugas	Relative Statistical Error (ECV)
September 13, 2009	Total Sakhalin-Amur	2293	0.355
August 8, 2010	Total Sakhalin-Amur	1574	0.265
	Mean weighted value	1774	0.213
	Corrected beluga number=	3547	
	Nmin	**2972**	
	PBR (Rmax=0.04, Fr=0.5)	**30**	

Sakhalin-Amur and Shantar

Pooling the Sakhalin-Amur data with data collected from all the Shantar bays (which presumes both Sakhalin-Amur and Shantar belugas are part of a common stock), using Chelintsev and Shpak's (2011) estimates of ECV for the Shantar direct count data, results in a PBR of 86 (Table 3).

Table 3. Sakhalin-Amur and Shantar Region

Survey Date	Region	Estimated Number of Belugas	Relative Statistical Error (ECV)
Aug 5-Sep 13, 2009	Total Sakhalin-Amur+Shantar	3881	0.210
August 7-8, 2010	Total Sakhalin-Amur+Shantar	4780	0.088
	Mean weighted value	4620	0.081
	Corrected beluga number=	9240	
	Nmin=	**8632**	
	PBR (Rmax=0.04, Fr=0.5)	**86**	

The highest direct count for all the Shantar bays combined occurred on August 7 and 8, 2010, when 3,206 beluga whales were recorded. This direct count approach, not accounting for animals missed, results in a Shantar-only PBR of 32 (0.01 x 3,206). The 32 added to the Sakhalin-Amur PBR of 30 results in a combined PBR of 62.

Chapter 9
Conclusions

The annual quota of live-captures of beluga whales in Sakhalin Bay has ranged between 40 and 57. Although no more than 33 have been taken in any given year, it is important to know whether the annual quota is sustainable; whether the quota exceeds the stock PBR. Recognition of the stock as limited to the Sakhalin-Amur aggregation results in a PBR of 30, or 10 animals below the 2011 annual quota of 40 (but more than the actual number of animals taken in any given year except in 2005 when 31 were collected and 2011 when the 33 were removed). However, the National Marine Fisheries Service manages biological removals over a five-year average. The average number of animals removed since 2007 has been 22, or well below the Sakhalin-Amur PBR. There is no indication of any additional human-caused incidental mortality (IUCN 2011), so incidental mortality has not been taken into account in the above calculations.

However, overall genetic and satellite tagging study results suggest that considerable gene flow occurs between the Sakhalin and Shantar aggregations, and actually more so than among the Shantar aggregations alone, suggesting the all five aggregations are genetically homogenous. Accepting this single stock concept, results in a conservative PBR of 62 (direct count) or an analytical PBR of 86 (with the data pooled and ECVs estimated). Thus, the 2011 annual quota of 40 animals, and the five-year average removal of 22 animals, would fall well within the PBRs for this Sakhalin-Shantar stock designation.

Finally, the number belugas under request to be imported to the United States is 18, which were collected over three years. Thus, the annual collection average of 6 animals represents less than 7% (PBR = 86) to 20 percent (PBR = 30) of the annual PBR.

Chapter 10
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APPENDIX B
RANGE-WIDE BELUGA WHALE POPULATIONS: DISTRIBUTION, STOCKS, AND STATUS

Contents

Acronyms and Abbreviations

IWC	International Whaling Commission
NAAMC	North Atlantic Marine Mammal Commission
NMFS	National Marine Fisheries Service
PBR	Potential Biological Removal
U.S.	United States

Chapter 1
Stock Definition

Beluga whales occur in north temperate to polar waters of North America and Eurasia. In 2000, the International Whaling Commission (IWC) proposed 29 discrete stocks (IWC 2000), although, as discussed later, more recent data and analyses indicate that some of these may not be substantially differentiated, others may be divisible into smaller stocks, and still others may only represent seasonal concentrations of migrant males originating from other stocks. In general, the term "stock" as used in this Appendix is not intended to represent a stock as defined under the Marine Mammal Protection Act. We use the term "stock" because it was used by the researchers being cited, and they generally made no effort to define the term. In nearly all cases, those researchers use the term descriptively, to refer to summer breeding aggregations of whales. Observational data suggest that different summer breeding aggregations may represent different populations, but in most cases, it is not known if these populations are genetically distinct. Only in Alaska have beluga stocks been evaluated and designated in the context of United States (U.S.) Law.

The existing distribution of beluga stocks largely represents a history of dispersal and colonization since the last ice age, (i.e., during the past 7,000 to 14,000 years). Genetic analyses (Wilson et al. 1996; Brown Gladden et al. 1997; O'Corry-Crowe et al. 1997) suggest that Nearctic (Alaska, Canada, and Greenland) populations originated from two glacial refugia, one in the Pacific Ocean and the other in the Atlantic Ocean. Patterns of variation in mitochondrial DNA haplotypes are consistent with the hypothesis that Alaska, Greenland, and most Canada populations originated from a Pacific (Bering Sea) refugium, while the St. Lawrence River and East Hudson Bay stocks originated from an Atlantic origin (or possibly a glacial Lake Agassiz) refugium. Work to date suggests that West Greenland, Svalbard, White Sea, Beaufort Sea, Gulf of Alaska, and Gulf of Anadyr populations are rather closely related, with evidence of recurrent episodes of gene flow across the Arctic Ocean between the Beaufort Sea and Svalbard stocks (Hobbs et al. 2007; O'Corry-Crowe et al. 2010). Thus, the Russian Arctic stocks would all appear to belong to the "Pacific" group. Given the beluga's prevalent adaptation for foraging in and among pack ice, it is likely that long-term changes in the distribution and composition of stocks have been strongly influenced by changes in the distribution and season variation of Arctic Sea ice from the period of glacial maxima to the present.

Apart from the meridional distribution of stocks around the pole, there is also a strong latitudinal component to stock differentiation. Whereas the polar stocks are relatively well mixed, greater genetic differentiation separates the arctic from the subarctic and north-temperate stocks, which are isolated by geography. This differentiation is least pronounced between the stocks native to the Chukchi, Beaufort, and Bering Seas, presumably because formation of continuous winter sea ice forces most of these whales to winter in the Bering Sea. It is likely that a similar process unites the Karskaya stocks of the palearctic, which include the stocks of Russia from the Laptev Sea westward, including Svalbard; a large portion of these whales primarily winter in the Barents Sea because continuous ice cover excludes them from the Kara and Laptev Seas and the areas around Svalbard and Franz Josef Land. However, the Cook Inlet, Saint Lawrence River, and Okhotsk Sea stocks represent Pleistocene relics physically separated from other stocks by projecting land masses (the Alaska Peninsula, Labrador Peninsula, and Kamchatka Peninsula, respectively). These stocks have likely remained isolated for some thousands of years; this has been demonstrated by using molecular genetic markers (O'Corry-Crowe et al. 1997; Meschersky 2011). The Okhotsk Sea stocks do; however, seem to represent whales of the Pacific rather than the Atlantic refugium (Meschersky et al. 2008, 2010).

Chapter 2
North Temperate Zone Stocks

As noted previously, there are two isolated North Temperate Zone stocks: the Cook Inlet stock in Alaska, and the Saint Lawrence stock in eastern Canada. They are two of the smallest stocks, both having experienced severe declines because of human activity.

Cook Inlet

Mitochondrial DNA data have been used to assert that the Cook Inlet beluga population is genetically distinct from other Alaska populations and may have been isolated from other stocks since the last ice age (O'Corry Crowe et al. 1997). Laidre et al. (2000) showed that sightings of belugas outside Cook Inlet were exceedingly rare, comprising a few stragglers from the Cook Inlet stock observed at Kodiak Island, Prince William Sound, and Yakutat Bay. This stock largely confines itself to the upper Cook Inlet (Laidre et al. 2000; Speckman and Piatt 2000; Rugh et al. 2000).

The Cook Inlet stock has been the focus of management concerns since experiencing a severe decline in the 1990s. Between 1994 and 1998 the stock declined 47%, a result of overharvesting by subsistence hunting which was annually removing 10% to 15% of the population. The National Marine Fisheries Service (NMFS) listed the population as "depleted" in 2000 as a consequence of the decline, and as "endangered" in 2008 when the population failed to recover following a moratorium on subsistence harvest. Only five belugas have been harvested since 1999, yet the population has continued to decline over the past decade at an annual rate of 1.5% (Allen and Angliss 2010). Known non-harvest deaths have averaged about 11 per year over the same period (Allen and Angliss 2010). The most recent minimum population estimate is 326 animals. This population, for unknown reasons, continues to decline.

Saint Lawrence River

The Saint Lawrence River, Saint Lawrence River estuary, and Gulf of Saint Lawrence are recognized by authorities as supporting a distinctive stock of beluga whales (IWC 2000; Committee on the Status of Endangered Wildlife in Canada 2004). This southernmost stock in the species is highly isolated from all other stocks, is very restricted in its range, and is among the smallest stocks. Recent status reviews include those of COSEWIC (2004) and Mosnier et al. (2009). Curiously, although the summer distribution of the stock is well established to be within the Saint Lawrence River estuary and is well studied in that area, very little is known of the stock's movement and activity outside of the summer season. The whales were long thought to move downstream into the Gulf of Saint Lawrence, particularly in response to ice formation in the estuary (Mosnier et al. 2009). Aerial surveys in December 1989 through March 1990 found concentrations of whales in the lower estuary and in the northern portion of the Gulf of Saint Lawrence (Boivin and INESL 1990; Michaud et al. 1990; both cited in Mosnier et al. 2009). Later surveys in April and June 1990 indicated that the whales were concentrated in the upper Saint Lawrence River estuary (Michaud and Chadenet 1990 cited in Mosnier et al. 2009), leading to the conclusion that the whales seem to spend most of the year within various portions of the estuary, except under conditions of extensive ice formation.

Hammill et al. (2007) derived a "pristine" population estimate for the stock of 7,800 +/- 600 animals in 1866. The population was greatly reduced during the twentieth century through commercial harvest and noncommercial hunting by fishermen who regarded the whales as competitors, reaching a low of approximately 350 animals in the late 1970s (Pippard and Malcolm 1978, cited in Mosier et al. 2009). At that time hunting was prohibited. Systematic aerial surveys conducted at 3- to 5-year intervals since the late 1980s indicate that the population is relatively stable at about 1,100 animals. A variety of theories, mostly invoking anthropogenic habitat modification, have been advanced to explain why the population has stabilized at this relatively low value (Mosier et al. 2009). As summarized by Michaud and Béland (2001):

> …in addition to small size, geographical isolation (Sergeant 1986, Michaud et al. 1990), apparently reduced genetic variability (Patenaude et al. 1994) and restricted summer range (Michaud 1993), high contaminant burdens (Béland et al. 1993), and the threats from heavy marine traffic (Blane and Jaakson 1994, Lesage et al. 1999), place this population at increased risk (Lesage and Kingsley 1998). Consequently, all the above intrinsic and extrinsic factors have been identified as potential limiting factors for the recovery of the population (Bailey and Zinger 1995).

Chapter 3
Hudson Bay-Greenland Stocks

The IWC (2000) identified ten stocks in Hudson Bay, West Greenland, and the intervening Canadian Arctic archipelago. These named stocks include

- North Water,
- West Greenland,
- Cumberland Sound,
- Frobisher Bay,
- Ungava Bay,
- Foxe Basin,
- West Hudson Bay,
- South Hudson Bay,
- East Hudson Bay, and
- James Bay.

North Water and West Greenland

The stocks proposed by IWC (2000) as the North Water and West Greenland have uncertain affinity. They either represent a single stock that overwinters in two separate locations—the High Arctic-North Water polynya north of Baffin Bay and the coast of West Greenland—or two separate stocks that summer in the same region (Heide-Jørgensen et al. 2003). Satellite tag tracking studies by Heide-Jørgensen et al. (2003) support the former interpretation. Three of five belugas tagged in Creswell Bay (Somerset Island) in August 2001 later wintered in West Greenland, while the remaining two wintered in the North Water polynya. The implication from these results is that most belugas in this stock travel to North Water polynya where they remain for the winter, while a fraction of these whales continue down the West Greenland coast to winter between Maniitsoq and Disko Island, approximately 600 to 1,000 kilometers south of the North Water wintering grounds. Heide-Jørgensen et al. (2003) estimated that about 15% of the belugas that summer in the Eastern High Arctic winter in West Greenland (based on collective results from their satellite tracking study and those by Richard et al. [1998, 2001]).

In contrast to the satellite tagging studies, genetic studies by de March et al. (2002) showed a distinction in mitochondrial DNA haplotype distribution between whales harvested in the North Water polynya and West Greenland. Further, contaminant levels (heavy metals) between the two groups differ, and the Greenland Inuit have recognized two differing types of belugas based on appearance. Palsbøll et al. (2002), however, have argued that genetic studies, because of the way tissues are sampled (subsistence harvest), may be discriminating more between pods of related whales, rather than stocks, and the differences in contaminant concentrations may reflect differences in wintering areas rather than discrete stocks.

The most recent estimate for the size of the combined North Water-West Greenland stock is approximately 21,000 based on surveys conducted in 1996 (Innes et al. 2002a, 2002b), which included about 3,000 (Heide-Jørgensen et al. 2003) to 7,900 (Heide-Jørgensen and Acquarone 2002) whales that winter in West Greenland. Summer hunting pressure on this stock is low (less than 100 animals), and there is no winter harvest of animals that winter in the North Water polynya (Committee on the Status of Endangered Wildlife in Canada 2004).

West Greenland belugas are harvested in the fall as they first arrive on their wintering grounds. Between 1981 and 1994, this wintering population declined by over 60% as a result of unsustainable harvest (Heide-Jørgensen and Reeves 1996). This decline continued until 2004 when harvest restrictions were imposed reducing the annual catch by over half (from more than 400 down to less than 200). From 2004 to 2009 the population increased by about 8% with a most recent (2009) population estimate of 10,600 (North Atlantic Marine Mammal Commission 2010). While this population is now increasing, it remains at 31% of carrying capacity (North Atlantic Marine Mammal Commission 2010).

Cumberland Sound and Frobisher Bay (Southeast Baffin Island)

Cumberland Sound

The Cumberland Sound stock forms a large summer aggregation at Clearwater Fiord in the inner reaches of Cumberland Sound and may winter in the vicinity as well (Committee on the Status of Endangered Wildlife in Canada 2004). Richard and Orr (1986, 1991) argued that the Cumberland Sound population was part of a more dispersed stock inhabiting the southeastern Baffin area, but both genetics studies (Brown Gladden et al. 1997; de March et al. 2002) and satellite tagging efforts (Richard 2010) affirm distinction of the Cumberland Sound stock. Further, there are no other areas in southeastern Baffin Bay where belugas aggregate in the summer (see Frobisher Bay below), and animals collected in this region outside of Cumberland Sound appear to have genetic affinity with Hudson Bay beluga populations, which winter in southeastern Baffin Bay.

Subsistence harvest and commercial hunting prior to 1940 reduced the original Cumberland Sound population of about 5,000 animals to less than 1,000 by the 1970s (Brodie et al. 1981; Mitchell and Reeves 1981). The most recent population estimate of 1,547 animals (Richard 2002) is based on aerial surveys conducted by Richard and Baratin (2002) in 1999. The current annual subsistence quota is 41 animals, and although there are too few surveys of this population to establish an accurate trend, the population is considered stable.

Frobisher Bay

The IWC (2000) also identified a Frobisher Bay stock because belugas have been observed in Frobisher Bay during the summer months. However, there is no estuary in the bay suitable for molting and calving (IWC 2000). Traditional knowledge confirms the absence of calving grounds in the bay (Kilabuk 1998). Based on new genetic and satellite tagging studies, Frobisher Bay whales are likely summer strays from the Hudson Bay population (Richard 2010).

Ungava Bay

The Ungava Bay stock, much like the Cumberland Sound stock, is a small localized population that suffered significantly from overharvest. It now may be extinct and, if not, is the most endangered of all beluga stocks. Commercial harvest in the nineteenth century and ongoing subsistence harvest has prevented stock recovery (Finley et al. 1982; Reeves and Mitchell 1987). The original number of belugas that concentrated at the mouths of the Mucalic, George, and Whale Rivers is unknown, but the present population is tentatively considered to be around 50 (Kingsley 2000), and possibly extirpated (Committee on the Status of Endangered Wildlife in Canada 2004). Summer aerial surveys conducted in 1985 (Smith and Hammill 1986), 1993 (Kingsley 2000), and 2001 (Hammill et al. 2004) failed to detect any beluga in Ungava Bay, although a few beluga (less than ten on any day) were recorded by shore-based observers in 1985.

Because the population is so small, it may not be possible to obtain enough genetic samples to determine whether the Ungava Bay stock is (or was) a distinct stock. Genetic analysis has been conducted on 44 belugas harvested in the Ungava Bay area (Mancuso 1995; de March and Maiers 2001) with a higher than expected haplotype diversity for such a reputedly isolated population. However, the timing and locations of the animals harvested suggest that some of these whales may have been members of other populations (e.g., Hudson Bay), so that the affinity or distinction of the original population can no longer be determined (Committee on the Status of Endangered Wildlife in Canada 2004).

Foxe Basin

The Foxe Basin stock was proposed by the IWC (2000), but the Committee on the Status of Endangered Wildlife in Canada (2004) took a broader view of the West Hudson Bay stock than the IWC, extending it northward into the area assigned by the IWC to the Foxe Basin stock. Turgeon et al. (2009) analyzed samples that included three locations in the Foxe Basin and classified them as of "mixed" origin. They present model results suggesting that the genetic diversity found in Foxe Basin whales sampled during the summer are consistent with a mixed composition of 80% from the West Hudson Bay stock and 20% from the East Hudson Bay stock, shifting to a fall composition of 100% West Hudson Bay stock (no samples in winter or spring). Additionally, there are no reports of summer breeding aggregations in the Foxe Basin. Beluga observations in the Foxe Basin likely represent migrant individuals from neighboring stocks, from the West Hudson Bay and East Hudson Bay.

West Hudson Bay and South Hudson Bay

The most current analysis of beluga stock genetic differentiation in the Hudson Bay area is presented by Turgeon et al. (2009). Within Hudson Bay, their analysis discriminates West Hudson Bay and East Hudson Bay stocks; the West Hudson Bay stock includes the West and South Hudson Bay stocks provisionally proposed by the IWC (2000), and extends north toward the area where the IWC (2000) proposed the Foxe Basin stock, discussed above. The genetic analysis of Turgeon et al. (2009) is probably the most data-rich performed to date, including tissue samples from 1,432 belugas and representing 37 mitochondrial DNA haplotypes—a sufficient data set to both confirm the differentiation of affected stocks and demonstrate that there are areas of mixed stock composition, primarily reflected by locally elevated frequencies of West Hudson Bay haplotype groups within neighboring stocks.

The most recent effort to enumerate the stock was performed using aerial surveys flown in West and South Hudson Bay in late July and early August 2004, yielding a population estimate of 57,300 animals with 95% confidence limits of 37,700 to 87,100 animals. A portion of the survey overlapped an aerial survey performed in 1987 and yielded approximately the same uncorrected numbers, indicating little population change between 1987 and 2004 (Richard 2005). The survey did not address outlying areas, such as Somerset Island, that have since been found to be dominated by West Hudson Bay belugas, and thus, the actual population is somewhat higher. Removals from this population due to indigenous hunting typically number about 500 per year, although about 764 were taken in 2003, the most recent year for which precise estimates have been published (Committee on the Status of Endangered Wildlife in Canada 2004). No Potential Biological Removal (PBR) value has been calculated for this stock, but the population is assessed as stable (Committee on the Status of Endangered Wildlife in Canada 2004).

East Hudson Bay and James Bay

As noted above, the analysis of Turgeon et al. (2009) provides a substantially clearer view of stock structure in the Hudson Bay area than was perceived by the IWC in 2000, which conservatively chose to demarcate a James Bay stock as distinct from the East Hudson Bay stock. It now appears that whales forming summer breeding congregations all along the eastern shores of Hudson Bay, from southern James Bay north and then east almost to Ungava Bay, form a discrete stock that is clearly differentiated from the West Hudson Bay, Ungava, and Cumberland Sound stocks, and which is most closely related to the Saint Lawrence stock (Brown Gladden et al. 1997). The differentiation is strong enough that these two stocks are thought to have occupied a Pleistocene refugium in the Atlantic Ocean basin; whereas, all other beluga stocks seem to have originated from a Pacific Ocean basin refugium (inferred for Canadian Arctic stocks by Brown Gladden et al. 1997, but consistent with information since discovered for Gulf of Alaska, Cook Inlet, Svalbard, White Sea and Okhotsk Sea stocks by O'Corry-Crowe et al. 1997, 2010; and Meschersky et al. 2008, 2010).

Historical records indicate that the East Hudson Bay stock was once quite abundant, but intensive commercial exploitation beginning in the nineteenth century severely depleted the stock, and with continued pressure from indigenous subsistence whalers, stock recovery has been very limited (Gosselin 2005). Surveys performed in August 2004 detected 3,993 animals at the surface in James Bay (95% confidence interval of 2,375 to 6,716) and 2,040 in East Hudson Bay (95% confidence interval of 1,047 to 3,977) (Gosselin 2005). No attempt was made to derive a population size estimate or a PBR. However, the Committee on the Status of Endangered Wildlife in Canada (2004) estimated the abundance of the East Hudson Bay stock (not including the James Bay whales) at 1,227 animals, with a declining trend (36% decline from 1986 to 2001, or 2.6%/year), attributing the decline to overexploitation, hydroelectric development of tributary rivers, and anthropogenic noise. Under such circumstances the PBR would be zero.

Chapter 4
Karskaya Stocks

European and Russian polar beluga stocks are separated from Bering/Pacific polar stocks by a zone of nearly perennial sea ice and fast ice in the vicinity of the Novosibirsk Islands, which separate the Laptev Sea from the East Siberian Sea. Belugas on the European side of this barrier show commonalities of seasonal behavior and—to the limited extent that studies have been done—of genetic makeup, and were described by Heptner et al. (1976) as the Karskaya group. This includes stocks assigned by the IWC (2000) to Svalbard, Franz Josef Land, and the White, Barents, Kara, and Laptev seas. Preliminary genetic work (O'Corry-Crowe et al. 2010) suggests that these whales also show commonalities with the Beaufort Sea and West Greenland stocks, collectively comprising a large genetic unit centered on the Arctic Ocean basin and the polar sea ice mass.

Svalbard and Franz Josef Land

The IWC (2000) tentatively proposed two Svalbard stocks, one associated with Svalbard and the other with the Franz Josef Land archipelago 350 kilometers to the east; however, they acknowledged that there may be no distinction between these stocks, noting that almost nothing was known about the Franz Josef whales. That situation has not changed. The North Atlantic Marine Mammal Commission (NAMMC) (2005) regarded these two populations as representing a single Svalbard stock. Satellite tracking data for Svalbard whales shows that they spend the summer and autumn ice-free periods in the fjords, primarily close to glacier fronts (Lydersen et al. 2001), but there are few data on their winter distribution. It has been supposed that they forage in the Barents Sea, east of Svalbard (IWC 2000), as do the majority of the Karskaya stocks. Gavrilo and Ershov (2010) stated that belugas are the most common cetacean in Franz Josef Land during the summer, yet the winter status remains unclear. Anecdotal reports have identified summer herds of over 100 individuals, but there has been no confirmation that breeding grounds occur in Franz Josef Land.

O'Corry-Crowe et al. (2010) analyzed mitochondrial DNA for White Sea, Svalbard, West Greenland, and Beaufort Sea stocks and found them all to be clearly distinct. For the Svalbard whales, they report evidence of multiple past episodes of recurrent gene flow, both across the Atlantic (with the west Greenland stock) and especially across the Arctic Ocean, with the Beaufort Sea stock. The differentiation between Svalbard and Beaufort Sea populations is quite low relative to the distance between these areas, which are on opposite sides of the ocean. The same analysis indicates a ratio in population sizes between the Beaufort Sea and Svalbard populations of about 11:1; with a current Beaufort Sea population size of nearly 40,000 animals (Allen and Angliss 2010), suggesting a Svalbard population of about 3,600. Apart from this estimate, there has been no recorded attempt to quantify the population of the Svalbard (or Franz Josef Land) belugas via surveys (Jefferson et al. 2008). The IWC (2000), based on professional judgment, estimated the Svalbard islands stock at a "few hundreds to low thousands" and the Franz Josef stock at a "few hundreds." The Svalbard population was hunted commercially from the early seventeenth century until the early 1960s (Kovacs and Lydersen 2008). Numbers of whales taken are unknown. The IWC (2000) regarded the stock as likely depleted relative to historical levels. As for the Franz Josef stock, there have been no surveys, there is no record of whaling, and there have been no published estimates of population status and trend.

White Sea

The IWC (2000) proposed three stocks in the White Sea based on summer calving grounds in Onega Bay, Dvina Bay, and Mezen Bay. Subsequent work has identified eight White Sea local herds, defined as a group of animals united by kinship, common acoustic signals, and territorial isolation (from other local herds) of reproduction areas (Belkovich 2010). All are delimited only upon the basis of observed geographic affinity. No molecular genetics work has been done.

Since 2001, Russian researchers have performed numerous investigations of the physiology, acoustics, behavior, migration, and population size for the White Sea stocks. Although this work has involved no satellite tracking and almost no genetic sampling, it has done much to elucidate the life history of these whales, and has largely revealed that the White Sea functions as the foremost "nursery" for beluga populations of the Barents, Kara, and Laptev Seas (although smaller "nurseries" also occur in Svalbard and several estuaries of the Kara and Laptev Seas). Tissue samples analyzed by O'Corry-Crowe et al. (2010) evaluated both nuclear and mitochondrial DNA from belugas of West Greenland, Svalbard, and the White Sea, pooling their results with previous analyses of samples from the Gulf of Alaska and Beaufort Sea. Nuclear DNA identified three discrete populations: Gulf of Alaska, Beaufort Sea, and the combined Greenland-Svalbard-White Sea, with only a weak distinction between the Beaufort Sea and Greenland-Svalbard-White Sea populations. The latter populations were discriminated using mitochondrial DNA, but small sample size precluded clarifying the relation of the White Sea whales to the Svalbard or Greenland populations. Generally, the level of mitochondrial DNA differentiation observed between arctic whale stocks was much less than that seen between arctic and subarctic stocks, indicating "a close historical relationship among many of the most northerly populations" (O'Corry-Crowe et al. 2010).

Aerial surveys across the entire White Sea in March 2008 found 2,183 +/- 836 animals, times a correction factor (not specified) for submerged/not visible animals (Nazarenko et al. 2008; Glazov et al. 2010). All detections were in the central part of the sea (i.e., far from the Barents Sea), indicating that these were overwintering whales, which suggests that a portion of the White Sea population is perennial. Adrianov and Lukin (2008) analyzed from 1962 to 1993 aircraft observational data and, although no population estimates were possible, they did derive data on the seasonal distribution of White Sea belugas. Whales in the summer are coastal in their distribution, reflecting the distribution of local herds. Whales in winter are broadly distributed in the open sea, in a pattern that reflects seasonal ice accumulations. Whales in spring are primarily either coastal or are in the northern sea, near the Barents Sea, presumably reflecting spring migration of breeding females from the open waters of the Barents Sea and/or resident male migrations toward the Barents, Kara, and Laptev Seas.

In the 1930s, the White Sea beluga population was estimated at 8,000 to 10,000 (Svetochev et al. 2002). By 2001 all harvest had ceased, and a coastal survey estimated a White Sea summer population of 1,500 to 2,000 whales. The most rigorous and extensive surveys to date used aerial observations in 2007 to develop a 95% confidence interval for the population of 3,404 to 7,037 (2007) animals, predominately comprising females and immature animals of both sexes (Glazov et al. 2008). Survey data are not yet adequate to develop a quantitative estimate of partitioning between migratory and non-migratory populations in the White Sea.

Ob, Yenisey, and Khatanga Gulf

The Gulf of Ob, the Yenisey Gulf, and the Khatanga Gulf are long, narrow estuaries below the mouths of the Ob, Yenisey, and Khatanga Rivers, respectively. The Ob and Yenisey discharge to the Kara Sea, and the Khatanga to the southwest Laptev Sea. The Kara Sea is an extremely cold sea that retains extensive areas of ice throughout the year. The Laptev Sea is even colder, separated from the Chukchi Sea to the east by year-round sea and fast ice that forms a barrier to marine mammal movements. These estuaries, along with areas near Barents Sea and some large polynyas, are the principal ice-free zones in summer (Boltunov and Belikov 2002a). Almost no research has examined the beluga populations inhabiting these areas. The IWC (2000) proposed these stocks on the basis of a statement of opinion by Belikov, and Boltunov and Belikov (2002a), who claim that the Ob and Yenisey Gulfs are "famous for large aggregations of belugas," largely because they were hunted in these areas for many decades. They cite Heptner et al. (1976) as stating that these whales winter in the Barents Sea, which has comparatively large ice-free areas through the winter, moving through the straits north of Novaya Zemlya (which open before the southern straits) and entering the Ob, Yenisey, and Khatanga Gulfs to feed in the summer. Thus, the Ob, Yenisey, and Khatanga stocks are likely composed primarily of whales that winter in the Barents Sea and home to the Ob, Yenisey, and Khatanga Gulfs only during the summer months, when they feed on Arctic cisco (*Coregonus autumnalis*) runs in the Ob and Yenisey Rivers (Boltunov and Belikov 2002a), and presumably on comparable resources in the Khatanga Gulf. Belkovich (2010) suggests that there are summer breeding populations in these Gulfs, but acknowledges the lack of research on this point. No published sources were found describing any use of these areas for calving. However, the movements, distribution, and numbers of animals reported from a lengthy compilation of observations and historical records by Kleinenberg et al. (1964) are similar to accounts of such use in other areas, including the White Sea. This observation suggests that summer aggregations and calving occur in suitable shallow waters along the margins of the Ob, Yenisey, and Khatanga Gulfs, and perhaps also in the mouth of the Anabar River immediately east of the Khatanga Gulf and in the Lena River estuary 400 kilometers farther east.

There is little confidence in the size of the Yenisey, Ob, and Khatanga stocks. The Ob-Yenisey area evidently has a fairly high carrying capacity, since it has a whaling history going back to the nineteenth century or earlier with long periods of harvest amounting to several hundred animals per year (Boltunov and Belikov 2002a). Between 1954 and 1966, however, harvest rates surged to between 1,164 and 3,222 animals annually in the Kara Sea, with the majority taken in the Ob and Yenisey areas. This increased harvest rate resulted in a "dramatic" population decline, such that in 2000, Belikov (pers. comm. in IWC 2000) described the population as a "few hundreds" and "depleted compared to 1930s." For the Khatanga Gulf stock, the IWC (2000) described the population as simply "unknown," although Kleinenberg et al. (1964) do offer reports of "a few hundred" animals in Khatanga Gulf in August 1948 and "several hundred" in the Anabar River estuary in 1950. No more recent estimates are available.

Chapter 5
Bering Stocks

The Bering stocks include a substantial number of animals that migrate through the Bering Strait to winter in the Bering Sea, although the details of habitat use and life history differ between these stocks in substantial ways. Genetic and satellite tracking data suggest that—like the congregations of whales in the Canadian Arctic archipelago and in the Karskaya group—these whales home to distinctive summer aggregations, but overlap widely in their migrations and their use of winter range.

Beaufort Sea

The Beaufort Sea stock calves and molts at three concentration areas in the Mackenzie River Estuary (Northwest Territories) (Fraker 1980). The stock has one of the longest annual migration routes found among belugas. Once the whales leave the Mackenzie River estuary they travel north deep into the pack ice before finally moving south to the Bering Sea at the onset of winter. Some have been tracked westward to Wrangell Island before traveling south to Chukotka and then east to the Bering Straits (Richard et al. 2001). Presumably, this stock winters in areas similar to other Alaskan stocks; however, this stock is genetically distinct enough to suggest an independent origin from Alaskan stocks, though it has remarkable similarities to the Svalbard stock on the opposite side of the Arctic Ocean (O'Corry-Crowe et al. 1997, 2010).

At nearly 40,000 animals (Allen and Angliss 2010), the Beaufort Sea stock is second only to the West Hudson Bay stock in size. The provisional PBR for this stock is 324 animals, although NMFS no longer considers this value valid due to the age of the survey data used to calculate this estimate (1992 surveys conducted by Harwood et al. [1996]). The recent (2002–2006) average annual harvest of this stock has been about 114 animals in the estuary with about another 25 taken in United States waters (Allen and Angliss 2010). The current trend of this stock is unknown, although harvest numbers have consistently been less than the provisional PBR and there is no indication the stock is declining.

Chukchi Sea

The IWC (2000) proposed separate stocks in the west (Russian) and east (American) Chukchi Sea, but to date, no summer calving grounds have been identified in association with western Chukchi Sea shorelines (along Wrangell Island and the Chukotka Peninsula). Available evidence suggests the population may be derived primarily from calving grounds in the 130-kilometer Kasegaluk Lagoon in northwest Alaska.

The Eastern Chukchi Sea stock calves and molts in the 130-kilometer Kasegaluk Lagoon in June and July. Limited satellite tag data (Suydam et al. 2005) indicate that by mid-July males from this stock move into the pack ice to reach the deeper waters of the Arctic Ocean and both the Alaskan and Canadian Beaufort Seas, where they may intermix with belugas from the Beaufort Sea stock. Females and juveniles remain in the Chukchi Sea the rest of the summer. By October, both genders move south with the pack ice to overwinter in the Bering Sea. A tagged animal overwintered in the waters north of Saint Lawrence Island suggesting that the winter polynyas associated with this island are as important to belugas as they are to bowhead whales (Moore and Reeves 1993).

The minimum population estimate for this stock is 3,710 (Allen and Angliss 2010) based on surveys conducted by Frost et al. (1993) between 1980 and 1991. Because these surveys did not cover the full distribution of these animals at the time of survey, the survey results are considered conservative. Based on the survey results, the PBR would be 74 animals. However, NMFS is reluctant to calculate a PBR using data over 8 years old and currently considers the PBR for this stock as undetermined (Allen and Angliss 2010).

Seasonally, the western Chukchi Sea evidently has a substantial beluga population. Sea ice survey data (Belikov and Boltunov 2002) indicate numerous observations throughout the survey area; there are almost no observations from January through July, but abundant observations in the northern sea in August-September and a substantial number farther south in October. In winter, whales apparently migrate from the western Chukchi Sea to the southern extent of sea ice in the Bering Sea, although a small number may remain in coastal polynyas along the northern Chukotka Peninsula (Belikov and Boltunov 2002). Limited satellite tag data for individuals in the eastern Chukchi Sea (Suydam et al. 2005) indicate that by mid-July males from this stock move into the pack ice to reach the deeper waters of the Arctic Ocean in both the Chukchi and Beaufort seas, primarily moving nearly due north from the Kasegaluk Lagoon area, but in a substantial number of cases moving northwest as far as Wrangell Island. In the process they may intermix with belugas from the Beaufort Sea stock. Females and juveniles remain in the eastern Chukchi Sea the rest of the summer. By October both genders move south with the pack ice to overwinter in the Bering Sea. A tagged animal overwintered in the waters north of Saint Lawrence Island suggesting that the winter polynyas associated with this island are important to belugas, as they are to bowhead whales (Moore and Reeves 1993).

Population estimates for the western Chukchi Sea are tenuous. The IWC (Belikov pers. comm.) gives the abundance of the western Chukchi stock as "assumed few thousands." However, it is not clear where summer breeding aggregations occur in the Chukchi Sea. Whaling stations on the northern Chukotka Peninsula, described by Kleinenberg et al. (1964), evidently exploited migratory whales, taking the bulk of their harvest in spring and fall and, thus, were not associated with breeding areas. Large summer aggregations are reported near Wrangell Island (Kleinenberg et al. 1964), which could support summer breeding as in Svalbard, but no data confirm or deny the possibility. Absent summer breeding aggregations, the stock would likely be supported by migration from Alaskan or Bering Sea calving grounds. Satellite tracking studies of Beaufort Sea whales, tagged with satellite transmitters in the Mackenzie Delta area, indicate movement across the Chukchi Sea to Wrangell Island, and then back east along the Chukotka Peninsula and south through the Bering Strait (Huntington 2001; Richard et al. 2001). Other whales tagged with satellite transmitters in Kasegaluk Lagoon in the eastern Chukchi Sea moved into the northern sea, in the area surveyed by Belikov and Boltunov (2002), in some cases traveling west of Wrangel Island (Suydam et al. 2005). It is possible that the east and west Chukchi Sea stocks are one, likely including some measure of mixing with the Beaufort Sea stock, and that the breeding grounds for these animals may lie in Alaska and the Mackenzie Delta (Huntington 2001). If so, then the summer presence of likely one to several thousand animals in the western Chukchi Sea should be considered in the evaluation of the Beaufort and Eastern Chukchi stock status.

East Bering Sea

The East Bering Sea stock forms breeding aggregations in Norton Sound and the nearby mouth of the Yukon River during the ice-free months (Lowry et al. 1995), and migrates south with the pack ice in the winter (Huntington et al. 1999) where they may intermix with other stocks. Belugas occasionally overwinter in Norton Sound if open water is present (Frost 1996). The stock appears to be genetically distinct from other stocks, but may have diverged from the Bristol Bay stock (O'Corry Crowe et al. 1997). The most recent minimum population size was estimated at approximately 15,000 (Allen and Angliss 2010).

The annual subsistence harvest, managed by the Alaska Beluga Whale Commission, averaged about 200 animals (high 249) between 2002 and 2006, which is below the current PBR of about 300 animals (Allen and Angliss 2010). Although some under reporting of harvest is known to occur, there is no indication that this stock is declining.

Bristol Bay

The Bristol Bay stock inhabits the nearshore waters of Bristol Bay, especially in the vicinity of the Nushagak and Kvichak River mouths (Allen and Angliss 2010). Presumably, these whales overwinter in the Bering Sea where they mix with other stocks from the Bering, Beaufort, and Chukchi Seas. However, recent telemetry data has shown that at least some portion of this stock may live year-round in Bristol Bay as ice conditions allow (Allen and Angliss 2010). While genetically distinct from other Alaskan populations, it is similar to the nearby Eastern Bering Sea stock, suggesting one may have founded the other (O'Corry-Crowe et al. 1997).

Based on aerial surveys conducted by Lowry et al. (2008), the current minimum population estimate is slightly less than 2,500 animals. Annual subsistence harvest averaged 17 animals between 2000 and 2006, which is 35% of the PBR of 49 animals Allen and Angliss (2010) calculated for this population. Other human-related mortalities are unknown. Surveys conducted between 1993 and 2005 showed that the population has increased by about 65% during the 12-year period (Lowry et al. 2008), a very high average annual rate of 4.7%.

Gulf of Anadyr

The Gulf of Anadyr stock is generally recognized but has received little study. Limited genetics studies have been done on the Gulf of Anadyr stock, indicating a close relationship to the Beaufort Sea stock (Hobbs et al. 2007). The IWC (2000, citing Belikov pers. comm.) proposed a single Anadyr Gulf stock that summers in the Anadyr Lagoon and River and winters in the Gulf of Anadyr, assessing its abundance as "no estimate, assumed few thousands." A satellite tracking study in July 2001 tagged four Anadyr belugas; the last transmitter stopped functioning in March 2002. During that time the whale remained in the Gulf of Anadyr, spending the summer in the Anadyr estuary area, then moved north in November to Cresta Bay. When the bay froze over, the two whales that still bore functioning transmitters crossed the gulf to the south and remained near Cape Navarin from January to March (Litovka et al. 2002), results which confirmed earlier survey data and which were in turn confirmed in tracking of a single whale from August 2006 into early 2007 (Hobbs et al. 2007). It is also known that the Anadyr whales congregate in the estuary in summer to feed on the annual run of chum salmon (*Oncorhynchus keta)* (Litovka 2002), sometimes moving upstream (the Anadyr River) as far as 100 km to forage in Lake Krasneno (Boltunov and Belikov 2002b). There are no estimates of the population size, current removals, or population trends for this stock.

Chapter 6
Okhotsk Stocks

Sea of Okhotsk belugas form summer aggregations at three general locations: Shelikov Bay, Shantar Bay, and Sakhalin Bay/Amur River Estuary. A fourth location, Tauy Bay (Magadan) southwest of Shelikov Bay, was subject to intense commercial harvest and is no longer used (Melnikov 1999). The Sea of Okhotsk stocks are addressed in Appendix A.

Chapter 7
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APPENDIX C
COLLECTION METHODOLOGY

Contents

Acronyms and Abbreviations

DFO	Canadian Department of Fisheries and Oceans
NMFS	National Marine Fisheries Service
USDA	U.S. Department of Agriculture

Chapter 1
Introduction

This document describes the procedures, protocol, personnel, and equipment used to collect beluga whales from the Sakhalin-Amur region in the Sea of Okhotsk. The beluga whales that would be imported by the Georgia Aquarium under this application were collected using these techniques.

The procedures used to collect the beluga whales that will be imported under the proposed permit activity closely mimic the collection procedures used by scientific and regulatory organizations such as the National Marine Fisheries Service (NMFS) (Ferraro et al. 2000), the Canadian Department of Fisheries and Oceans (DFO) (Orr et al. 2000), and the Society of Marine Mammalogy (Gales et al. 2009). Techniques used to collect the beluga whales that will be imported as part of the permit activity, like those used by NMFS, DFO, or the Society of Marine Mammalogy, are safe and humane.

Belugas that will be imported under the proposed permit activity were originally collected by an experienced team of 10 to 12 people from the Marchenko family and led by Dr. Lev Mukhametov, Director of Utrish Marine Dolphinarium. The Marchenko family has been collecting belugas from the Sakhalin-Amur area for over 30 years. Of the 18 belugas whales included in the permit activity, two were collected in 2006, eleven were collected in 2010, and five were collected in 2011. All whales were collected in accordance with Russian law and under collection permits which we issued as part of their collection. The original collection permits are included in Chapter 6 of this appendix. All whales were collected during the summer using the methods and practices described below.

Chapter 2
Collection Methods

During the short summer collection season, the team bases its operations at Chkalova Island, approximately 8 kilometers (5 miles) northwest of the primary collection site near Baydukova Island. Collection attempts were only initiated during low tide when water depth was shallow (2 to 4 meters [6.6 to 13.1 feet] deep). The collection team sailed with equipment from Chkalova Island, a location near the mid-point of Baydukova Island where belugas are known to forage for salmon in shallow water near shore. As the team sailed, it searched for beluga groups swimming in shallow waters (approximately 2 to 4 meters [6.6 to 13.1 feet] deep) using binoculars. The collection team did not chase or drive whales into shallow waters to engage in a collection attempt. Instead, the team would only engage whales that were already located in shallow waters or those that were moving voluntarily in the direction of shallow waters. For groups fitting the latter description, the collection team would track the location of the group from a distance and would only engage once the whales had moved into sufficiently shallow water.

When a group of belugas was detected, the collection team conducted an initial visual assessment using binoculars to estimate the number and age of the animals present, and to identify the presence of any newborn calves, mother–calf pairs, or juveniles less than one year old. No action was taken by the team until the initial assessment was completed and it was certain of the composition of the group. Because the collection team could safely engage only a limited number of whales in one attempt, the collection team would not engage if there were more than five animals present. Furthermore, the collection team would not engage any group if mother–calf pairs, calves, large adults, or juveniles less than one year old were identified during the initial assessment. Groups including mother-calf pairs and calves identified individually were not engaged because calves are not collected, nor does the collection team separate calves from their mothers. Additionally, groups with large adults were not engaged because large adults are too heavy to collect safely without specialized equipment.

The equipment used by the collection team included three *baidars* (traditional motor/sail boats approximately 14 meters (46 feet) in length with low freeboards, a flat deck, and a central outboard motor) and up to 12 other boats approximately 3 meters (9.8 feet) in length with 40-horsepower outboard motors. Two of the baidars were loaded with half of a seine net measuring approximately 1.5 kilometers (0.9 mile) in length and 8 meters (26.2 feet) in depth with a stretched mesh approximately 30 centimeters (1 foot) in cell size. The seine net was constructed of a soft nylon rope and had buoys along the length of the top rope and sewn-in, heavy leaded thread along the bottom rope. This design prevents escape by allowing the net to take a vertical orientation once deployed into the water. One-half of the net was placed on each baidar and the two baidars traveled closely side by side (Figure 1) with other boats tied to the stern of each (Figure 2) until the net was deployed. A third baidar was only used if the initial collection attempt conducted by the other two baidars failed.

When a suitable group of belugas was located in sufficiently shallow water, the collection team would begin engaging the whales. The baidars would separate and encircle the whales by deploying the seine net behind them in a curving trajectory to create a “compass” around the whales. Once the compass was formed, the two ends of the net were tied together to minimize escape and to eliminate areas of net overlap where whales might become trapped.

Once the seine net was closed around the whale group, the team conducted a second visual assessment of the animals swimming inside the seine net. If there were any newborn calves, mother–calf pairs, large adults, or juveniles less than one year old present, the net was opened and all of the animals allowed to exit. If the net did not include newborn calves, mother–calf pairs, large adults, or juveniles less than one year old, one baidar would sail for the nearby beach of Baydukova Island. There, the baidar would be beached and the collection team would begin slowly pulling the net into shore by hand. This would simultaneously decrease the diameter of the compass while moving the whales into shallower waters where they could be more easily handled.

Throughout this process, the smaller boats would position themselves around the outside of the compass to watch for entangled whales. These boats moved very slowly (approximately 4 kilometers [2.5 miles] per hour) during this process in order to minimize noise. If at any time a beluga contacted the seine net in a manner that could constitute a threat to the whale, the crew of at least one boat would lift the beluga to the surface using the net and tie a large buoy onto the seine net close to the whale's head. This would maintain the beluga's position at the surface and ensure that it could breathe freely and continuously. If a beluga contacted the net and somehow became entangled in such a way that it was difficult to ensure its safe breathing (e.g., the whale became wrapped in the seine net), the boats were positioned so that they could maneuver close to the beluga and personnel on a boat could pull the whale to the surface by the net, secure it in the water along the side of the boat, and provide continuous supervision until the whale could be disentangled. Although beluga whales can detect nets both visually and acoustically and no documented occurrences of marine mammal entanglement have occurred in association with Sea of Okhotsk commercial fisheries, the possibility of entanglement during collection cannot be eliminated. However, the practice of using the boats to slowly patrol the compass is designed to minimize the risk of injury should entanglement occur. The deployment and retrieval of the seine net in this fashion supports a safe and humane collection by working to create a safe swimming zone within the compass where the whale can remain safe, while other whales are brought to shore.

As each whale was moved into shallow waters near the beached baidar, it was removed from the seine net, transferred to a soft net stretcher, and loosely secured along the sides of the nearby baidar in the water parallel to and facing the bow of the boat (Figure 3). Each beluga was supervised by one or two team members who ensured its safe, unimpeded breathing. With the belugas secured and monitored in this position, the baidars sailed slowly (less than 5 miles per hour—within the normal swimming speed for beluga whales) to the Chkalova Island camp. The trip to Chkalova Island was undertaken cautiously, with the whales secured to the baidar in a manner that was both safe and in a position that ensured the unimpeded breathing of the whales.

Once the baidars had slowly motored to the Chkalova Island camp and were in approximately 1 meter of water, a soft fabric tail belt was placed around the tail peduncle of the belugas to help control them (Figure 4). The animals were then moved from alongside the baidar in their net stretchers to shallow water where measurements were taken and their condition was inspected by Dr. Elena Rozanova, the on-site veterinarian. They were also often kept partially covered under a section of the small net that surrounded them to secure their flippers and avoid injury while being examined. Dr. Elena Rozanova from the Utrish Dolphinarium performed a full health assessment of each whale to determine fitness and condition.

After the initial assessments, the whales were guided through the water slowly by hand into a nearby shore-side net-pen and released from their net stretchers. There are four pens at the Chkalova Island camp. Each shore-side net pen measures approximately 12.2 meters long by 12.2 meters wide by 2.4 meters deep (40 feet long by 40 feet wide by 8 feet deep) and may hold approximately six whales (Figure 5), which complies with U.S. Department of Agriculture (USDA) size restrictions for housing marine mammals.

Once in the shore-side pens, the belugas were monitored and cared for by husbandry and veterinary staff from the Utrish Dolphinarium.

While in the shore-side pens, the whales were fed locally caught herring and Icelandic capelin. In each case noted, the whales began taking food no later than the second day after collection, which is earlier than the typical normalization period for belugas. The beluga whales remained in the shore-side pens under constant supervision and with full-time medical care for approximately 2 months before they were transported to the Utrish Marine Mammal Research Station on the Russian coast of the Black Sea. The transport of the whales from Chkalova Island is described in Appendix D attached to this permit application.

The techniques and methods used to collect beluga whales described above were carefully designed to ensure that collection activities were conducted in as humane and safe a manner as possible. As noted previously, the methods used by the team for collecting the beluga whales that will be imported under the permit accompanying this appendix are virtually identical to those practiced by NMFS, the Canadian DFO, and the Society of Marine Mammalogy. No beluga whales applied for in the accompanying permit died during or after collection and none received serious injury.

Chapter 3
Key Staff Members

The names and qualifications of some key staff members who treated and cared for the beluga whales during the collection and at Chkalova Island are listed below.

Dr. Lev Mukhametov is the head of the Marine Mammals Behavior Group and of the Utrish Marine Station of the Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences and the Director of Utrish Dolphinarium Ltd. Since earning his Ph.D. in 1967, Dr. Mukhametov has spent his career studying and working in the field of marine mammal behavior and comparative physiology of sleep-wakefulness cycle, as well as the collection, transportation, and maintenance in captivity of marine mammals. Dr. Mukhametov has published over 150 papers in Russian, English, French, and Italian. He has participated in and presented lectures and oral presentations at 20 international congresses, conferences, and symposia of Sleep Societies and Aquatic Mammals Associations.

Dr. Elena Rozanova has been the lead veterinarian for Utrish Dolphinarium Ltd. since 1998. During this time, Dr. Rozanova has overseen collection and care of whales and assisted in their safe adaptation to captivity, provided medical treatment, and conducted health analyses. Dr. Rozanova has also provided veterinary support for the transportation of marine mammals and participated in many scientific conferences on the study of marine mammals. She is a graduate of Moscow Medical College, Pirogov Russian National Research Medical University, and Moscow State Veterinary College.

Andrei Abramov is the Vice Director of Utrish Dolphinarium Ltd. He is responsible for the safe collection of marine mammals, nutrition and diet planning, facilitating marine mammals in their adaptation to captivity, and transportation of marine mammals. He has supported the transportation of marine mammals from Russia to a number of foreign destinations including Canada, China, and Thailand. Mr. Abramov earned a degree in zoology from Moscow State University and has served on the faculty in the Biology Department at that institution.

Oleg Vassiliev is a Senior Trainer who has worked with dolphins and pinnipeds since 1991.

Alexei Timshin is a Senior Trainer who has worked with dolphins and pinnipeds since 2001.

Dr. Olga Russkova is a veterinarian who has worked with marine mammals since 2000. Dr. Russkova graduated from the Moscow Medical Institute in 1998.

Dr. Sergei Solovkin is a veterinarian who has worked with marine mammals since 2002. Dr. Solovkin earned a Ph.D. from the Veterinarian Academy in 1983.

Chapter 4
References

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Attachment A

Figures

Figure 1. Baidars Sailing Side by Side

Figure 2. Boats Tied to the Stern of Baidar

Figure 3. Beluga Secured along Side of Baidar before Transition to Shore-Side Pen

Figure 4. Beluga Being Released from Net (tail strap shown)

Figure 5. Belugas in Shore-Side Net Pen

Attachment B

Original Collection Permits

2006

Федеральная служба по ветеринарному и фитосанитарному надзору

УПРАВЛЕНИЕ ФЕДЕРАЛЬНОЙ СЛУЖБЫ ПО ВЕТЕРИНАРНОМУ И ФИТОСАНИТАРНОМУ НАДЗОРУ ПО ХАБАРОВСКОМУ КРАЮ И ЕВРЕЙСКОЙ АВТОНОМНОЙ ОБЛАСТИ

РАЗРЕШЕНИЕ № 003405

на вылов (добычу) водных биологических ресурсов в научно-исследовательских, контрольных целях, для воспроизводства, акклиматизации, в учебных, культурно просветительских целях

на 2006 год

Настоящее разрешение выдано *ООО "Утришский дельфинарий"*
Приказ ФАР № 105 от 28.04.2006, плата за ВБР 10% - 6000 руб., п/п № 495 от 13.06.06., госпошлина 200 руб., квитанция от 15.06.06

на право лова (добычи) водных биологических ресурсов для *культурно-просветительских*

Вылов (добычу) разрешается производить в *о-ва Чкалова, Байдукова*

подзона 61.05.1, Сахалинский залив, Петровская коса

с 17.06.2006 по 30.09.2006г. **следующими орудиями лова:**

Ахан дл. 1500 м., яч. 300-400 мм 1 шт.

Разрешается вылов (добыча) следующих видов водных биологических ресурсов в количестве (по видам)
живоотлов белухи 20гол.

Вылов (добыча) производится *катер "Амур", Хабаровский край*
ООО "Утришский дельфинарий"

бригадир Марченко Н.М.

Ответственный за проведение вылова (добычи) является
Е.Г. Шалаев - сотрудник ООО "Утришский дельфинарий"

Куда направляются выловленные (добытые) водные биологические ресурсы
ООО "Утришский дельфинарий"

Сведения о владельце квот (наименование, ОГРН, ИНН, КПП)
ООО "Утришский дельфинарий", ОГРН ИНН7725062?0 КПП772501001

Особые условия *мотобайды - 3 шт., лодки "Прогресс" - 4 шт.*

Дата выдачи *16 июня 2006 г.*

Заместитель Руководителя (подпись) *А.А. Васильков* ф.и.о.

Изготовлено ЗАО "ПИТ", г. Владивосток, 2004 г., уровень "В"

Федеральное агентство по рыболовству

Амурское территориальное управление

РАЗРЕШЕНИЕ

на добычу (вылов) водных биологических ресурсов

№139-Н

Основание для выдачи разрешения

Приказы Росрыболовства от 27.05.2010 г. № 503 таб. 3, № 504 таб. 3.

Сведения о пользователе (наименование, местонахождение, ИНН, КПП, ОКАТО)

ООО РОЦ «Дельфин и Я» 107014, г.Москва, ул.Гастелло, 41, ИНН 7718612161, КПП 771801001, ОКАТО 45263591000

Вид рыболовства *в учебных и культурно-просветительских целях.*

Условия добычи (вылова) водных биологических ресурсов (далее - водные биоресурсы)

Район добычи (вылова) водных биоресурсов (вылова), рыбопромысловый участок	Виды водных биоресурсов	Квоты (объемы) добычи (вылова) водных биоресурсов	Орудия, способы добычи (вылова) водных биоресурсов	Сроки добычи (вылова) водных биоресурсов
Сахалинский залив Северо-Охотоморской подзоны	Белуха	25шт.	Невод дл. 1500м., яч. 300-400мм., неводной способ добычи.	с 28.07. по 15.10.2010
	Косатка	2шт.	Невод дл. 900м., яч. 400-500мм., неводной способ добычи.	

Ф.И.О., должность лица, ответственного за добычу (вылов) водных биоресурсов

Шпак Ольга Виленовна – научный сотрудник

Ф.И.О., должность лица, ответственного за выполнение программы (плана) работ

Шпак Ольга Виленовна – научный сотрудник

Примечания

- *Обязательным условием являются соблюдение при осуществлении добычи (вылова) водных биоресурсов требований в области охраны окружающей среды, правил рыболовства и ограничений рыболовства, установленных законодательством Российской Федерации и международными договорами Российской Федерации в области рыболовства и сохранения водных биоресурсов для рыбохозяйственного бассейна.*
- *В случае аннулирования или окончания срока действия разрешения, его оригинал с отчетом о промысле в 15-дневный срок сдать по месту его получения.*

Дата выдачи 27 июля 2010 г.

Заместитель руководителя Управления С. В. Михеев

Серия УР № 002367 *

Федеральное агентство по рыболовству

Амурское территориальное управление

РАЗРЕШЕНИЕ

на добычу (вылов) водных биологических ресурсов

№ 27-1632

Основание для выдачи разрешения: Приказы Федерального агентства по рыболовству от 31.05.2011 г. № 536, № 537.

Сведения о пользователе (наименование, адрес, ИНН, КПП, ОКАТО): ООО РОЦ "Дельфин и Я", 107014, г.Москва, ул.Гастелло, дом 41, ИНН 7718612161, КПП 771801001, ОКАТО 45263591000

Вид рыболовства: рыболовство в учебных и культурно-просветительских целях

Условия добычи (вылова) водных биоресурсов:

Районы добычи (вылова), рыбопромысловый участок	Виды водных биоресурсов	Объёмы добычи (вылова), штук	Орудия (способы) добычи (вылова)	Сроки добычи (вылова)
Северо-Охотоморская подзона	белуха	5	невод закидной длина 1500 м, ячея 300-400 мм (неводной), невод закидной длина 900 м, ячея 400-500 мм (неводной)	27.07.2011-30.09.2011
Северо-Охотоморская подзона	косатка	2		

Бригада рыбаков: Марченко Н.М., Кирсанов А.В., Морозовский А.В., Тарасов А.В., Морозовская Е.Н., Гречухин А.С., Войтович А.Н., Крыжановский И.А., Шемелин А.А., Кузнецов Д.П., Тарасов В.А., Рыжиков Р.Ю., Антушевич А.В., Козенко В.Н., Виговский А.А.

Тип и название судна, бортовой номер: парусно-моторная Байда Р 76-94 ХГ, парусно-моторная Байда Р 76-95 ХГ, парусно-моторная Байда Р 76-96 ХГ. Договор аренды от 20.07.2011.

Наименование и адрес собственника судна: Н.М. Марченко, 682460, г.Николаевск-на-Амуре, ул.Батарейная, 32.

Ф.И.О., должность ответственного за добычу (вылов): Степанов Сергей Юрьевич - ветеринарный врач.

Ф.И.О., должность лица, ответственного за выполнение программ (плана) работ: Степанов Сергей Юрьевич - ветеринарный врач.

Особые условия: Обязательным условием является соблюдение при осуществлении добычи (вылова) водных биоресурсов требований в области охраны окружающей среды, правил рыболовства и ограничений рыболовства, установленных законодательством Российской Федерации и международными договорами Российской Федерации в области рыболовства и сохранения водных биоресурсов для рыбохозяйственного бассейна. Разрешение подлежит регистрации в районном отделе контроля, надзора и охраны водных биологических ресурсов и среды их обитания.

Дата выдачи: 26 июля 2011

Заместитель Руководителя _______ С.В. Михеев

Серия АТУ № 000860

APPENDIX D
TRANSPORT AND HOLDING

Contents

Figures

Acronyms and Abbreviations

APHIS	Animal and Plant Health Inspection Service
applicant	Georgia Aquarium
AWA	Animal Welfare Act
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species
IATA LAR	International Air Transport Association
MMPA	Marine Mammal Protection Act
U.S.	United States
USDA	U.S. Department of Agriculture
USFWS	U.S Fish and Wildlife Service

Chapter 1
Introduction

Appendix D, Transport and Holding, accompanies and supplements the Application for a Public Display Permit under the Marine Mammal Protection Act (MMPA). This appendix includes additional detail, figures, and descriptions of the equipment, facilities, methods, and personnel that will be directly involved with the transport and temporary holding of beluga whales sought for import by Georgia Aquarium, Inc. (GAI or "applicant") under this permit application. This includes transport of the beluga whales from their capture location in the Sea of Okhotsk to temporary holding facilities at Utrish Marine Mammal Research Station (UMMRS), and from UMMRS to the United States (U.S.). Also provided in this appendix are summaries of applicable laws, regulations, and guidelines, and copies of the necessary permits and certifications required for transport and import. Detailed information regarding the facilities at the Georgia Aquarium into which whales will be imported under the permit is included in Appendix H, also attached to this application.

Chapter 2
Transport Practices, Guidelines, and Regulations

There are a number of applicable and established guidelines, practices, and regulations regarding the safe and humane transport of marine mammals. The applicant's standards of practice are designed to meet or exceed all U.S. federal regulations, industry standards, and international treaties applicable to the proposed import of 18 beluga whales from Russia into the U.S. A list of applicable industry standards, federal regulations, and international treaties is included below, along with summaries of pertinent requirements of each.

CRC Handbook of Marine Mammal Medicine

Published in 2001, the second edition of the *CRC Handbook of Marine Mammal Medicine* (Dierauf and Gulland 2001) outlines procedures for the safe and humane transport of marine mammals, including cetaceans. The Handbook describes the challenges and risks associated with cetacean transport and provides practices to address them. Historically, cetaceans undergoing transport have been known to develop conditions including muscle stiffness, appetite depression, anemia, pressure necrosis, and respiratory infections. Recommendations regarding planning, procedures, equipment, facilities, and personnel necessary for safe transport are also supplied in the handbook and include the following:

- numbers and qualifications for personnel attending animal transport;
- guidelines for design and specifications of stretchers and containers;
- pre-transport health examinations;
- contingency plans in case of aborted or delayed transport;
- loading and unloading equipment;
- use and type of aircraft;
- ground transport equipment and ground transportation routes;
- environmental parameters to be maintained during transport (water temperature, air temperature, aircraft cabin pressure, etc.); and
- post-transport observations and examinations.

The applicant is experienced with and committed to the procedures described in the *CRC Handbook of Marine Mammal Medicine* (Dierauf and Gulland 2001). The transport of beluga whales under this permit will meet or exceed the guidelines included in the Handbook. The applicant will also ensure that all employees, contractors, and service providers involved with the transport comply with the procedures of the Handbook.

International Air Transport Association Live Animals Regulations

The International Air Transport Association (IATA) Live Animals Regulations (LAR)—a mandatory standard for international transport of live animals by commercial airlines—is an essential reference for professionals in the business of shipping live animals by air as well as for the training of personnel in the industry. The regulations include standards that have been adopted worldwide by shippers, freight forwarders, airlines, ground-handling companies, service providers, veterinarians, laboratories, governments, and animal welfare organizations. Their purpose is to ensure the correct packaging, storing, loading, and transportation of live animal shipments by air. The IATA LAR provide requirements for the containers to be used in the international carriage of live animals, preparatory measures to be taken prior to air transportation, and general guidelines for feeding, care, and loading. Over 250 airlines worldwide use the IATA LAR on a regular basis. The regulations are endorsed as the official transportation guidelines by the Convention on International Trade in Endangered Species (CITES), the Office International des Epizooties, the European Union, and the U.S. Fish and Wildlife Service, among others.

The IATA LAR are revised annually by the IATA Live Animals and Perishables Board in light of available scientific evidence and practical experience. A new edition of the IATA LAR becomes effective each October 1. IATA carriers and the air transport industry are obliged to adhere to the edition of the regulations in force at the time of the shipment. Each new edition of the IATA LAR is intended to improve the safety of animals being shipped.

Container requirements are set out in the IATA LAR. There are general requirements for various groups of animals and specific requirements that can be applied to each species of animal. When taken together, the specific and general requirements set out the minimum standard of compliance. *Container Requirement 55* describes principles of container design applicable to belugas, dolphins, narwhals, dugongs, and other whale species. It states that the container must take the shape of a box. Though it can be constructed from a variety of materials, the container must be watertight. Its dimensions must be sufficient to allow for one animal to be suspended by a stretcher supported on a foam rubber pad. There must be at least 20 centimeters (8 inches) of clearance on all four sides of the animal. The animal's stretcher can be construction of a variety of suitable materials and must allow the flippers to protrude outside the stretcher. However, as noted in *Container Requirement 55,* containers that conform to the principle of written guidelines may differ slightly and still meet the IATA standards.

The applicant follows the IATA LAR as a matter of standard practice and has experience successfully implementing the regulations for past animal transport actions. During import, all applicable IATA LAR standards will be met or exceeded by the applicant. The applicant will also require that its employees, contractors, and service providers involved in this action comply with the IATA LAR.

The Convention on International Trade in Endangered Species Guidelines for Transport and Preparation for Shipment of Live Wild Animals

CITES guidelines for transport and preparation for shipment of live wild animals and plants were adopted by the Conference of the Parties to CITES at its second meeting in San José, California in 1979. The guidelines require national legislation to be adopted for their enforcement, and are intended to incorporate basic standards for the humane transport of live animals, in a form adaptable to local legislative requirements.

The guidelines for transporting animals consist of two parts. The first section of the guidelines is intended for shipping agents, airline staff, ship's personnel, railway staff and any others who may be involved in the handling and checking of live animal consignments. It consists of a three-part Advice to Carriers section, which covers various aspects of the animals' welfare, transport arrangements, and the design and construction of containers (CITES 2011a).

The second section of the guidelines is intended for those who are directly responsible for providing the containers and making the advance arrangements for the transport of wild animals. It consists of 18 packer's guidelines covering a number of animal groups including marine mammals (CITES 2011b).

The proposed import will be carried out by the applicant in such a way that applicable CITES guidelines are met or exceeded. The applicant will require that all employees, contractors, and service providers involved in the transport process comply with applicable CITES guidelines.

Animal Welfare Act

The Animal Welfare Act (AWA) (Laboratory Animal Welfare Act of 1966, P.L. 89-544) was signed into law in 1966. The primary function of the AWA is to ensure that pets and animals intended for use in research facilities, public display, and exhibitions are provided with humane care and treatment. The AWA requires that minimum standards of care and treatment be provided for certain animals bred for commercial sale, used in research, transported commercially, or exhibited to the public. Other laws, policies, and guidelines may include additional species coverage or specifications for animal care and use, but all refer to the AWA as the minimum acceptable standard. The AWA was amended six times (1970, 1976, 1985, 1990, 2002, and 2007) and is enforced by the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) and Animal Care agency. Marine mammals, along with most other warm-blooded exotic animals, have been included under the AWA, and regulations for their care have been in effect since September 20, 1979.

The applicant's proposed import will comply with all applicable provisions of the AWA. The applicant will ensure that the activities of its employees, contractors, and service providers are in compliance with the provisions of AWA.

Animal Welfare Regulations

In addition to the AWA, the USDA has established the Animal Welfare Regulations which provide more detail regarding the care and use of regulated animals. Title 9 of the Code of Federal Regulations (9 C.F.R.), Animal and Plant Products, Subpart E Specifications for the Humane Handling, Care, Treatment, and Transportation of Marine Mammals, includes sections with specifications, guidelines, and instructions pertaining to the following:

- space requirements for facilities (Sec. 3.100);
- consignments to carriers and intermediate handlers (Sec. 3.112);
- primary enclosures used to transport marine mammals (Sec. 3.113);
- primary conveyances (motor vehicle, rail, air and marine) (Sec. 3.114);
- food and drinking water requirements (Sec. 3.115);
- care in transit (Sec. 3.116);
- terminal facilities (Sec. 3.117); and
- handling (Sec. 3.118).

The applicant will meet or exceed these regulations. Although some of the regulations apply to carriers and handlers, the applicant will require that all employees, contractors, and service providers involved in the transport process comply with the regulations.

United State Fish and Wildlife Service Regulations

The U.S Fish and Wildlife Service (USFWS) regulations contained in 50 C.F.R. 14 provide uniform rules and procedures for the import, export, and transport of wildlife. With limited exceptions, all specimens imported into the U.S. must be cleared through a USFWS port designated for wildlife. Shipment must be declared and must receive clearance from USFWS prior to shipment.

Various sections under 50 C.F.R. Part 14 are applicable to the applicant's action. These include:

- Section 14.14 – In-transit shipments;
- Section 14.18 – Marine mammals;
- Section 14.61 – Import declaration requirements;
- Section 14.104 – Translations;
- Section 14.105 – Consignment to carrier;
- Section 14.106 – Primary enclosures;
- Section 14.107 – Conveyance;
- Section 14.108 – Food and water;
- Section 14.110 –Terminal facilities; and
- Section 14.111 – Handling.

The applicant will meet or exceed all applicable regulations and requirements under 50 C.F.R. 14. Although some of the regulations apply to carriers and handlers, the applicant will require that all employees, contractors, and service providers involved in the transport process comply with the regulations.

The Lacey Act, 16 U.S.C. §§ 3371-3378

The Lacey Act, 16 U.S.C. §§ 3371-3378, protects both plants and wildlife by creating civil and criminal penalties for a wide array of violations. Most notably, the Act prohibits trade in wildlife, fish, and plants that have been illegally taken, possessed, transported, or sold. Thus, the Act underscores other federal, state, and foreign laws protecting wildlife by making it a separate offense to take, possess, transport, or sell wildlife taken in violation of those laws. The Act prohibits the falsification of documents for most shipments of wildlife (a criminal penalty) and prohibits the failure to mark wildlife shipments (civil penalty). The Lacey Act is administered by the Departments of the Interior, Commerce, and Agriculture through their respective agencies. These include USFWS, National Marine Fisheries Service, and APHIS (Wisch 2003).

Because the beluga whales that will be imported under this permit were legally taken, transported, and possessed in compliance with the laws and regulations of the Russian Federation, the applicant's proposed import will comply with the Lacey Act.

Chapter 3
Transport Methods

This chapter describes the methods used to transport the 18 beluga whales, starting with their collection site, and concluding with their arrival at U.S. aquaria facilities. Where available, detailed descriptions and diagrams are included to outline the specific practices, facilities, equipment, and personnel involved in the transport. In all cases, the methods used by the applicant will meet or exceed the requirements and practices described in the regulations and guidelines presented in Chapter 2. The personnel, equipment, facilities, and procedures involved in the collection of the animals are described in Appendix C to the Application for a Public Display Permit under the MMPA.

Transport between Collection Site and Utrish Marine Mammal Research Station

All beluga whales collected in the Sea of Okhotsk in 2006, 2010, and 2011 were initially transported from the camp at Chkalova Island, to UMMRS located on the Russian Black Sea coast, and operated by the Russian Academy of Science's Severtsov Institute of Ecology and Evolution. The methods described below characterize the transport procedures for whales collected in all years. The transport was conducted in accordance with professionally accepted standards and techniques in compliance with all applicable regulations, standards, and conditions set forth under the AWA, MMPA, CITES, USFWS regulations, USDA regulations, and IATA LAR. The transport employed all contemporary and accepted methods outlined in the *CRC Handbook of Marine Mammal Medicine*, Second Edition (Direauf and Gulland 2001).

Immediately after their collection, the beluga whales were held in shore-side temporary pens measuring approximately 12 meters long, by 12 meters wide, by 2.5 meters deep (40 feet long by 40 feet wide by 8 feet deep) at Chkalova Island, Russia for an acclimation period of approximately two months. During their time in the shore-side pens, the belugas were monitored and cared for by husbandry and veterinary staff from the Utrish Dolphinarium. Dr. Elena Rozanova from the Utrish Dolphinarium performed a full health assessment of each whale to determine fitness and condition. Dr. Rozanova has been the lead veterinarian for Utrish Dolphinarium since 1998. During this time, Dr. Rozanova has overseen collection and care of whales, assisted in their safe adjustment to captivity, provided medical treatment, and conducted health analyses.

An animal trainer worked with the whales to condition them for human contact. The trainer hand-fed the whales locally caught salmon and worked with the animals to develop their trust of humans. Shortly before transport from their temporary holding facilities at Chkalova Island, the whales were examined by Dr. Rozanova to verify that the animals were healthy enough to undergo transport. Specifically, the whales were examined for any disease or illness that could have caused them to be in a compromised state of health. Females were also checked to ensure they were not pregnant or lactating.

After their veterinary examinations were complete, the whales were transferred by hand from the temporary sea pens into transport container units already on board a nearby helicopter using a soft nylon sling. Transport units were designed to accommodate up to two beluga whales per container and, although they were tailored specifically to accommodate the whale or whales that would be transported in them. Usually, whales were transported individually, but in some circumstances it was appropriate to transport two whales in the same container. For example, whales could be placed together in a container if it was observed that they provided a calming influence on each other. The framework box of each container was constructed from galvanized steel covered with pressboard and a vinyl, waterproof liner. Air mattresses were added to line the bottom, front, back, and sides of each container. The whales were not secured in the containers using straps or in a sling, but instead were allowed to move freely. Ambient water from the sea pen was pumped in before the whales were placed in the containers. Approximately 30.5 to 45.7 centimeters (12 to 18 inches) of water was added to each container to allow for enhanced thermoregulation and comfort for the whales. This amount of water is necessary for the safety, health, and comfort of each whale.

From Chakalova Island, the whales were transported by a Mil Mi-8 helicopter (Figure 1) to the Nikolaya-na-Amur Airport located approximately 45 kilometers (28 miles) to the southwest. The approximate travel time from Chkalova Island to the nearby airport was 10 minutes. The cargo capacity of this helicopter allows for one whale transport container per trip.

Figure 1. Mil Mi-8 Helicopter

Upon arriving at the Nikolaya-na-Amur Airport, the whales were immediately removed from the transport containers aboard the helicopter and placed into pre-loaded transport containers that were onboard an Antonov An26 plane (Figure 2) for transport approximately 7,000 kilometers (4,350 miles) west to the Utrish Marine Mammal Research Station in the Black Sea. To remove the whales from the helicopter, slings were placed into the containers under the whales; they were lifted from the containers and removed from the helicopter by hand. Then each whale was moved to the rear of the An26 and their sling was secured to an I-beam overhead track system within the cabin of the aircraft. Using the I-beam, the whales were hoisted, moved forward in the aircraft, and lowered into transport containers already onboard the aircraft. The transport containers onboard the An26 were nearly identical to those used in the Mi-8 in materials, design, and dimensions. This aircraft has capacity for three whale transport containers per trip; the cargo weight capacity allows for approximately 76.2 centimeters (30 inches) of water to be added to each whale transport container.

To minimize the risk of the whales regurgitating and aspirating food items and to prevent waste materials in the transport containers, the belugas were not fed during transport or 12 hours in advance of transport. The aircraft flew at a maximum altitude of 2,438 meters (8,000 feet) to avoid exposure to air pressures to which the animals might not be accustomed. Takeoff and descent approaches were made gradually to keep the orientation of the whale containers as close to level as possible. The animals were attended to continuously during transport. Air and water temperatures were controlled to ensure that the animals were kept cool. Their position within the transport containers was monitored and adjustments were made as needed to keep them wet, safe, and comfortable. Veterinarians and support staff from the Utrish Marine Mammal Research Station

(UMMRS) accompanied the journey to attend to the health, comfort, and safety of the whales throughout the transport process.

From Nikolaya-na-Amur Airport, the beluga whales were flown to the Anapa Airport, near the Russian coast of the Black Sea approximately 6,900 kilometers (4,287 miles) to the west. This distance exceeds the maximum range of the An26; therefore, refueling stops were required. The approximate travel time between Nikolaya-na-Amur Airport and Anapa Airport was 16 to 18 hours (not including refueling stops). Upon arrival at the Anapa Airport, the whales were removed from the An26 in soft slings hoisted and moved along the I-beam toward the rear of the aircraft. From there, the whales were loaded into transport containers that were secured to several stake-bed trucks. These containers were identical to those on the An26. Each truck was equipped with a crane that was used to lift the whales into the containers. Once the trucks were loaded and ready, they traveled to UMMRS, approximately 35 kilometers (21.7 miles) to the southeast. The journey took between 90 and 120 minutes and was conducted in the early morning or late evening when air temperatures were cooler.

Figure 2. Antonov An26 Airplane

Upon arriving at the Utrish Marine Mammal Research Station, the belugas were transferred to one or more pens or tanks (Figure 3 through Figure 8). The largest is a saltwater sea pen measuring approximately 37 meters wide by 48 meters long by 12 to 18 meters deep (121.4 feet wide by 157.5 feet long by 39.4 to 59.0 feet deep) located in a natural lake connected to the Black Sea (Figure 5). There were three smaller sea pens on site (Figure 6 through Figure 8) as well as a fully enclosed tank (Figure 3 and Figure 4). The beluga whales were collected during the field seasons of 2006, 2010, and 2011 and will be held at UMMRS until the permit is granted to import them into the U.S. At that point, they will be imported into the U.S. as expeditiously and as safely as possible.

During their stay at UMMRS, the whales are monitored and evaluated to ensure that they remain in good health. Belugas at UMMRS are fed squid, capelin, and fish from Newfoundland that were flash-frozen and shipped to Russia. The food items used at UMMRS were personally inspected by the Georgia Aquarium Vice President of Animal Operations and were determined to meet USDA standards for animal care. Furthermore, this diet is identical to that consumed by captive beluga whales presently living at the Georgia Aquarium. At the Utrish Marine Mammal Research Station, animal trainers continue to provide care and attention to the whales to further accustom them to human contact and prepare them for life in an aquarium.

UMMRS is part of the Severtsov Institute of Ecology and Evolution, created by the Russian Academy of Science approximately 27 years ago. Its staff of approximately 200 includes trainers, veterinarians, water engineers, scientists, and other support personnel. Although not subject to U.S. laws and regulations, the facilities meet or exceed requirements that U.S.-based aquaria are subject to under U.S. laws and regulations.

Figure 3. Utrish Marine Mammal Research Station Tank

Figure 4. Beluga Whales Swimming in Utrish Marine Mammal Research Station Tank

Figure 5. Utrish Marine Mammal Research Station Sea Pen Facilities

Figure 6. Beluga Whales being fed in Utrish Marine Mammal Research Station Sea Pen

Figure 7. Beluga Whale Swimming in Utrish Marine Mammal Research Station Sea Pen

Figure 8. Utrish Marine Mammal Research Station Sea Pens

Transport from the Utrish Marine Mammal Research Station to U.S. Aquaria Facilities

The whales that will be imported under the applicant's permit will be transported to the U.S. facilities in the U.S. directly from UMMRS in Russia. The whales will be moved via transport containers in stake-bed trucks and chartered cargo jet aircraft, accompanied by qualified attendants using equipment and methods in accordance with professionally accepted standards and techniques and in compliance with all applicable regulations, standards, and conditions set forth under the AWA, MMPA, CITES, USFWS regulations, USDA regulations, and IATA LAR. The transport will employ all contemporary and accepted methods outlined in the CRC Handbook of Marine Mammal Medicine, Second Edition (Direauf and Gulland 2001). GAI will take custody of the animals in Belgium. While GAI will have staff observing the transport from UMMRS to Anapa, and subsequently to Belgium, the animals will still be owned by UMMRS until leaving Russian air space.

Prior to their departure from UMMRS, each whale will be examined by a certified veterinarian who will verify that all animals are healthy enough to undergo transport. Assessments will occur in the same manner as are performed in the U.S., within 10 days of transport. Each whale will be examined for any disease or illness that could cause them to be in a compromised state of health. Females will be checked to ensure they are not pregnant or lactating. To ensure that breeding does not occur, males and females are being housed separately, except in the case of any immature animals, where breeding is not a risk.

The journey from UMMRS to aquaria facilities in the U.S. will begin with overland travel to the Anapa Airport, approximately 35 kilometers (21.7 miles) to the north. The journey is expected to take 90 to 120 minutes and will be conducted in the early morning or late evening when air temperatures are cooler. The whales will be removed from their tanks at the research station in soft nylon net slings using the cranes equipped on the stake-bed trucks. The containers that will be used to transport the animals from Russia to Belgium will be constructed individually so that they are of adequate length, width and depth to hold the animals**.** The design and materials of these containers will be similar to those that were used to transport the belugas from Anapa Airport to UMMRS.

Prior to the whales being placed in the containers, the containers will be loaded and secured on stake-bed trucks and filled with saltwater to a level of approximately 80 centimeters (31.5 inches). A team of UMMRS veterinarians and support staff members will accompany the overland transport to attend to the comfort and safety of the whales. The journey to Anapa Airport is expected to take 90 to 120 minutes and will be conducted in the early morning or late evening when air temperatures are cooler.

At Anapa Airport, three Ilyushin IL-76 cargo aircraft will be waiting to fly the whales to Liege Airport in Belgium, approximately 2,450 kilometers (1,500 miles) to the northwest. Travel time to Liege Airport will be approximately 2.7 hours. During the flight, the whales will receive continuous monitoring and care by the UMMRS veterinary and husbandry staff. There will be four attendants per flight—the maximum number that can be accommodated on the plane given its configuration. The attendants will include experienced animal care and veterinary staff. Veterinarians will accompany all flights in all aircraft. Takeoff and descent approaches will be made gradually to keep the orientation of the whale containers as close to level as possible.

Once at Liege Airport, the whales will be offloaded from the IL-76s, placed in GAI-owned ballistic nylon slings and into waiting transport containers secured to cookie sheets[1] on K-loaders. These containers will be specially designed and constructed transport units that meet or exceed IATA LAR standards for transporting cetaceans. Each transport unit will be designed to contain one whale and will be 5.3 meters long, by 2.5 meters wide, by 2.3 meters deep (17.5 feet long, 8 feet wide, and 7.5 feet deep) (Figure 9 and Figure 10). The transfer will be accomplished using heavy equipment with lifting capabilities. Once each whale is secure in its container, the K-loaders will load the containers into two waiting chartered Boeing 747 cargo jets for the flights to Atlanta Hartsfield International Airport and JFK International Airport. This transfer will be done expeditiously.

Extra water and ice will be used to keep the whales cool and moist during loading. Prior to the departure, each whale will be examined by GAI's certified veterinarians, Dr. Bossart and Dr. Claus, to ensure they are healthy enough to undergo transport. Females will also be rechecked to ensure they are not pregnant or lactating. Regarding health status, any animal that does not pass its examination will have a delayed transport using the same methods as used for the other animals, except that a smaller aircraft will be used. Regarding pregnancy or lactation, reproduction has been made impossible by the housing management/arrangements of the different sexes.

The transfer of animals from Il-76 aircraft to Boeing 747 aircraft in Belgium is necessary because these 747s are not allowed to land in Russia. Similarly, the Il-76 aircraft cannot enter the U.S. because Il-76 planes do not meet U.S. air emission and noise standards. Moreover, there are only two 747 aircraft in the world that are known to be configured in a way that will allow the transport containers and 12 attendants per plane. Other 747 configurations would result in fewer attendants per plane and per animal.

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[1] "Cookie sheets" are flat metal platforms, on which containers are assembled and secured by nets and straps.

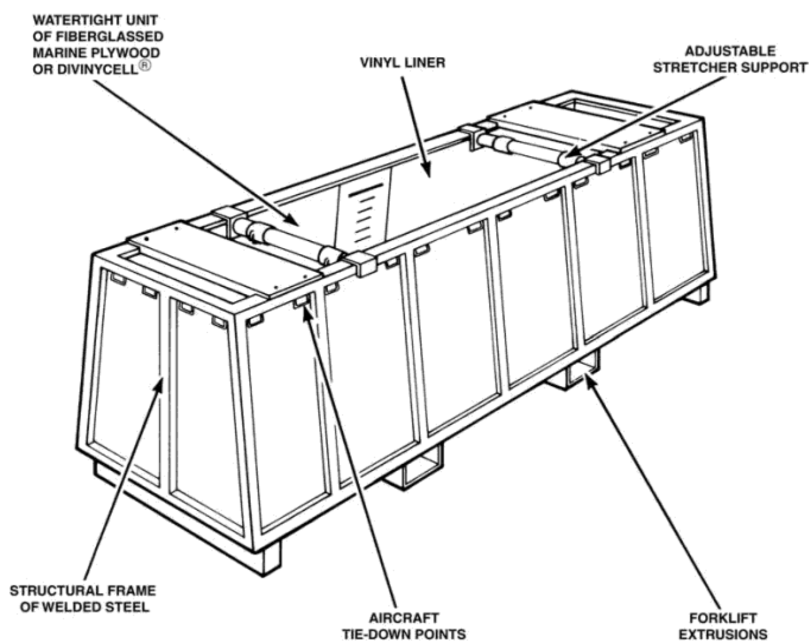
Once aboard the Boeing 747 aircraft, the cookie sheets upon which the containers are placed will be securely locked into the floor to prevent any shifting from occurring while in flight. To minimize total travel time, the transport containers will be loaded almost immediately after the whales arrive at Liege Airport, and the aircraft will depart as soon as possible after containers are aboard. Twelve attendants per flight will provide continuous monitoring during importation into the U.S. During the importation, there will be at least one veterinarian attending for every three to four beluga whales.

Although the final composition of all veterinarians and caregivers is not presently known, there are a number of personnel who are expected to attend. Key personnel from the Georgia Aquarium that will attend and oversee the transport of the beluga whales include the following:

- Billy Hurley, Senior Vice President and Chief Zoological Officer;
- Dr. Greg Bossart VMD, PhD, Chief Veterinary Officer and Senior Vice President, Veterinary Services;
- Dr. Tonya Clauss, Chief Veterinarian;
- Dennis Chisten, Director of Animal Training;
- Eric Gaglione, Director of Zoological Operations for Mammals and Birds; and
- Cara Lisa Field DMV, Staff Veterinarian.

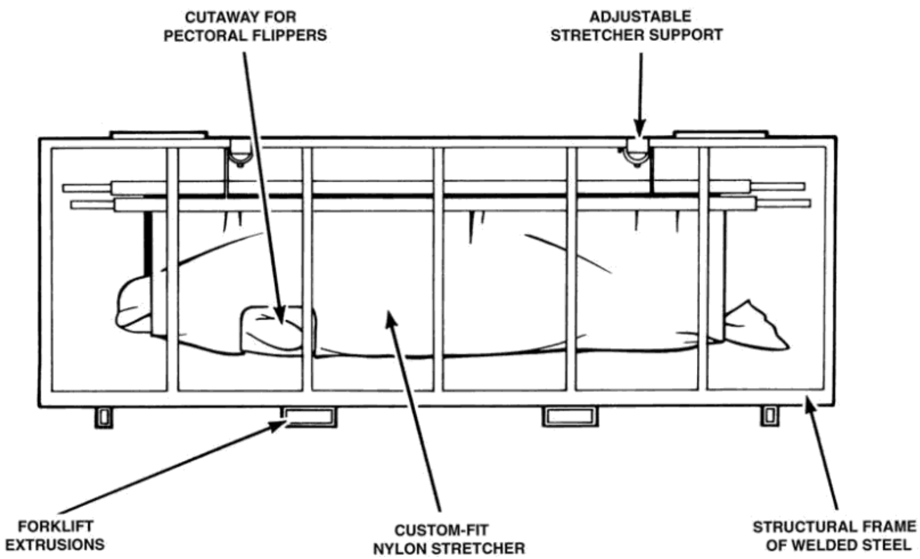
Biographies for these key Georgia Aquarium staff are included in the permit application that this appendix accompanies.

Figure 9. Beluga Transport Container



Source: SeaWorld Parks & Entertainment in Dierauf and Gulland 2001.

Figure 10. Beluga Transport Container, Side Cutaway View



Source: SeaWorld Parks & Entertainment in Dierauf and Gulland 2001.

The chartered aircraft used to transport the belugas into the U.S. will be pressurized to avoid exposure to air pressures to which the animals may not be accustomed. Takeoff and descent approaches will be made gradually to keep the orientation of the whale containers as close to level as possible, and the animals will be attended to continuously during transport. Air and water temperature will be controlled to ensure they are kept cool. Their position within the transport containers will be monitored and adjustments will be made as needed to keep them wet, safe, and comfortable. The whales will begin fasting from solid food 12 hours pre-transport. Conditioning of the animals to eat ice has been addressed (in order to provide hydration), as GAI staff has done when moving other cetaceans. Staff may provide fluids via gastric tubing or small amounts of fish/invertebrates should the need arise. This is the methodology employed on all long-distance transports and it complies with the applicable U.S. and international standards.

From Liege Airport, one charter aircraft will fly directly to Atlanta Hartsfield International Airport; the other will fly directly to JFK International Airport in New York. The trip to New York is expected to take approximately 6.5 hours and the trip to Atlanta is anticipated to take 7.8 hours.

The beluga whales to be imported under this permit will be transported to Georgia Aquarium and, under breeding loans, to Shedd Aquarium, Mystic Aquarium, Sea World Orlando, Sea World San Antonio, and Sea World San Diego. In all cases, from pool to pool and including loading/unloading times and ground transportation, the total transport time is anticipated to be 26 to 30 hours. Furthermore, all transport activities conducted after importation into Atlanta and New York, regardless of final destination, will be conducted in full compliance with the guidelines of the IATA LAR, the *CRC Handbook for Marine Mammal Medicine* (Dierauf and Gulland 2001), and the *CITES Guidelines for Transport and Preparation for Shipment of Live Wild Animals*. Applicable regulations, standards, and conditions set forth under the AWA, MMPA, and USFWS regulations, and USDA regulations would also be followed during the transport activities.

For animals transferred to the Georgia Aquarium, upon arrival at Atlanta Hartsfield International Airport, the transport containers containing the animals will be transferred to covered and refrigerated tractor-trailers and taken to the aquarium facilities (approximately 19 kilometers [12 miles] north of the airport in downtown Atlanta) with a police escort. At the Georgia Aquarium, the tractor-trailers will arrive at the specially designed loading docks. The belugas' stretchers will be connected to hoists that will transfer the whales directly from their containers and place them into a pool at the aquarium. Once lowered into the pool, the whales will be able to swim freely out of the stretcher and into the pool.

Beluga whales transported to Sea World Orlando, Sea World San Antonio, and Sea World San Diego pursuant to breeding loans will be flown to major airports close to these facilities. Flights will be planned to transport the belugas to major airports with equipment and infrastructure capable of supporting safe and humane loading and offloading located as close to the other aquaria facilities as possible. It is anticipated that these airports will include Orlando International Airport (Sea World Orlando), San Antonio International Airport, (Sea World San Antonio), and San Diego International Airport (Sea World San Diego). Offloading at these airports and ground transport to the other aquaria facilities will be conducted using similar methods and equipment as those used for whales transferred to the Georgia Aquarium described above.

Of the whales imported through New York, some would be loaded into ground transport vehicles (likely covered and refrigerated trucks) and driven to Mystic Aquarium approximately 210 kilometers (130 miles) to the northeast. The whales will be placed at Mystic Aquarium pursuant to a breeding loan. Beluga whales being transported to Shedd Aquarium under a breeding loan will be flown to Chicago, Illinois, and transported by ground to Shedd Aquarium. It is anticipated that the transport flight will land at either Chicago O'Hare International Airport or Chicago Midway International Airport. Offloading at either airport and ground transport to the Shedd Aquarium facilities will be conducted using similar methods and equipment as those used for whales transferred to the Georgia Aquarium described above.

Regardless of the destination for the beluga whales, all whales will receive immediate and continuous evaluation and monitoring of medical conditions and behavior immediately upon their arrival at the new facilities to ensure they adjust to their new surroundings. This may analysis of blood, gastric, exhale, and fecal samples; frequent weighing and measuring; ultrasounds to assess lung, plural, heart, kidney, and liver condition; oral/dental examinations; and a number of other preventative care procedures. Upon arrival at U.S. facilities, all current U.S. holders of beluga whales have quarantine capabilities, and follow all applicable guidelines found in the APHIS regulations as well as those set forth by the Alliance of Marine Mammal Parks and Aquariums. Any decision to quarantine the animals upon their arrival at facilities in the U.S. will be made by veterinary staff based on the best interests of the animal.

Permits and Certifications

Reproductions of the following permits, certifications, and documentation are included as attachments to this appendix in support of the Application for a Public Display Permit under the MMPA.

Transport from the Russian Federation to the United States

- Original CITES Export Permits.
- Original letter from Russian authorities attesting to the humaneness and legality of the capture and the legal compliance of temporary holding.
- Original letter from attending veterinarian responsible for the animals during import certifying that the methods of import and post-import care will be adequate to ensure the well-being of the animals.

Chapter 5

References

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Attachment A. Transport from the Russian Federation to the United States

Original CITES Export Permits

ОРИГИНАЛ / ORIGINAL

КОНВЕНЦИЯ О МЕЖДУНАРОДНОЙ ТОРГОВЛЕ ВИДАМИ ДИКОЙ ФАУНЫ И ФЛОРЫ, НАХОДЯЩИМИСЯ ПОД УГРОЗОЙ ИСЧЕЗНОВЕНИЯ (СИТЕС) **CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA**	[X] ЭКСПОРТ EXPORT [ ] ИМПОРТ IMPORT [ ] РЕ-ЭКСПОРТ RE-EXPORT [ ] ПРОЧЕЕ OTHER	**РАЗРЕШЕНИЕ (PERMIT)** **№ 12RU000212** **ЗАЩИТНАЯ МАРКА (SECURITY STAMP)** **№** **ДЕЙСТВИТЕЛЬНО ДО: (VALID UNTIL):** **19.10.2012**	**ФЕДЕРАЛЬНАЯ СЛУЖБА ПО НАДЗОРУ В СФЕРЕ ПРИРОДОПОЛЬЗОВАНИЯ** **FEDERAL SERVICE FOR SUPERVISION OF NATURAL RESOURCES MANAGEMENT OF RUSSIAN FEDERATION** ул. Б. Грузинская, 4/6 РОССИЯ, 123995, ГСП-5, Москва, Д-242 4/6 ul.B.Gruzinskaja, Moscow, D-242, GSP-5,123995 RUSSIA

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A **БЕЛУХА** **DELPHINAPTERUS LEUCAS**	**ЖИВОЙ / LIVE** **САМЕЦ/ MALE** **MICROCHIP №** **643094100037079**	**II**	**T**	**W**	**1**
		Страна происхождения / Country of origin: **РОССИЯ / RUSSIA**			Страна предыдущего реэкспорта / Country of last re-export: **XXX**
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B **БЕЛУХА** **DELPHINAPTERUS LEUCAS**	**ЖИВЫЕ / LIVE** **САМКИ / FEMALES** **MICROCHIPS №№** **643094100037058** **643094100037017** **643094100046739** **643094100046741**	**II**	**T**	**W**	**4**
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CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

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353460, KRASNODAR REGION, GELENDZHIK
LUNACHARSKIY STR., 130

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A **БЕЛУХА DELPHINAPTERUS LEUCAS**	**ЖИВЫЕ / LIVE САМКИ / FEMALES MICROCHIPS №№ 972270000046481 972270000046269**	**II**	**T**	**W**	**2**
		Страна происхождения / Country of origin: **РОССИЯ / RUSSIA**			Страна предыдущего реэкспорта / Country of last re-export: **XXX**
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B **XXXXXXXX XXXXXXXXXXXX**	**XXXXXXX XXXXXXXXXX**	**XXX**	**XXX**	**XXX**	**XXX**
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№ 10RU000683 23.12.2010
№ 10RU000685 23.12.2010
№ 11RU000036 09.02.2011
№ 11RU000037 09.02.2011
№ 11RU000411 22.06.2011

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A **БЕЛУХА** **DELPHINAPTERUS LEUCAS**	**ЖИВЫЕ / LIVE** **САМЦЫ/ MALES** **MICROCHIPS №№** **643094100037095** **643094100037077** **643094100037079**	**II**	**T**	**W**	**3**
		Страна происхождения / Country of origin: **РОССИЯ / RUSSIA** № разрешения и дата / Permit № and date			Страна предыдущего реэкспорта / Country of last re-export: **XXX** № разрешения и дата / Permit № and date
B **БЕЛУХА** **DELPHINAPTERUS LEUCAS**	**ЖИВЫЕ / LIVE** **САМКИ / FEMALES** **MICROCHIPS №№** **643094100037086** **643094100037142** **643094100037069**	**II**	**T**	**W**	**3**
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A **БЕЛУХА** **DELPHINAPTERUS LEUCAS**	**ЖИВЫЕ / LIVE** **САМЦЫ/ MALES** **MICROCHIPS №№** **643094100037126** **643094100037081** **643094100037068** **643094100037080**	**II**	**T**	**W**	**4**
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B **БЕЛУХА** **DELPHINAPTERUS LEUCAS**	**ЖИВАЯ / LIVE** **САМКА / FEMALE** **MICROCHIPS №№** **643094100037121**	**II**	**T**	**W**	**1**
		Страна происхождения Country of origin: **РОССИЯ / RUSSIA** № разрешения и дата Permit № and date			Страна предыдущего реэкспорта Country of last re-export: **XXX** № разрешения и дата Permit № and date

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Attachment B. Transport from the Russian Federation to the United States

Original Letter from Russian Authorities Attesting to Humaneness and Legality of the Capture and the Legal Compliance of Temporary Holding

February 14, 2012

William C. Hurley
Sr. Vice President and Chief Zoological Officer
Georgia Aquarium, Inc.
225 Baker Street, N.W.
Atlanta, GA 30313

Dear Billy:

This is to confirm that Utrish Dolphinarium Ltd. has collected eighteen beluga whales, eight males and ten females, which will be transferred to the Georgia Aquarium if all the required approvals are provided by the Governments of the Russian Federation and of the United States. Two whales were collected in 2006, eleven were collected in 2010, and five were collected in 2011. All of the whales were collected in Sakhalin Bay in the Sea of Okhotsk.

The whales were each collected in accordance, and in full compliance, with, permits lawfully issued by the Government of the Russian Federation. Each of the beluga whales was collected, placed into and maintained at temporary holding facilities, and then transported to Utrish Marine Station in the same manner.

The collection was done in the same manner as used by scientists and regulatory agencies when collecting beluga whales for tagging and other scientific research. All collections occurred in shallow water, shoulder deep or less, when the whales voluntarily entered such waters. Our shallow water collection techniques enabled us to determine before any acquisition efforts were undertaken if any pregnant or lactating females, or any juveniles less than approximately one year old, were included in the group. If any such animal was present, no collection was attempted for any member of that group.

The members conducting the collection were all experienced individuals. Among the persons involved with the collection process were scientists, veterinarians, and animal care specialists. These persons were involved to provide additional precautions to ensure the humane and safe treatment of the whales and to provide for their health and nutritional needs following initial collection.

Following a short adjustment period after collection, the whales were transported to the Utrish Marine Station. During the adjustment period, the whales were observed and monitored by scientific, veterinary and animal care staff to ensure their proper care. The transport of the whales from the Sea of Okhotsk to the Utrish Marine Station was done in full accord with all of the applicable professional standards. Throughout the transport process, the whales were observed and monitored by scientific, veterinary, and animal care staff to ensure their health and well being.

Upon the arrival of the whales at the Utrish Marine Station, they were placed into pools and pens at the Station. The physical facilities at the Station meet or exceed the standards applicable to such facilities in the United States. In addition, each whale has been, and is being, observed and monitored by the professional staff at the Utrish Marine Station, including our veterinary and animal care staff, to ensure the health and well being of each whale.

The collection, transport, and maintenance of these eighteen beluga whales was, and is, in compliance with all the laws and regulations of the Russian Federation, as well as with accepted and agreed international norms.

We appreciate the opportunity to work with you on this project.

UTRISH DOLPHINARIUM LTD.

By: ______________________

L.M. Mukhametov, Director

Attachment C. Transport from the Russian Federation to the United States

Original Letter from Attending Veterinarian Responsible for the Animals during Import Certifying that the Methods of Import and Post-Import Care Will Be Adequate to Ensure the Well-Being of the Animals

GEORGIA AQUARIUM

April 27, 2012

Veterinary Certification

As the Chief Veterinary Officer for the Georgia Aquarium, I hereby certify that the beluga whales (*Delphinapterus leucas*), intended for importation from Russia, will be cared for in a manner that will safeguard the health and welfare of the whales.

The methods utilized during transport, as well as post-import, will meet or exceed standards created by USDA/APHIS, AMMPA, AZA, IATA Live Animal Regulations, CRC Handbook, and CITES Guidelines for transport, or other applicable agencies/organizations. These standards were written to ensure the well-being of the animals.

Should the importation permit be approved by NOAA/NMFS, the standard health examinations pre-transport will occur, and will include health certificates for each of the animals.

Greg Bossart, VMD, PhD

Appendix E

Alternatives Evaluation

Contents

Tables

Acronyms and Abbreviations

AI	artificial insemination
AMMPA	Alliance of Marine Mammal Parks and Aquariums
AZA	Association of Zoos and Aquariums
ECV	error coefficient of variation
ESA	Endangered Species Act
IUCN	International Union for the Conservation of Nature
IWC	International Whaling Commission
MMPA	Marine Mammal Protection Act
NAMMCO	North Atlantic Marine Mammal Commission
NMFS	National Marine Fisheries Service
PBR	Potential Biological Removal
SSP	Species of Survival
UMMRS	Utrish Marine Mammal Research Station

Chapter 1
Introduction, Purpose of and Need for the Proposed Permit Activity

Appendix E, Alternatives Evaluation, accompanies and supplements the Application for a Public Display Permit under the Marine Mammal Protection Act (MMPA). This Appendix includes descriptions of alternatives to the importation of 18 wild beluga whales (*Delphinapterus leucas*) from Sakhalin Bay in the Sea of Okhotsk, evaluates the feasibility of each, and examines the ability of each to meet the purpose of and need for the proposed permit activity. Included in this analysis is a no-action alternative.

As described in the Application for a Public Display Permit under the MMPA, the purpose of the permit activity—to import for public display 18 wild beluga whales collected in Sakhalin Bay in the Sea of Okhotsk—is to promote conservation and education and to enhance the North American beluga breeding cooperative by increasing the population base of captive beluga whales to a self-sustaining level. The ability of the proposed permit activity to achieve this purpose is described in Chapter 2 of this Appendix.

As of February 1, 2012, 35 beluga whales are living in captivity in aquaria in the United States and Canada that are part of the Association of Zoos and Aquariums (AZA) and Alliance of Marine Mammal Parks and Aquariums (AMMPA). The North American beluga breeding cooperative comprises these whales. To determine the need to import animals to stabilize the population, Willis (2012) modeled the change in the beluga whale population in AZA and AMMPA facilities based on the population's age and sex structure, and projected its future status using historical population survival and fecundity rates. Willis' model used the base population as of March 2011, which was 37 whales, and ran 1,000 iterations of the individual-based simulation. The model projects that if the population continues to be managed as it has been for the past 5 years, there is 56% probability that the population will be smaller in 30 years. The likelihood of a decline in the North American captive beluga whale population demonstrates the need for this population to be supplemented in order to enhance the sustainability of the North American beluga breeding cooperative. A sustainable captive population provides research opportunities to benefit wild populations and will ensure that the general public continues to have opportunities to encounter and learn from beluga whales, thereby promoting education and conservation.

In addition to the need to enhance the base population of the captive beluga whales, there is also a need to enhance the genetic diversity of the captive population. In February 2010 (the publication date of the most recent Beluga Whale Species Survival Plan [SSP]), when there were 37 individuals in the captive beluga population comprising the North American Beluga Breeding Cooperative (including 21 founders), the measured gene diversity was 94.87% (Rupp et al. 2010). It was projected that without the addition of new individuals into the population and with a growth rate of approximately 3%, the gene diversity would fall below 90% by 2044 and would decline to 83% by 2110. As noted by the Population Center of the AZA, when the gene diversity falls below 90% in a founding population, it is expected that reproduction and survivability are increasingly compromised (Rupp et al. 2010).

Because beluga whales presently held in North American facilities typically thrive, there is not a need, per se, for improvements to the social groups of captive beluga whales. However, the proposed import would likely enhance the social structure of the animals by virtue of increasing the group size. Although this is not a primary purpose of the proposed permit activity and there is not a need for this enhancement, it would nonetheless be an anticipated benefit of the proposed importation.

Chapter 2

Proposed Permit Activity—Import 18 Russian Beluga Whales Collected from Sakhalin Bay (Alternative 1)

The purpose of the permit activity is to import 18 beluga whales for public display to promote conservation and education and to enhance the North American beluga breeding cooperative by increasing the population base of captive belugas to a self-sustaining level. The whales were collected over three years: two whales were collected from Sakhalin Bay of the Sea of Okhotsk in 2006, eleven were collected in 2010, and five were collected in 2011. All 18 were collected by a local team working for Utrish Dolphinarium Ltd. in accordance with all applicable laws and regulations of the Russian Federation. The whales are presently being held in facilities at Utrish Marine Mammal Research Station (UMMRS) on the coast of the Russian Black Sea. The beluga whales to be imported were collected from the Sakhalin-Amur region in the Sea of Okhotsk.

Beluga whales found in the Sakhalin-Amur region have been the subject of a multi-year study led by Dr. Olga Shpak designed to determine the sustainability of this population to annual live-capture. During the summers of 2009 and 2010, Shpak et al. (2011) conducted aerial surveys in Sakhalin and Shantar bays to calculate population estimates for these regions. Shpak et al. (2011) took the average of three aerial surveys and calculated an estimated 20th percentile population minimum of 2,927 animals for the Sakhalin-Amur population, which resulted in a potential biological removal[6] (PBR) of 29 animals for the putative Sakhalin-Amur stock. An International Union for the Conservation of Nature (IUCN) scientific panel (Reeves et al. 2011) reviewed Shpak et al.'s data and, although they calculated a slightly lower population minimum of 2,891 animals, their estimated PBR was also 29 animals. Subsequent to the publication of the IUCN report, the error coefficient of variation (ECV) was reduced following the recommendations of the IUCN scientific panel by pooling survey data across area and years. This refined the minimum population estimate parameters, which resulted in increasing the minimum population estimate to 2,972 and the PBR to 30 (see Appendix A accompanying this permit application for additional details regarding the calculation of PBR).

There has been scientific debate over the delineation of stocks within the Sea of Okhotsk. As described in Appendix A accompanying this permit application, many authors have asserted that a single stock inhabits the entire Sea of Okhotsk, while others have argued the geographical separation of summer beluga aggregations indicates there are three separate stocks. Because the PBR is a calculation specific to individual stocks, if the Sakhalin-Amur aggregation is determined to be a discrete stock, the potential effects of collection would be analyzed in the context of its population, not including the population of any of the nearby bays. As described above, this aggregation was estimated to have a population of 2,972 and a corresponding PBR of 30.

However, overall genetic and satellite tagging study results suggest that considerable gene flow occurs between the Sakhalin and Shantar aggregations (see Appendix A that accompanies this permit application). This suggests that all five aggregations are genetically homogenous and constitute a single stock of beluga whales. A direct count of the bays in the Shantar region

[6] PBR is defined as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

conducted on August 7 and 8, 2010, recorded 3,206 beluga whales by direct count. This direct count approach, (not accounting for animals missed), results in a Shantar-only PBR of 32. The 32 added to the Sakhalin-Amur PBR of 30 results in a combined PBR of 62. However, pooling the Sakhalin-Amur data with data collected from all of the Shantar bays, and using a correction factor for animals missed during the Shantar direct count (either because they were not seen or could not be seen because they were well below the surface), results in a higher population estimate and a PBR of 86.

Regardless of whether the annual PBR for the beluga whales in the Sakhalin-Amur region is 30, 62, or 86, as discussed in Appendix A, the importation of 18 whales collected over three years from this area is well below the level of removal necessary to prohibit the stock from maintaining its optimum sustainable population.

Additional information regarding the Sea of Okhotsk beluga whale populations, is included in Appendix A that accompanies this application. Appendix C that accompanies the permit application provides details regarding the collection methods used. Appendix D describes transport methods from the collection site and the intermediate holding facilities.

The importation of 18 beluga whales originally collected in Sakhalin Bay in the Sea of Okhotsk would meet the purpose of the proposed permit activity by enhancing the North American beluga breeding cooperative. Modeling scenarios by Willis (2012) that account for the addition of the specific 18 animals proposed for import to the 2011 base population of 37, indicate that the addition of imported animals will provide the total captive population with a greater than 70% chance of stability in 30 years[7] (Willis 2012). The 18 beluga whales proposed for importation will be distributed among six different aquaria facilities including the Georgia Aquarium, Shedd Aquarium, Mystic Aquarium, Sea World Orlando, Sea World San Antonio, and Sea World San Diego. The whales would be allocated among the facilities in accordance with population management strategies that best benefit the North American captive beluga population as a whole and maximize population growth. Therefore, the importation of 18 whales will increase the population base of the North American beluga population to a level that will reduce the likely population decline and increase the likelihood of population maintenance and growth. In that regard, it should be noted that 18—over half—of the beluga whales currently in the North American breeding cooperative were born at public display facilities. Captive breeding is a successful technique that can be used to maintain a self-sustaining captive population given the genetic diversity and population structure that will be provided by this importation. Furthermore, the addition of these whales will enhance the genetic diversity of future offspring (Willis 2012)[8] and the increase in group sizes at the facilities where the beluga would be held will enhance the social structure of the belugas living therein.

This alternative will also serve to improve conservation and education opportunities by providing an immediate increase in the base population size and long-term sustainability of the population. This will result in an increase in the number of people exposed to beluga whale conservation and education opportunities in the short term and for the foreseeable future. Approximately two million people visit the Georgia Aquarium each year, where they may experience seven different

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[7] The base population of 37 was used in the model because it reflected the current population of beluga whales in AZA facilities when the model was first developed in March 2011.

[8] Since Willis' models were run, the population of the North American captive beluga population has declined from 37 to 35 animals. Although the current population is now less than the number Willis used in his models, his overall conclusions are not affected. Because the baseline population in actually smaller than the modeled baseline, Willis' projections of growth in the base population without supplementation by the proposed import may be slight overestimates.

educational programs that specifically address belugas. These programs include Aqua Tales, Sea Life Safari, Bite Size Basics, Weird and Wild, Undersea Investigators, Aquarium 101, and Matchmaking with Marine Animals. Appendix H that accompanies this permit application includes additional information regarding beluga programs at the Georgia Aquarium.

Approximately 45 million people visit all AMMPA facilities each year. Through programs at the Georgia Aquarium and all other AMMPA facilities, visitors interact and experience marine mammals and belugas in a way that teaches them about the ocean environment and motivates them toward conservation actions. The viewing of live animals such as beluga whales is considered an emotionally-enriching experience that fosters a sense of concern and spurs people to take conservation actions that can support marine animals and their environments. Without the knowledge gained from animals in public display facilities, the ability to conserve and manage wild populations would be diminished. Therefore, the importation of 18 beluga whales via the proposed permit activity will further these results and promote educational opportunities and the conservation of beluga whales, as well as other marine animals.

Equally important, increasing the current North American population size will provide additional opportunities to learn more about the behavior, health, husbandry, and physiology of these animals through means that present little risk and discomfort to the animals. This will provide much-needed information that can be applied to the conservation of stocks in the wild.

Chapter 3
Capture and Import from Other Wild Populations (Alternative 2)

Introduction

As an alternative to the proposed permit activity, collection and import from other wild beluga whale populations was considered. The 28 remaining discrete stocks proposed by the International Whaling Commission (IWC) (2000) were considered. Like the proposed permit activity, this alternative would involve the importation and addition of 18 beluga whales into the United States. This alternative would result in the addition of a sufficient number of beluga whales to achieve sustainability of the captive population and to increase opportunities for education and conservation, thereby satisfying the purpose of the proposed permit activity. However, collection from any other stock would either be impractical, would result in adverse impacts on the natural environment, or both. Each of the remaining 28 stocks is summarized below. Additional details on each stock can be found in Appendix A and Appendix B that accompany the permit application.

North Temperate Zone Stocks

Cook Inlet

The Cook Inlet stock is generally largely confined to the upper Cook Inlet, from the Gulf of Alaska into Knik Arm and Turnagain Arm in south-central Alaska (Laidre et al. 2000; Speckman and Piatt 2000; Rugh et al. 2000). After enduring over-harvesting in the mid to late 1990s, the stock's most recent population estimate is 326 animals. The National Marine Fisheries Service (NMFS) listed the population as "depleted" under the MMPA in 2000 (65 Fed. Reg. 34590, May 31, 2000) as a consequence of a major stock decline in the 1990s, and as "endangered" in 2008 when the population failed to recover following a moratorium on subsistence harvest (73 Fed. Reg. 62919, October 22, 2008). Following the issuance of the endangered determination, the State of Alaska sued NMFS seeking to have the Service's listing determination vacated. In a November 21, 2011 ruling, the U.S. District Court for the District of Columbia denied the plaintiff's motions and upheld the Service's determination. The Cook Inlet stock's designation under the Endangered Species Act (ESA) prohibits individual takings, and as such, eliminates this stock from being considered a viable alternative to the proposed importation.

Saint Lawrence River

The Saint Lawrence River stock is the southernmost stock for the species, highly isolated from all other stocks, very restricted in its range, and among the smallest stocks. Although the summer distribution of the stock is within the Saint Lawrence River estuary and is well studied in that area, very little is known about the stock's movement and activity outside of the summer season. Systematic aerial surveys conducted at 3- to 5-year intervals since the late 1980s indicate the population is relatively stable at about 1,100 animals. Although this stock appears to be relatively stable, it is considered relatively low in number, especially in comparison to the "pristine" population level estimated at approximately 7,800 by Hammill et al. (2007). A number of anthropogenic factors are believed to be limiting this population's recovery (Mosnier et al. 2009). Capture from the Saint Lawrence stock would, therefore, constitute an additional factor limiting the recovery of the population. Furthermore, since 1992, Canada has banned the capture of belugas for export (Fisheries and Oceans Canada 1999). Therefore, taking and import from this stock are not a viable alternative.

Hudson Bay—Greenland Stocks

North Water and West Greenland

The stocks classified by the IWC (2000) as the North Water and West Greenland stocks have uncertain affinity. They either represent a single stock that overwinters in two separate locations—the High Arctic-North Water polynya north of Baffin Bay and the coast of West Greenland—or two separate stocks that summer in the same region (Heide-Jørgensen et al. 2003). The most recent estimate for the North Water and West Greenland combined stock is approximately 21,000 (Innes et al. 2002a, 2002b). Between 1981 and 1994, the West Greenland population declined more than 60% as a result of unsustainable harvest (Heide-Jørgensen and Reeves 1996). The population continued to decline until 2004 when harvest restrictions were imposed. As a result of reduced harvests, the population increased about 8% between 2004 and 2009, providing a 2009 population estimate of 10,600 (North Atlantic Marine Mammal Commission 2010). Although this population is now increasing, it remains at 31% of carrying capacity (North Atlantic Marine Mammal Commission 2010). The uncertainty over stock delineation, the need for further studies, and the history of human pressure all preclude taking and export from these stocks from being a viable alternative.

Cumberland Sound and Frobisher Bay (Southeast Baffin Island)

The Cumberland Sound stock forms a large summer aggregation at Clearwater Fjord in the inner reaches of the Cumberland Sound of Canada's Baffin Island, and may winter in the vicinity (Committee on the Status of Endangered Wildlife in Canada 2004). This stock suffered from overharvest and the most recent estimate of 1,547 animals (Richard 2002) is significantly lower than the original population estimated at approximately 5,000 animals (Brodie et al. 1981). Although there are too few surveys of this population to establish an accurate trend, the population is considered stable. Due to the Canadian ban on the capture of beluga whales for export (Fisheries and Oceans Canada 1999) and the depleted size of the stock, the importation of beluga whales taking from this stock is not a viable alternative.

The IWC (2000) identified a Frobisher Bay stock based on the fact that belugas have been observed in Baffin Island's Frobisher Bay during the summer months. However, there is no estuary in the bay suitable for molting and calving (International Whaling Commission 2000). Based on recent genetic and satellite tagging studies, Frobisher Bay whales are likely summer strays from other Hudson Bay populations (Richard 2010). Regardless, capture of beluga whales in Frobisher Bay for export is banned by Canada (Fisheries and Oceans Canada 1999). Therefore, importation of animals taken from this stock is not a viable alternative to the proposed permit activity.

Ungava Bay

The Ungava Bay stock, much like the Cumberland Sound stock, is a small localized population that suffered significantly from overharvest. Located off the coast of the Canadian province of Quebec, it now may be extinct and, if not, is the most endangered of all beluga stocks. The present population is tentatively considered to be around 50 (Kingsley 2000), and is possibly extirpated (Committee on the Status of Endangered Wildlife in Canada 2004). An alternative to the proposed permit activity that included capture from this stock would not be preferable because of the extreme risk that would be inherent in any depletion of this stock. Furthermore, capture from this stock for export is banned by Canada (Fisheries and Oceans Canada 1999).

Foxe Basin

The Foxe Basin stock was defined narrowly by the IWC (2000) to include the populations in Foxe Basin, but the Committee on the Status of Endangered Wildlife in Canada (2004) took the broader view that the West Hudson Bay stock extends northward into the area the IWC assigned to the Foxe Basin stock. Belugas observed in the Foxe Basin likely represent migrant individuals from neighboring stocks from West Hudson Bay and East Hudson Bay. Because of the ban on capture for export common to all beluga whale stocks in Canada (Fisheries and Oceans Canada 1999), the import of whales taken in the Foxe Basin is not a viable alternative to the proposed permit activity.

West Hudson Bay and South Hudson Bay

Analysis by Turgeon et al. (2009) identifies West Hudson Bay and East Hudson Bay stocks. The West Hudson Bay stock includes the West and South Hudson Bay stocks provisionally identified by the IWC (2000), and extends north toward the area where the IWC (2000) identified the Foxe Basin stock. The most recent effort to enumerate the stock was performed using aerial surveys flown in West and South Hudson Bay in late July and early August 2004, yielding a population estimate of 57,300 animals with 95% confidence limits of 37,700 to 87,100 animals. The population is considered stable. However, removal from these stocks for export is banned by Canada (Fisheries and Oceans Canada 1999). Therefore, the import of whales that were captured from these stocks cannot be considered a viable alternative to the proposed permit activity.

East Hudson Bay and James Bay

Although the IWC (2000) conservatively chose to demarcate a James Bay stock as distinct from an East Hudson Bay stock, Turgeon at al. (2009) provides a substantially clearer view of stock structure in the Hudson Bay area. It now appears that whales forming summer breeding congregations all along the eastern shores of Hudson Bay, from southern James Bay north and then east almost to Ungava Bay, form a discrete stock that is clearly differentiated from the West Hudson Bay, Ungava, and Cumberland Sound stocks (Brown Gladden et al. 1997). Historical records indicate that the East Hudson Bay stock was once quite abundant, but intensive commercial exploitation beginning in the nineteenth century severely depleted the stock. With continued pressure from indigenous subsistence whalers, stock recovery has been limited (Gosselin 2005). Surveys performed in August 2004 detected 3,993 animals at the surface in James Bay (95% confidence interval of 2,375 to 6,716) and 2,040 in East Hudson Bay (95% confidence interval of 1,047 to 3,977) (Gosselin 2005). No attempt was made to derive a population size estimate or a PBR. However, the Committee on the Status of Endangered Wildlife in Canada (2004) estimated the abundance of the East Hudson Bay stock (not including the James Bay whales) at 1,227 animals, with a declining trend. Under such circumstances, the PBR would be zero. Regardless of the ability of the population in the East Hudson Bay and James Bay to withstand take, capture for export from all Canadian beluga whale stocks has been banned by Canada (Fisheries and Oceans Canada 1999). Therefore, an alternative to the proposed permit activity that includes the import of whales taken from these stocks is not considered viable.

Karskaya Stocks

Svalbard and Franz Josef Land

The IWC (2000) tentatively identified two Svalbard stocks, one associated with Svalbard, Norway, and the other with the Franz Josef Land archipelago in Russia 350 kilometers (217 miles) to the east. The IWC, however, acknowledged there may be no distinction between these stocks, noting that almost nothing was known about the Franz Josef whales. The North Atlantic Marine Mammal Commission (NAMMCO) (2005) regarded these two populations as representing a single Svalbard stock. Based on professional judgment, the IWC (2000) estimated the Svalbard islands stock at a "few hundred to low thousands" and the Franz Josef stock at a "few hundreds." The Svalbard population experienced commercial hunting from the early seventeenth century to the 1960s (Kovacs and Lydersen 2008), and the IWC (2000) regarded the stock as likely depleted relative to historical levels. As for the Franz Josef stock, there have been no surveys, there is no record of whaling, and there have been no published estimates of population status and trend.

Because Franz Josef Land whales are not well studied and their population level may be very low, take and export may jeopardize this stock. Therefore, importing whales taken from this stock is not considered a viable alternative to the proposed permit activity. There is also a high degree of uncertainty associated with the Svalbard stock's population estimate. In lieu of further studies, it is not known what level of take, if any, could occur without initiating a population decline. Therefore, import of whales taken from the Svalbard stock would not be a viable alternative to the proposed permit activity.

White Sea

The IWC (2000) identified three stocks in the White Sea based on summer calving grounds in Onega Bay, Dvina Bay, and Mezen Bay. Aerial surveys across the entire White Sea in March 2008 found approximately 2,183 animals, times a correction factor (not specified) for submerged/not visible animals (Nazarenko et al. 2008; Glazov et al. 2010). Previously robust with an estimated population at 8,000 to 10,000 (Svetochev et al. 2002), the White Sea beluga population began to decline rapidly in the 1930s. By 2001 when harvest had ceased, a coastal survey estimated a White Sea summer population of 1,500 to 2,000 whales. Since survey data are not yet adequate to develop a quantitative estimate of partitioning between migratory and non-migratory populations in the White Sea, the 2001 population estimate should be considered to include migratory populations.

Because of the low population size and inadequacy of survey data of the White Sea stocks, an alternative to the proposed permit activity that includes import of whales collected in the White Sea is not a viable alternative to the proposed permit activity.

Ob, Yenisey, and Khatanga Gulf

The Gulf of Ob, the Yenisey Gulf, and the Khatanga Gulf are long, narrow estuaries below the mouths of the Ob, Yenisey, and Khatanga Rivers, respectively. The Ob and Yenisey discharge to the Kara Sea, and the Khatanga to the southwest Laptev Sea. All of these gulfs are located along the north coast of Russia. These estuaries, along with areas near Barents Sea and some large polynyas[9], are the principal ice-free zones for these beluga stocks in the summer (Boltunov and Belikov 2002). Almost no research has examined the beluga populations inhabiting these areas. The IWC (2000) identified these stocks on the basis of an opinion by Belikov, and Boltunov and Belikov (2002) who claim that the Ob and Yenisey Gulfs are "famous for large aggregations of belugas," largely because they were hunted in these areas for many decades. The Ob, Yenisey, and Khatanga stocks are likely to be composed primarily of whales that winter in the Barents Sea and populate the Ob, Yenisey, and Khatanga Gulfs only during the summer months.

There is little confidence regarding the size of the Yenisey, Ob, and Khatanga stocks. For the Khatanga Gulf stock, the IWC (2000) described the population as "unknown," although Kleinenberg et al. (1964) do offer reports of "a few hundred" animals in Khatanga Gulf in August 1948 and "several hundred" in the Anabar River estuary in 1950. No more recent estimates are available.

Because of the small estimated population and uncertainty surrounding the estimates, it is not known what, if any, level of removal could sustainably occur. Therefore, an import of whales collected from these stocks is not a viable alternative to the proposed permit activity.

Bering Stocks

Beaufort Sea

The Beaufort Sea stock inhabits Canadian waters from the Mackenzie River to the Bering Sea. At nearly 40,000 animals (Allen and Angliss 2010), the Beaufort Sea stock is second in size only to the West Hudson Bay stock. The provisional PBR for this stock is 324 animals, although NMFS no longer considers this value valid due to the age of the survey data used to calculate this estimate (1992 surveys conducted by Harwood et al. [1996]). Presumably, this stock winters in areas similar to those of other Alaskan stocks. However, this stock is generally considered sufficiently distinct to suggest an independent origin from Alaskan stocks (O'Corry-Crowe et al. 1997, 2010). Because the capture of Canadian whales for export has been banned since 1992 (Fisheries and Oceans Canada 1999), import of whales collected from the Beaufort stock is not considered a viable alternative to the proposed permit activity.

Chukchi Sea

The IWC (2000) identifies separate stocks in the west (Russian) and east (American) Chukchi Sea, but, to date, no summer calving grounds have been identified in association with western Chukchi Sea shorelines (along Wrangell Island and the Chukotka Peninsula). Available evidence suggests the population may be derived primarily from calving grounds in the 130-kilometer Kasegaluk Lagoon in northwest Alaska.

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[9] A polynya is an area of open water surrounded by sea ice.

The minimum population estimate for the eastern Chukchi Sea stock is 3,710 (Allen and Angliss 2010) based on surveys conducted by Frost et al. (1993) between 1980 and 1991. Because these surveys did not cover the full distribution of these animals at the time of the survey, survey results are considered conservative. Based on the survey results, the PBR would be 74 animals. However, NMFS is reluctant to calculate a PBR using data over 8 years old that was not a complete survey, and considers the PBR for this stock as undetermined (Allen and Angliss 2010). It is precisely because the PBR for this stock is considered to be undetermined that the collection of whales from the eastern Chukchi stock is not a viable alternative to the proposed permit activity.

In addition, there is no existing and proven collection infrastructure in the eastern Chukchi Sea, such as the one that exists in Sakhalin Bay in the Sea of Okhotsk. The lack of existing collection infrastructure in the areas where beluga whales from the eastern Chukchi stocks would be collected presents challenging conditions for collection that may increase the potential for injury or stress to the whales.

Population estimates for the western Chukchi Sea are tenuous. The IWC (Belikov pers. comm. in International Whaling Commission 2000) gives the abundance of the western Chukchi stock as "assumed few thousands." However, it is not clear where summer breeding aggregations occur in the Chukchi Sea. It is possible that the east and west Chukchi Sea stocks are one, likely including some measure of mixing with the Beaufort Sea stock, and that the breeding grounds for these animals may lie in Alaska and the Mackenzie Delta (Huntington 2001). If so, then the summer presence of likely one to several thousand animals in the western Chukchi Sea should be considered in the evaluation of the Beaufort and Eastern Chukchi stock status.

Regardless of the status of the western Chukchi stock, there is no existing and proven collection infrastructure in the western Chukchi Sea, such as the one that exists in Sakhalin Bay in the Sea of Okhotsk. The lack of existing collection infrastructure in the areas where beluga whales from the western Chukchi stocks would be collected presents challenging conditions for collection that may increase the potential for injury or stress to the whales.

Furthermore, collection of belugas from the western Chukchi Sea stock that congregate near Wrangel Island is limited by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) designation of the Wrangel Island Reserve, which was established in 2004. This reserve, which encompasses Wrangel Island, neighboring Herald Island, and surrounding waters, is on UNESCO's World Heritage List (United Nations Educational, Scientific, and Cultural Organization 2011) for a number of significant criteria including that it has the highest level of biodiversity in the high Arctic.

The tenuous nature of the population estimates for the western Chukchi Sea stock restricts a reliable and accurate PBR from being calculated. There is uncertainty regarding the level of sustainable take of whales captured from the western Chukchi Sea stock. Therefore, collection from this stock is not considered a viable alternative to the proposed permit activity.

Because of the tenuous nature of the population and PBR estimates, the lack of existing collection infrastructure, and designation of the world heritage site where many of the belugas from this stock aggregate, import of beluga whales collected from the western Chukchi Sea would not be a viable alternative when compared to the proposed permit activity.

East Bering Sea

Located on the western-Alaskan coast, the East Bering Sea stock forms breeding aggregations in Norton Sound and the nearby mouth of the Yukon River during the ice-free months (Lowry et al. 1995) and migrates south with the pack ice in the winter (Huntington et al. 1999) where they may intermix with other stocks. The most recent minimum population size was estimated at approximately 15,000 (Allen and Angliss 2010). The annual subsistence harvest, managed by the Alaska Beluga Whale Commission, averaged about 200 animals between 2002 and 2006, which is below the current PBR of approximately 300 animals (Allen and Angliss 2010). Although some underreporting of harvest typically occurs, there is no indication that this population is declining (Allen and Angliss 2010). Although the removal of an additional 18 animals from this stock would not increase the total take from this stock above the estimated PBR, the Norton Sound area lacks beluga collection infrastructure requisite for safe collection and subsequent transport of whales such as the infrastructure found in the Sea of Okhotsk. Therefore, collection from this stock is not a viable alternative to the proposed permit activity.

Bristol Bay

The Bristol Bay stock inhabits the nearshore waters of Alaska's Bristol Bay, especially in the vicinity of the Nushagak and Kvichak river mouths (Allen and Angliss 2010). They may mix with other beluga stocks from the Bering, Beaufort, and Chukchi seas; however, they are genetically distinct from other Alaskan populations. Based on aerial surveys conducted by Lowry et al. (2008), the current minimum population estimate is slightly less than 2,500 animals. Annual subsistence harvest averaged 18 animals between 2000 and 2006, which is 35% of the PBR of 49 animals Allen and Angliss (2010) calculated for this population. Although the removal of an additional 18 animals from this stock would not increase the total take from this stock above the estimated PBR, Bristol Bay lacks beluga collection infrastructure requisite for safe collection and subsequent transport of whales such as the infrastructure found in the Sea of Okhotsk. Therefore, collection from this stock is not a viable alternative to the proposed permit activity.

Gulf of Anadyr

The Gulf of Anadyr[10] stock, in Russia, is generally recognized but has received little study. The IWC (2000, citing Belikov pers. comm.) identified a single Anadyr Gulf stock that summers in the Anadyr Lagoon and River and winters in the Gulf of Anadyr, assessing its abundance as "no estimate, assumed few thousands." There are no estimates of the population size, current removals, or population trends for this stock. Because of this uncertainty, the effects of removal of whales cannot be reliably predicted. Therefore, the import of whales taken from the Gulf of Anadyr stock is not considered to be a viable alternative to the proposed permit activity.

[10] Labeled as Anadyrskiy Gulf in Figure 1.

Sea of Okhotsk Stocks

Shelikov Bay

Shelikov Bay is found in the northern extreme of the Sea of Okhotsk. The Bay itself is divided into two smaller embayments: Ghizhiga and Penzhina Bays. Both are used extensively by summering belugas. Berzin and Vladimirov (1989) estimated that approximately 10,000 summering beluga whales begin arriving in Shelikov Bay in May to feed on spawning herring. By mid-July, these whales begin to form feeding aggregations of 2,500 to 3,000 whales exploiting pink salmon (*Oncorhynchus gorbuscha*) runs (Berzin et al. 1988). As salmon runs end in mid-September, these belugas disperse in search of food, eventually migrating south into coastal polynas or central ice fields to overwinter (Melnikov 1999).

Additional research is needed before the PBR for the Shelikov Bay beluga whale population can be reliably estimated. Because of the need for further studies combined with the lack of experienced beluga catchers and infrastructure in the Northern Sea of Okhotsk, the collection, and import of whales captured in Shelikov Bay is not a viable alternative to the proposed permit activity.

Shantar Sea and Sakhalin Bay

As described in Chapter 2 above and in detail in Appendix A accompanying this permit application, there is some evidence that beluga whales from bays of the Shantar Sea and the Sakhalin-Amur region constitute a single stock, rather than the separate stocks that were identified by the IWC (International Whaling Commission 2000). The potential effects of importing whales collected from Sakhalin Bay—under both the single stock and separate stock scenarios—are considered in the proposed permit activity in Chapter 2 of this Appendix.

Chapter 4
Acquire Animals Already on Public Display (Alternative 3)

Under this alternative, the applicant would acquire 18 beluga whales that are already on public display at other aquaria, either within or outside the North American captive population.

As of February 1, 2012, the beluga whale population in North American aquaria registered as members of the AZA and AMMPA was 35 animals. This includes belugas at Georgia Aquarium, Shedd Aquarium, Vancouver Aquarium, Mystic Aquarium, Sea World San Diego, Sea World San Antonio, and Sea World Orlando.

Table 1 presents the distribution of captive beluga whales in North American AZA and AMMPA facilities. There are presently another 39 belugas residing at Marineland of Canada located in Niagara Falls, Ontario. Prior to exploring collection options, Georgia Aquarium Inc. (GAI) had numerous discussions with Marineland of Canada regarding the potential for acquiring beluga whales. This dialogue included visitations by GAI staff to Marineland of Canada, Marineland of Canada ownership visiting GAI, and many telephone conversations. The end result of these efforts was an incompatible relationship, both financially and philosophically. Based on these extensive discussions, GAI concluded that the acquisition of animals from Marineland of Canada was not a viable alternative.

Table 1. Distribution of Beluga Whales at AZA and AMMPA facilities in North America

Facility Name/Location	Resident Beluga Whales
Georgia Aquarium/Atlanta, GA	2 males; 2 females
SeaWorld/Orlando, FL	2 males; 2 females
SeaWorld/San Antonio, TX	2 males; 6 females
SeaWorld/San Diego, CA	2 males; 3 females
Shedd Aquarium/Chicago, IL	2 males; 5 females
Mystic Aquarium/Mystic, CT	2 males; 2 females
Vancouver Aquarium/Vancouver, BC	0 males; 3 females
Total	12 males; 23 females

While the physical acquisition of beluga whales in the North American captive population may theoretically be possible, this would not meet the purpose of, or address the need for, the proposed permit activity. As described in Chapter 1 of this Appendix, a key component of the purpose of the proposed permit activity is to enhance the North American beluga breeding cooperative by increasing the population base of captive belugas to a self-sustaining level. An alternative that relied on the acquisition of North American beluga whales by the applicant would result in no net gain of animals in the breeding cooperative. Furthermore, the proposed permit activity includes the additional benefit of enhancing genetic diversity in the North American captive population; a benefit that Alternative 3 does not achieve.

As of September 2010, there were an estimated 206 beluga whales in captivity worldwide. Seventy-two of these whales were located in the United States and Canada, 37 were in China, 22 were in

Japan, 51 were in Russia, 2 were in Indonesia, 2 were in Spain, 6 were in Taiwan, 7 were in Thailand, 3 were in Turkey, and 4 were in the Ukraine. If it were possible to permanently acquire and import captive beluga whales held in foreign aquaria, this would result in a net increase in the number of whales in the North American beluga breeding cooperative and would likely enhance the sustainability of the North American captive population. However, acquisition of animals living in non-United States facilities is not a viable alternative to the proposed permit activity because beluga whales owned by foreign facilities are not generally available for acquisition. Moreover, there is often insufficient evidence regarding the status of the populations from which the animals were collected, the method of collection, the post-collection care and transport of the animals, and the health status of individual whales to determine if any of these animals satisfy the MMPA standards such that they would be eligible for importation.

The purpose of the proposed permit activity is to promote conservation, education, and enhance the North American beluga breeding cooperative by increasing the population base of captive belugas to a self-sustaining level. Because the acquisition of animals that are currently on public display in the North American breeding population fails to increase the population base of captive belugas to a self-sustaining level, and the acquisition of animals that are on display in other countries is not feasible, the acquisition of beluga whales already on public display is not a viable alternative to the proposed permit activity.

Chapter 5
Use Captive Breeding Loans and Artificial Insemination (Alternative 4)

Captive Breeding Loans

Captive breeding loans between aquaria have been used to manage and grow captive marine mammal populations for years. This process entails transporting individual animals from their home aquaria to those with potential mating partners to encourage successful reproduction. Breeding loan exchanges are informed by species survival plans, which provide potential mating recommendations based on the genetics and demography of the population.

Captive breeding loans are common among the North American beluga breeding cooperative and have resulted in a number of successful pregnancies. In the United States, 18 beluga whale calves have been born successfully under human care. The knowledge that has been gained from initial beluga breeding efforts has led to more a more successful and effective breeding loan program. For instance, based on the fact that belugas, like many mammals, learn valuable birthing and nursing lessons from their families, the North American beluga breeding cooperative tries to place younger females with experienced females to encourage proper breeding and calving behavior. Additionally, the cooperative has found that the presence of more than one male in the tank with a sexually mature female helps to promote mating behavior.

Modeling scenarios of the current North American captive beluga population indicate that the addition of 18 imported animals would provide the total captive population with a greater than 70% chance of persisting past 30 years (Willis 2012). Additionally, a baseline modeling scenario (Willis 2012) shows a trend of instability and potential decline of the current population. This scenario was included in a population model, which projects that there is a 56% probably that the population will decline over 30 years (Willis 2012). By running 1,000 iterations of the model, Willis (2012) determined that expected trends in population size are "largely a function of the current age and sex structure of the population." Willis' model uses a reproductive rate based on the last 5 years of observed growth in the North American captive beluga population, during which time a population management strategy was being implemented to achieve optimized growth for the population. It is likely to be the highest achievable growth rate with the current population. The use of captive breeding loans from whales within the population of North American AZA and AMMPA facilities fails to increase the population size and change the sex and age structure of the current population in a way that could be expected to change the present population trend.

The use of captive breeding loans from North American aquaria does not satisfy the proposed permit activity's purpose. Loans involving animals that are already on display and, as such, already part of the North American beluga breeding cooperative, would fail to introduce the requisite number of beluga whales into the current population necessary for sustainable growth. Without the addition of new genetic material, the captive breeding community will suffer from reduced genetic health in future individuals.

While new genetic material could be introduced to the North American captive beluga population from foreign captive beluga populations, the difficulties associated with the acquisition of belugas from non-United States facilities that are discussed in Chapter 4 are also associated with foreign captive breeding loans. The use of captive breeding loans from international aquaria is constrained by the current legal structure, as national and international laws and regulations do not encourage frequent transfers of marine mammals across international borders. Additionally, relationships and communications between North American and foreign beluga holding facilities would need to be established and/or enhanced before breeding loans could be considered feasible (Brennen 2007). Furthermore, the circumstances surrounding the collection, transport, and holding of beluga whales held in foreign facilities is not always well known and are not likely to meet the rigorous standards set forth in the MMPA for the importation of animals. For the reasons identified above, the use of captive breeding loans—both domestic and international—are not considered to be viable alternatives to the proposed permit action.

Artificial Insemination

Artificial insemination (AI) is viewed as a safer alternative to captive breeding loans because it eliminates the need for animal transfers. Although AI has been used successfully in select marine mammals for years, the technique was only first used in belugas in 2005 (Wojtas 2005). This first attempt at AI did not result in pregnancy. In 2008, Sea World successfully used artificial insemination to impregnate a beluga whale for the first time in history (O'Brien et al. 2008). In total, there have been four successful AIs of beluga whales. Having been recently developed and resulting in only limited instances of success, AI methods for beluga whales are still being perfected, and are not effective enough to be relied upon as the sole source of population increase. Without the addition of new genetic stock, the United States beluga population at public display facilities will lose genetic diversity, and population growth will be further limited if AI is the principal breeding technique.

It is theoretically possible to import semen from foreign-held beluga whales to be used in artificial insemination in the United States. Although this may result in an increase in genetic diversity among the resulting North American captive population, it is not likely to be an option as few or no male belugas outside of the United States have been trained to donate. Furthermore, the use of genetic material from beluga whales from foreign facilities or from the North American captive beluga population would not satisfy the proposed permit activity's purpose. The use of AI would not increase the base population of North American captive belugas and, as such, would not satisfy the requirements set forth in population models (Willis 2012) needed to maintain the current population size and to increase the likelihood of future population growth. Moreover, the model assumes that all females that are reproductively active will become pregnant as early as they are physically capable (reach reproductive age or wean their current calves). The importation of semen for AI would not result in accelerating the reproductive rate of the current females, and the population would not be expected to grow any faster than it would under a no-action alternative.

Furthermore, the conditions under which potential donating beluga whales from foreign facilities were collected, transported, and held may generally not be known, and are, therefore, not likely to meet the standards set forth in the MMPA for the importation of marine mammals, which term includes parts and products. In addition, the methods for semen collection of said foreign-held facilities may not meet the standards and practices that would be used as part of an artificial insemination program in the United States.

Chapter 6
Import Less than 18 Whales from Sakhalin Bay (Alternative 5)

Modeling scenarios performed by Willis (2012) illustrate that if the population continues to be managed as it has been for the past 5 years, there is a 56% probability that the population will be smaller in 30 years than it is today. Based on these model outputs, the current captive beluga population cannot be relied upon for the sustainable maintenance of the North American captive beluga whale population. However, modeling scenarios that account for the addition of 18 animals to the current population— using the specific 18 whales proposed for import by the applicant— indicate that the proposed permit activity will provide the total captive population with a greater than 70% chance of persisting past 30 years (Willis 2012). "This suggests that the current demography of the population is in fact preventing population increase in the short-term" (Willis 2012).

Although modeling scenarios were not run for the importation of fewer than 18 belugas, the model prepared by Willis (2012) demonstrates conclusively that it is necessary to provide a significantly larger population size if there is to be a sustainable population over time. Larger population sizes not only contribute to an increasing population, but also enhance the genetic health of the resulting population. Once the population has increased to a desired level, the realized growth can be maintained through the use of active population management measures and future breeding can be done selectively to maximize genetic variability within the population.

The importation of fewer than 18 beluga whales could be expected to provide some measure of growth in the captive population over the baseline—and would therefore increase educational and conservation opportunities—however, it is questionable if importation of less than 18 belugas would result in the long-term sustainability of the North American captive beluga population. Because this alternative may not lead to the long-term sustainability of the North American captive beluga population, there is a possibility that future import actions would be required to increase the population to a level that is sustainable over the long-term. Because of the reduced ability of this alternative to meet the purpose of and need for the proposed permit activity, as well as the likelihood that future import actions may be required, the importation of fewer than 18 beluga whales is not considered a viable alternative in comparison to the proposed permit activity.

Chapter 7
No-Action Alternative (Alternative 6)

Under a No-Action Alternative, no beluga whales originating in the Sakhalin Bay in the Sea of Okhotsk would be imported into the United States by the applicant in order to enhance the North American beluga breeding cooperative by increasing the population base of captive beluga whales to a self-sustaining level. The North American beluga breeding cooperative would continue to be managed as though the present population of 35 belugas living in captivity in AZA and AMMPA aquaria in the United States and Canada would not be supplemented.

The present population of captive beluga whales is not considered sustainable. As described in Chapter 1 of this Appendix, a population model has been prepared that presents anticipated trends for the captive population over the next 30 years. Under the No-Action Alternative, no additional whales would be added to the present population. This scenario was included in the population model, which projects that there is a 56% probably the population will decline over 30 years (Willis 2012).

In addition to the expected lack of growth in the captive population, the No-Action Alternative will preclude the introduction of new genetic material into the captive population that will accompany the introduction of 18 whales originating in the Sea of Okhotsk's Sakhalin Bay. In February 2010 (the publication date of the most recent Beluga Whale Species Survival Plan [SSP]), when there were 37 individuals in the captive beluga population comprising the North American Beluga Breeding Cooperative (including 21 founders), the measured gene diversity was 94.87% (Rupp et al. 2010). It was projected that without the addition of new individuals into the population and with a growth rate of approximately 3%, that the gene diversity would fall below 90% by 2044 and would decline to 83% by 2110. As noted by the Population Center of the AZA, when the gene diversity falls below 90% in a founding population, it is expected that reproduction and survivability are increasingly compromised (Rupp et al. 2010). Therefore, under the No-Action Alternative, it is likely that the gene diversity of the North American beluga breeding cooperative will fall to levels that impair the survivability of the population within approximately 30 years.

The SSP (Rugg et al. 2010) identified a number of population management strategies to improve gene diversity including improving the population growth rate. In addition to increasing effective population size—which would be addressed through the proposed importation—the SSP also identified equalizing founder representation by selecting breeding animals, recruiting the existing potential founders, and acquiring additional founders. If no beluga whales were imported into AZA and AMMPA facilities under the No-Action Alternative, it is possible that the Beluga Whale Breeding Cooperative would attempt to increase the gene diversity of the captive population using one or more of the strategies in the SSP and listed above. However, the reproductive rate of 3.2 whales per year (on average) of captive beluga whales in the SSP population over the last 5 years was higher than any time in the history of the captive population (Willis 2012), indicating that strategies to increase the reproductive rate of the existing population may only achieve limited success, if any, and cannot be relied upon to achieve sustainability in the North American captive beluga population.

Because the No-Action Alternative would result in no immediate additions to the population, would not change the overall pool of genetic material, and other alternative management strategies identified by the SSP that could possibly be implemented are not likely to result in growth of the North American captive beluga population, the No-Action Alternative would be expected to lead to the eventual decline of the population. It would also be expected to result in a steady decline in educational opportunities and conservation awareness related to beluga whales in specific, and arctic ecosystems in general.

Chapter 8
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APPENDIX F
SUPPORTING LITERATURE

This appendix contains the following documents:

- PBR Estimation for Different Combinations of Survey Regions Based on 2009 and 2010 Survey Data
- Genetic Analysis of Beluga Whales in the Russian Shantar and Sakhalin-Amur Regions
- Meschersky 2009 Genetics Report
- Genetic Analysis of Belugas (*Delphinapterus leucas*) Summering in Different Regions of Western Part of the Okhotsk Sea
- Beluga (*Delphinapterus leucas*) Adult Life Expectancy: Wild Populations versus the Population in Human Care
- Modeling the Population of Belugas (*Delphinapterus leucas*) in Alliance of Marine Mammal Parks and Aquariums Member Facilities
- Addendum to Modeling the Population of Belugas (*Delphinapterus leucas*) in Alliance of Marine Mammal Parks and Aquariums Member Facilities

PBR Estimation for Different Combinations of Survey Regions Based on 2009 and 2010 Survey Data

PBR ESTIMATION FOR DIFFERENT COMBINATIONS OF SURVEY REGIONS BASED ON 2009 AND 2010 SURVEY DATA.

BELOW ARE PRESENTED ABUNDANCE NUMBERS, ERRORS, NMIN, AND PBRS FOR THE FOLLOWING REGIONS:

1) SAKHALIN-AMUR
2) SHANTAR
3) SAKHALIN-AMUR+SHANTAR
4) SAKHALIN-AMUR+EASTERN SHANTAR (I.E. NIKOLAYA AND ULBANSKY)

THE CALCULATIONS ARE PRESENTED AS MEAN WEIGHTED VALUES OF ABUNDANCE FOR 2009- AND 2010-SURVEY ESTIMATES COMBINED.
MEAN WEIGHTED VALUES OF ABUNDANCE ESTIMATES ARE FURTHER DIVIDED BY 0.5, AS ONLY 50% (OR 0.5) OF BELUGAS ARE TAKEN AS VISIBLE TO OBSERVERS (SO CALLED AVAILABILITY FACTOR) AND "CORRECTED BELUGA NUMBER" VALUES EQUAL TO "MEAN WEIGHTED VALUE/0.5" ARE USED FOR NMIN ESTIMATION.

PLEASE ALSO SEE THE NOTE BY NIKITA CHELINTSEV REGARDING CALCULATION OF RELATIVE STATISTICAL ERROR (CV) FOR THE SHANTAR REGION ESTIMATES (THE APPENDIX IN THE END OF THIS DOCUMENT).

TABLE 1. SAKHALIN-AMUR REGION

Date of survey	Region	Estimated beluga number	Relative statistical error (cv)
September 13, 2009	Total Sakhalin-Amur	2293	0.355
August 8, 2010	Total Sakhalin-Amur	1574	0.265
	Mean weighted value	1774	0.213
	Corrected beluga number=	3547	
	Nmin	**2972**	
	PBR (Rmax=0.04, Fr=0.5)	**30**	

TABLE 2. SHANTAR REGION

Date of survey	Region	Estimated beluga number	Relative statistical error (cv)
August 5-6, 2009	Total Shantar	1588	0.018
August 7, 2010	Total Shantar	3206	0.012
	Mean weighted value	2397	0.010
	Corrected beluga number=	4794	
	Nmin=	**4753**	
	PBR (Rmax=0.04, Fr=0.5)	**48**	

TABLE 3. SAKHALIN-AMUR+SHANTAR REGION*

Date of survey	Region	Estimated beluga number	Relative statistical error (cv)
Aug 5-Sep 13, 2009	Total Sakhalin-Amur+Shantar	3881	0.210
August 7-8, 2010	Total Sakhalin-Amur+Shantar	4780	0.088
	Mean weighted value	4620	0.081
	Corrected beluga number=	9240	
	Nmin=	**8632**	
	PBR (Rmax=0.04, Fr=0.5)	**86**	

*PLEASE NOTE THAT FOR 2009 SURVEY, FROM AUGUST AND SEPTEMBER FLIGHT SERIES, WE COMBINED MAXIMUM ESTIMATES: FOR SHANTAR BAYS IT WAS THE SURVEY CONDUCTED ON AUGUST 5-6, AND FOR SAKHALIN-AMUR REGION - SURVEY CONDUCTED ON SEPTEMBER 13. THIS CAN CAUSE QUESTIONS, IF ONE SUPPOSES THE ANIMALS COULD MOVE BETWEEN THE TWO SURVEY REGIONS. ALTHOUGH, FOR 2010 SURVEY, SUCCESSIVE SERIES OF FLIGHTS (AUGUST 7 AND 8, FOR SHANTAR AND SAKHALIN-AMUR, RESPECTIVELY) WERE COMBINED WHILE ESTIMATING TOTAL ABUNDANCE, AND THE NUMBER CAME OUT EVEN HIGHER THAN FOR 2009-SURVEY. SAME COMMENT – FOR THE TABLE 4 BELOW.

TABLE 4. SAKHALIN-AMUR+EASTERN SHANTAR REGION

Date of survey	Region	Estimated beluga number	Relative statistical error (cv)
Aug 5-Sep 13, 2009	Total Sakhalin-Amur+ Eastern Shantar	2792	0.291
August 7-8, 2010	Total Sakhalin-Amur+ Eastern Shantar	2795	0.150
	Mean weighted value	2794	0.133
	Corrected beluga number=	5589	
	Nmin=	**4998**	
	PBR (Rmax=0.04, Fr=0.5)	**50**	

APPENDIX

PRELIMINARY NOTE BY O. SHPAK: THE STATISTICAL ERRORS FOR SOME ABUNDANCE ESTIMATES, LIKE THE ESTIMATES OF THE BAYS OF THE SHANTAR REGION, ARE EQUAL TO ZERO, BECAUSE THESE REGIONS WERE SURVEYED AS A "DIRECT COUNT", I.E. THE NUMBER OF BELUGAS IN THE BAY X SEEN BY AN OBSERVER WHILE FLYING A COASTAL SURVEY-ROUTE IN THIS BAY WAS THE "FINAL" ABUNDANCE NUMBER FOR THE ENTIRE BAY X USED FOR ANALYSIS. NO EXTRAPOLATION TO THE AREA OF THE BAY WAS DONE, THUS NO ERRORS EXIST FOR THIS ESTIMATE. LATER, WHEN WE COMBINED THE ABUNDANCE VALUES FOR DIFFERENT BAYS INTO ONE SHANTAR REGION ABUNDANCE NUMBER AND THEN TRIED TO ESTIMATE THE *MEAN WEIGHTED* VALUE FOR SHANTAR ABUNDANCE OF 2009 AND 2010 SURVEYS, WE FACED A PROBLEM, BECAUSE THE FORMULA FOR THE MEAN WEIGHTED INCLUDED ERRORS AND COULD NOT BE COMPLETED WITH ERROR=0 (#DIV/0!).

WE ALSO NEEDED THE VALUE OF ERROR (CV) TO CALCULATE NMIN AS PER NMIN-FORMULA.

IF THE MODEL BELOW SUGGESTED BY DR. N. CHELINTSEV CAN NOT BE ACCEPTED BY THE EXPERTS, I SUGGEST, WE CONTACT US STATISTICIANS FOR ADVICE REGARDING CALCULATING NMIN FOR THE SHANTAR REGION DIRECT COUNT ABUNDANCE ESTIMATE.

NOTE FROM DR. NIKITA CHELINTSEV (TRANSLATION BY O. SHPAK).

THE CALCULATION OF THE MEAN WEIGHTED OPTIMAL ABUNDANCE ESTIMATION WITH ZERO STATISTICAL ERRORS OF SEPARATE ESTIMATIONS CAN NOT BE DONE (AND, PROBABLY, THEORETICALLY, IS IMPOSSIBLE!).

THAT IS WHY I DECIDED TO PRESENT APPROXIMATED VALUES OF STAT. ERRORS FOR THE CASES WITHOUT EXTRAPOLATION OF THE SURVEY DATA ON THE AREA.

STATISTICAL MODEL OF SUCH A SURVEY ANALYSIS IS AS FOLLOWING:

WE SUPPOSE THAT EACH ANIMAL IS RANDOMLY LOCATED ON THE SURFACE AND CAN BE DETECTED BY AN OBSERVER WITH A PROBABILITY ***P***. THEN, RELATIVE STATISTICAL ERROR (=CV – O. SHPAK) OF THE ESTIMATE $\boldsymbol{N_{DET}}$ (THE NUMBER OF DETECTED BELUGAS) IS EQUAL TO

$$\boldsymbol{e}(\boldsymbol{N}_{\mathbf{det}}) = \sqrt{(\mathbf{1} - \boldsymbol{P})/\boldsymbol{N}_{\mathbf{det}}} \ . \qquad (1)$$

ACCEPTING ***P***=0.5 (50%), IN FORMULA (1) WE OBTAIN THE VALUE (1-***P***)=0,5. IF WE ACCEPT ***P***=0.3 (30%), THEN (1-***P***)=0.7, I.E THE ERROR $\boldsymbol{E}(\boldsymbol{N_{DET}})$ IS INCREASING WITH THE DECREASE OF PROBABILITY THAT BELUGA IS LOCATED ON THE SURFACE.

FORMULA (1) IS DRAWN FOR THE DIFFERENT TYPES OF ANIMAL SURVEYS IN MY BOOK (ЧЕЛИНЦЕВ, 2000).

WE CAN ADD ANOTHER MULTIPLIER ***K*** UNDER THE SQUARE ROOT IN FORMULA (1), WHICH IS CONNECTED WITH GROUPING THE ANIMALS THAT SUBMERGE AND EMERGE TO THE SURFACE («DIVING SYNCHRONIZATION»). I ASSUME, THAT AT PRESENT WE DO NOT POSSESS RELIABLE DATA FOR THE VALUE OF COEFFICIENT ***K*** AS WELL AS FOR THE PROBABILITY ***P***.

Genetic Analysis of Beluga Whales in the Russian Shantar and Sakhalin-Amur Regions

Genetic analysis of beluga whales in the Russian Shantar and Sakhalin-Amur regions

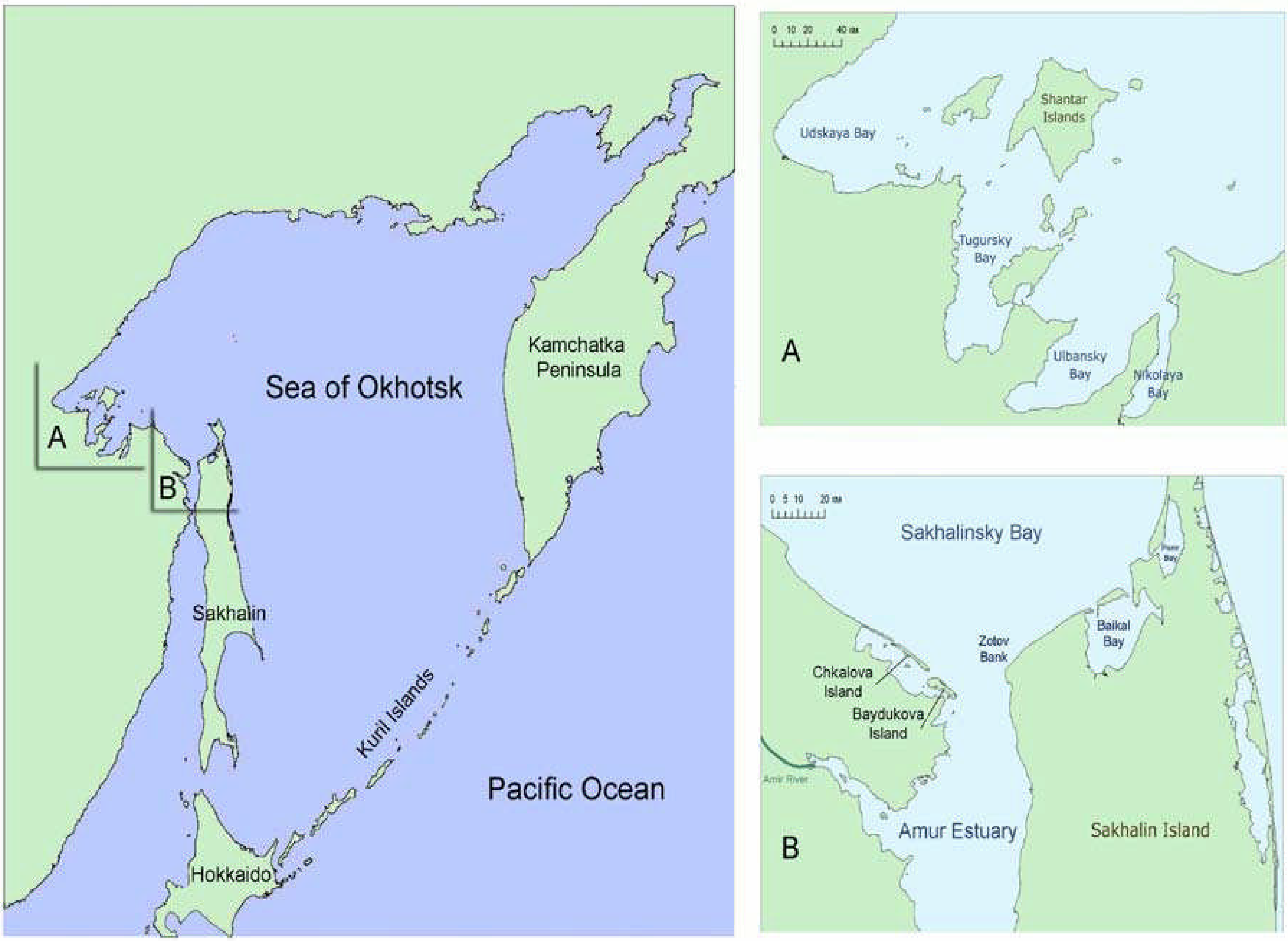
Matthew A. Cronin
29 March 2012

This report is based on genetic data for beluga whales (*Delphinapterus leucas*) reported by Meschersky and Yazykova (2012). This includes the sequences of 497 nucleotides of the mitochondrial DNA (mtDNA) control region in 225 beluga whales, and genotypes for 19 microsatellite DNA loci for 211 beluga whales. The whales occur in five populations in summering areas in the Sakhalin and Shantar regions in eastern Russia (Figure 1). This includes four areas in the Shantar region (Udskaya Bay, Nikolaya Bay, Ulbansky Bay, Tugursky Bay) and one area in the Sakhalin region (Chkalova).

Meschersky and Yazykova (2012) found:

1. The samples had considerable mtDNA variation, and microsatellite loci were largely in Hardy-Weinberg equilibrium with abundant allelic variation and heterozygosity.
2. Eight mtDNA haplotypes were identified. The haplotypes have small sequence divergence, with only one to four nucleotide substitutions each (0.2%-0.8% sequence divergence). MtDNA haplotypes were shared by the populations, and the most common haplotype occurred in all five populations. MtDNA haplotype frequencies differed among all of the populations except between Nikolaya and Chkalova and between Udskaya and Tugursky.
3. Microsatellite DNA allele frequencies were not genetically differentiated among the populations based on pair-wise F_{st} measures and Structure analysis, except for Chkalova and Ulbansky. Meschersky and Yazykova (2012) noted that an analysis of nine loci for 69 additional belugas showed that there are no significant differences between any of the populations.
4. Meschersky and Yazykova (2012) concluded for microsatellite loci that all the samples belong to a single population, and are probably subdivided into demes but not into summering areas. For mtDNA there is a high level of philopatry, and a distinct composition of maternal lines for most of the summer sites was confirmed.

Figure 1. Sea of Okhotsk with insets of the Shantar region (A) and the Sakhalin-Amur region (B). Courtesy of Olga Shpak (From Page 2 of Reeves et al. 2011).



Additional analyses

I did additional analyses of the microsatellite genotype and mtDNA haplotype data of Meschersky and Yazykova (2012) to augment their assessment of beluga whale population relationships.

1. Genetic distance analysis of microsatellites

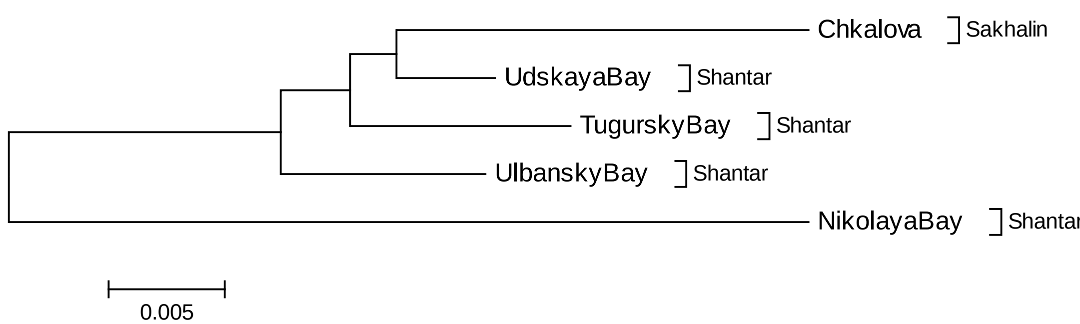
I calculated genetic distances (Nei 1972) between the populations (Table 1) with the Biosys computer program (Swofford and Selander 1981).

Table 1. Matrix of Nei (1972) genetic distances between beluga whale populations.

	Chkalova	Udskaya	Nikolaya	Ulbansky	Tugursky
Chkalova Sakhalin	0.000				
Udskaya Bay Shantar	0.022	0.000			
Nikolaya Bay Shantar	0.068	0.054	0.000		
Ulbansky Bay Shantar	0.033	0.019	0.055	0.000	
Tugursky Bay Shantar	0.029	0.016	0.061	0.019	0.000

The genetic distances are presented graphically in Figure 2, which was made with the Neighbor-Joining method in the MEGA program (Tamura et al. 2011).

Figure 2. Neighbor-Joining tree of Russian beluga whale populations calculated from Nei (1972) genetic distances (Table 1) from allele frequencies for 19 microsatellite loci.



I also calculated the following average genetic distances:

a. Average genetic distance between all five populations = **0.0376**
b. Average genetic distance between the Sakhalin (Chkalova) population and the individual Shantar populations (Udskaya Bay, Nikolaya Bay, Ulbansky Bay, Tugursky Bay) and = **0.0380**
c. Average genetic distance between populations within the Shantar region = **0.0373**
d. Average genetic distance between regions (Shantar populations combined into one population vs Chkalova) = **0.021**.

The genetic distances and dendrogram (Figure 2) indicate that the level of genetic differentiation of the beluga populations is small, and there is as much differentiation within the Shantar region as there is between the Shantar and Sakhalin regions. The genetic distance of the combined Shantar populations to Chkalova-Sakhalin (0.021) is smaller than the distances between three of the intra-Shantar population distances (Table 1). The Shantar and Sakhalin regions are not differentiated in the Neighbor-Joing tree (Figure 1). The Sakhalin Chkalova population clusters with the Shantar Udskaya population, and the other Shantar populations are outside this cluster. The genetic distance analysis indicates that the belugas in these two regions are not genetically differentiated. This is consistent with the microsatellite F_{st} analysis of Meschersky and Yazykova (2012).

2. mtDNA variation

MtDNA haplotype frequencies were compared by Meschersky and Yazykova (2012) who calculated F_{st} values between the five beluga sampling areas. Seven of the nine (0.78) inter-area comparisons have significantly different mtDNA haplotype frequencies. Three of four (0.75) of the F_{st} values between the Sakhalin and the Shantar samples show significant mtDNA haplotype frequency differences, and five of six (0.83) of the F_{st} values between areas within the Shantar region show significant mtDNA haplotype frequency differences (Meschersky and Yazykova 2012). This indicates that there is as much as much or more differentiation of mtDNA haplotype frequencies among the areas within the Shantar region as there is between the Shantar and Sakhalin regions.

It is important to consider the biological significance of the mtDNA data in addition to the statistical significance. All five areas share the most common mtDNA haplotype (DQ503433) at frequencies of 0.25 to 0.78. This haplotype occurred in 108 (0.48) of the 225 samples from all five areas. This indicates the most common maternal lineage in the region is shared by the five areas, which suggests there is female-mediated gene flow and movements among the five sampling areas. This premise is supported by the assessment of $N_e m$ below.

3. Estimation of $N_e m$ from microsatellite and mtDNA data.

The effective population size (N_e) times the migration rate (m), denoted $N_e m$, can be interpreted as the absolute number of individuals exchanged between populations per generation (Avise (1994:207). It is not an actual measurement of the numbers of animals moving between populations, but indicates the numbers of animals in an idealized population at equilibrium that would migrate between populations to result in the F_{st} (i.e., variance in allele frequencies) observed. $N_e m$ is often used as an estimator of the level of gene flow between populations.

The following equations were used to estimate $N_e m$ for the beluga populations. For mtDNA (mtDNA is maternally inherited and only refers to female migration so the symbol $N_{ef} m$ is used):

$N_{ef} m = ½(1/F_{st} – 1) = (1-F_{st})/2F_{st}$ (O'Corry-Crowe et al. 1997);

And for microsatellites:

$N_e m = (1-F_{st})/4F_{st}$ (Avise 1994:207).

The data in Table 2 show the level of genetic differentiation (i.e., F_{st}) and related $N_e m$ estimates for the Shantar and Sakhalin beluga populations. As reported by Meschersky and Yazykova (2012), there is greater mtDNA haplotype frequency differentiation than microsatellite allele frequency differentiation among the populations. The $N_e m$ values, particularly for microsatellite loci, suggest there is considerable gene flow and movement of animals among the populations.

The mtDNA estimates suggest there are from less than one female migrant to 62 female migrants among the beluga populations per generation, and the microsatellite estimates indicate there are considerably more than 33 migrants of both sexes per generation among these populations. This does not mean there are actually this many migrants every generation, the numbers may vary over time. However, the data indicate that the populations are not genetically isolated, particularly for the microsatellite loci. The pattern of low genetic differentiation may reflect gene flow among different breeding areas, or a common breeding population with some level of fidelity to the summering areas that were sampled (Meschersky and Yazykova 2012).

Table 2. F_{st} values from Meschersky and Yazykova (2012) and $N_{ef}m$, and $N_e m$ estimates for beluga whale populations in the Shantar and Sakhalin regions of Russia. Significant values are shown in **bold**. ∞ indicates infinity.

Populations	**mtDNA**		**Microsatellites**	
	F_{st}	**$N_{ef}m$**	**F_{st}**	**$N_e m$**
Chkalova-Nikolaya	0.0311	15.6	0.0020	124.1
Chkalova-Ulbansky	**0.1440**	3.0	**0.0076**	32.5
Chkalova-Tugursky	**0.0876**	5.2	0.0000	∞
Chkalova-Udskaya	**0.1093**	4.1	0.0000	∞
Nikolaya-Ulbansky	**0.3609**	0.9	0.0000	∞
Nikolaya-Tugursky	**0.1197**	3.7	0.0000	∞
Nikolaya-Udskaya	**0.1893**	2.1	0.0000	∞
Ulbansky-Tugursky	**0.2134**	1.8	0.0000	∞
Ulbansky-Udskaya	**0.2048**	1.9	0.0024	102.2
Tugursky-Udskaya	0.0079	62.5	0.0000	∞
Average	0.1468	10.08	0.0012	>124

The beluga whales in the Shantar and Sakhalin regions are relatively genetically homogeneous compared to belugas in Alaska (Table 3).

Table 3. F_{st} values and $N_{ef}m$, and N_em estimates for beluga whale populations in Alaska. Data from Cronin (2007, and references therein).

Populations	**mtDNA**		**Microsatellites**	
	$\mathbf{F_{st}}$	$\mathbf{N_{ef}m}$	$\mathbf{F_{st}}$	$\mathbf{N_em}$
Cook Inlet-Bristol Bay	0.551	0.407	0.071	3.271
Cook Inlet-Norton Sound	0.438	0.642	0.045	5.306
Cook Inlet-East Chukchi Sea	0.260	1.423	0.048	4.958
Cook Inlet-East Beaufort Sea	0.343	0.958	0.049	4.852
Bristol Bay-Norton Sound	0.042	11.405	0.017	14.456
Bristol Bay-East Chukchi Sea	0.446	0.621	0.027	9.009
Bristol Bay-East Beaufort Sea	0.400	0.750	0.019	12.908
Norton Sound-East Chukchi Sea	0.371	0.848	0.013	18.981
Norton Sound-East Beaufort Sea	0.333	1.002	0.005	49.750
East Chukchi Sea-East Beaufort Sea	0.214	1.836	0.014	17.607
Average	0.3398	1.9892	0.0308	14.110

The microsatellite F_{st} values are lower and the N_em values are higher in the Russian populations than in the Alaskan populations (Tables 2 and 3). The microsatellite data sets are not directly comparable because different numbers of loci were used in the Russian and Alaskan analyses. However, this comparison shows that the belugas in the Shantar and Sakhalin regions appear to be relatively genetically homogeneous for microsatellites. The F_{st} and $N_{ef}m$ values for mtDNA are more comparable between the Russian and Alaskan populations because the mtDNA control region was analyzed in both groups. The average mtDNA F_{st} values are lower and the $N_{ef}m$ values are considerably higher in the Russian populations than in the Alaskan populations (Tables 2 and 3).

Summary and Conclusions

The data for 19 microsatellite loci resulted in F_{st} values (Table 2, Meschersky and Yazykova 2010), genetic distances (Table 1), and a dendrogram (Figure 2) that indicate the beluga whales in the five areas in the Shantar and Sakhalin regions are not genetically differentiated and belong to one genetically homogeneous population.

The mtDNA data for the five beluga whale populations show that all five areas share the most common mtDNA haplotype. This indicates there are shared maternal lineages among the five areas. Haplotype frequencies are differentiated between several of the sampling areas, and there is as much or more differentiation of mtDNA haplotype frequencies among the areas within the Shantar region as there is between the Shantar and Sakhalin regions.

The combined microsatellite and mtDNA data indicate the beluga whales in the Shantar and Sakhalin areas are not genetically distinct groups and that beluga whales in the Shantar and Sakhalin regions comprise one genetic stock. The shared mtDNA haplotypes and homogeneity of microsatellite allele frequencies suggest there is movement and gene flow among the five sampling areas. Studies of movements of animals could be used to assess this.

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Meschersky 2009 Genetics Report

The main purpose of the study according to the Project objective is to test whether the belugas summering in Sakhalin Bay and Amur estuary belong to stock separated from other Okhotsk Sea stocks, i.e. should the stock be regarded as detached evolutionary and/or management unit.

Background

Western part of the Okhotsk Sea is one the mostly southern parts of the beluga's range. Some animals summering near Chkalova Island in Sakhalin Bay belong to mtDNA lineages not found anywhere outside the area (accordingly to nucleotide sequences data published for today: O'Corry-Crow et al.,1997; Brown Gladden et al., 1997). Although other belugas found here have a mtDNA control region haplotype widely spread in the Northern Pacific and American Arctic waters, the composition, diversity and occurence of mitochondrial lineages make Chkalova Island belugas evidently distinguished from the stocks of American Pacific waters (Meschersky et al., 2008). On the other hand, till present day there were no any genetic data allowing to compare Chkalova Island sample and belugas summering in other parts the Okhotsk Sea.

The so called Shantar Sea is the second, after Sakhalin-Amur area, main region in the western Part of Okhotsk Sea where large beluga concentrations are observed in summer. It is known that belugas are highly phylopatric, and the stocks summering in different bays may significantly differ one from another by maternal (mitochondrial) lineages composition in spite of the proximity of their summering grounds. The possible separation of Sakhalin-Amur and Shantar beluga summer stocks is suggested by some investigators but the idea is not accepted by others (Kleinenberg et al, 1964; Vladimirov, 1995; Doroshenko, N.V. and Doroshenko, A.N., 1996; Melnikov, 1999).

Furthermore, as some maternal groups of beluga may be conservative in the choice of their summering grounds, it doesn't mean their genetic isolation from conspecifics summering in other regions. It is believed that belugas mate in late winter - early spring (O’Corry-Crowe, 2002) while still in their wintering grounds or during spring migration. The wintering areas and migratory paths of Okhotsk Sea belugas are not well-studied. It is possible that the belugas from Amur and Shantar stocks, and maybe even belugas from the northern part of Okhotsk Sea (Gizhigin summer stock) spend winters in the same region. So, they may form a single population. Or may not - in addition to uncertain wintering grounds we know nothing about the belugas' mating preferences. Genetic studies should help to answer this question.

Two main approaches in beluga (as well as most other animals) population genetic studies are: mtDNA sequences - (1) and microsatellite allele frequencies and distribution (2) analyses. The control region (including its hypervariable left domain) that is suggested to be the most variable part of mtDNA was used in the study. Unique variations of the DNA sequences (haplotypes) mark different maternal lines. Genetic distances between the lines and their geographical distribution allow to make conclusion about the species' phylogeography. On the other hand, mtDNA lineages are inherited without recombination and remain immutable during millennia. Since beluga is a migratory species, the present distribution of maternal lines allows to analyze tendencies to phylopatry in separate stocks and global (or macrogeographical) population structure but not to estimate the real gene flow between the neighboring populations.

To do the latter, frequencies and distribution of alleles of different microsatellites loci have to be analyzed. Microsattelites are relatively small very variable fragments of nuclear DNA. Typically, they content repetitions of 2-6 nucleotides, and number of repetitions determines total nucleotide length specific for each allele. Each separate genetic group has a specific pool of the alleles inherited in different combinations from generation to generation. By analyzing allele distribution of many independent loci in the samples presenting different groups of animals, the level of genetic isolation of each group as well as gene flow rate between them may be estimated.

Methods

Beluga's total DNA for the analysis was isolated by standard procedures from skin samples taken by biopsy and preserved in alcohol.

Left part of mtDNA control region was amplified using L15926 and H00034 primers described by G.M. O'Corry-Crowe and co-authors(1997) and under PCR conditions described there. The primers restrict mtDNA fragment of about 670 bp including about 550 bp of the control region (about 330 bp of mostly hypervariable left domain and about 220 bp of more conservative central region). After purification, the PCR product of each sample was consequently sequenced with both forward and reverse primers on automated AB3130 and ABI PRIM 310 genetic analyzers (Applied Biosystems) and then the sequences were combined to eliminate single sequence reading errors. ABI PRISM BigDye Terminator v3.1 Ready Reaction Cycle Sequencing Kit was used for the sequencing reactions. At least 559 bp (62 bp of 3'-part of tRNA-Pro followed by 497 bp of the control region) was determined for all samples. The variations in 497 positions were used for analysis except when compared to the 410 bp sequences published by O'Corry-Crowe and co-authors (1997).

Ten microsatellite loci (DlrFCB3, DlrFCB4, DlrFCB5, DlrFCB17, EV37, EV94, 415/416, 417/418, 464/465, 468/469) originally described for beluga (Buchanan et al., 1996) or other Cetacean species (Schlötterer et al., 1991; Valsecchi, Amos, 1996) and all tested in beluga population structure studies (Brown Gladden et al., 1999; O'Corry-Crowe et al., 2006) were amplified using primers recommended in cited and some other studies. One primer in each set was fluorescently labeled by ROX, TAMRA, R6G, or FAM dyes (JSC Syntol, Moscow) and then diluted by the same but not labeled primer. Fragment analysis was done on AB3130 analyzer in presence of GeneScan TM-500 LIZ Size Standard (Applied Biosystems). Spectral calibration was done with ANY5DYES calibration set (JSC Syntol). Chromatograms were read by GeneMapper v 4.0. To correct the possible changes in fragment size determination between different years, at least two samples from the previous year set (i.e. of known genotypes) were re-analyzed during every next session.

For future analyses, the foolowingsoftware were used:

-BioEdit v.7.0.1 (Hall, 1999) for sequences alignment and storage,

-Network v.4.5.1.6. (Bandelt et al. 1999) for haplotype network analysis, Arlequin v.3.11 (Excoffier et al., 2005) for population analysis for both sequence and microsatellite allele data,

-GenePop 4.0.7 (Raymond & Rousset 1995) and Structure v 2.2 (Pritchard et al., 2000) for microsatellite allele data.

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Materials

For today, skin samples from 51 belugas captured or remotely biopsied in their summering grounds in the western Okhotsk Sea were genetically analyzed under the

Project framework. Thirty-nine samples were collected in Sakhalin Bay and Amur Estuary: 37 animals were captured near Chkalova Island in 2006-2008 (15 in 2006 /for Utrish Dolphinarium Ltd. needs/, 11 in 2007, and 11 in 2008), 1 beluga was found dead in 2008 on on the western coast of Sakhalin Island (Amur Estuary), and 1 was found alive entangled in the lower Amur Estuary in 2009. For the dead animal microsatellite analysis could not be performed due to the poor quality of the sample. Also, 12 samples were collected in the Shantar Sea : 7 – in Nikolaya Bay in 2009, and 5– in Udskaya Bay (1 in 2008, and 4 in 2009) .

For the mtDNA sequences analysis, previously published (Meschersky et al., 2008) data for 10 belugas captured near Chkalova and Baidukova Islands in 2004 and for 18 animals captured there in 2005 were included. Also, the data from 15 belugas captured near Chkalova and Baydukova Islands in 2009 under The White Whale Program (Russia) were taken into consideration. Conclusions below are made based on all data combined.

It is noteworthy that for all animals captured in 2004-2007 and for the most captured in 2008, the samples were provided with the gender information; therefore, sex determination genetic analysis was not performed. On the contrary, most of 2009 samples were collected remotely and thus lacked gender information. The analysis for sex-dependent differences in total sample was not performed. This question will be resolved in future work.

Results and Discussion

mtDNA

For 1-497 positions of the control region of 28 animals captured in 2004-05, seven haplotypes were found. Three of them were found in more than 20% of animals, and four - in less than 10% (Table 1). Most of the haplotypes differed one from another by 1 mutation (nucleotide substitution) and some - by 2 mutations (Figure 1).

Among 3 major haplotypes, one – named "sOkh22" in Meschersky et al., 2008 and present study, and named "5" (for 1st-409th control region positions) in O'Corry-Crowe et al, 1997 study – is very common for belugas summering in American waters in the Northern Pacific and Artctic Seas and appears to be "major" for at least some of the groups (O'Corry-Crowe et al, 1997.). The other 2 major haplotypes as well as 4 rare ones were not found anywhere else, except for the western part of the Okhotsk Sea, according to the data published to-date I am aware of (Figure 2).

In 2006-2007, no new haplotypes were found for belugas summering near Chkalova Island, and the known ones were presented in the samples in different proportion. In 2008, two new haplotypes were found: one (Okh706) for a dead beluga from Sakhalin Island coast and for the sample from Udskaya Bay in the Shantar Sea; another one (Okh148) - for the animal captured near Chkalova Island. The latter haplotype was found to be conspicuously different from all other haplotypes known for today – by at least 3 mutated positions compared to the Okhotsk Sea ones, and by at least 2 positions compared to any of 29 haplotypes presented in G.M. O'Corry-Crowe and co-authors study (1997) [Figures 1 and 2].

In 2009, no new haplotypes (compared to 2004-2007 samples) were found for belugas summering in Sakhalin Bay and Amur Estuary. Among 7 belugas from Nikolaya Bay, 6 had known from previous years "major" haplotypes (sOkh01 and sOkh22), and 1 beluga had a new haplotype (Okh130) that differed from sOkh22 by 1 nucleotide substitution (Figure 1). In 5 individuals from Udskaya Bay, a "major" haplotype sOkh22, the "rare" Okh706 and Okh148 (earlier found in belugas from Sakhalin-Amur region), and one new haplotype Okh247 were found. Okh247 differed from sOkh22 by 1 mutated position (Figure 1).

The data are summarized in Table 1. For Sakhalin Bay and Amur Estuary samples, it is seen that both occurrence of 3 "major" haplotypes as well as the indices of haplotype and nucleotide diversity didn't notably change between the data published earlier (Meschersky et al., 2008) and the total sample collected to-date.. Thus, mtDNA diversity of Sakhalin-Amur region may be considered well-studied. Haplotypes earlier known as "rare" remained similarly rare through the next 4 years of study, and the new ones are found to be rare, too.

The Shantar Sea sample (12 belugas) evidently differs from the Sakhalin-Amur sample (83 animals) both in presence and frequencies of haplotypes, but genetic distance between the samples based on sequence nucleotide composition is insignificant (population pairwise FST = 0.02329, FST P value = 0.16992). The most of observed variation in the total dataset is “within populations" (”populations”=

groups of comparison - "Sakhalin Bay" and the "Shantar Sea ") variation (97.67%), and only 2.33% is “among populations" variation.

On the other hand, genetic distance between samples collected in different years may be statistically significant. For instance, the sample set of 2006 (found to be of the least genetic diversity) is significantly different from all other samples. Chkalova Island samples of 2004, 2007 and 2008 did not differ from Nikolaya Bay sample, but the difference between the latter and the other Shantar Sea sample from Udskaya Bay was statistically significant (Table 2).

It is noteworthy, that 2 of 4 new haplotypes found in 2008-2009 were met both in Sakhalin Bay and Shantar Sea samples. This fact suggests a sporadic immigration (visit) of separate maternal lines from an unknown region during sample collection. On the other hand, permanent presence of these haplotypes in the studied areas can not be excluded either: being rare, they may be "discovered" only on the 5th year of investigations. In any case, the discovery of the new rare haplotypes doesn't significantly affect genetic distance between belugas from the two sites. Furthermore, analysis of 10 microsatellite loci allele frequencies of 3 belugas with "unusual" Okh148 haplotype didn’t reveal any distinction of each of them from other animals.

In addition to year-to-year fluctuations of beluga maternal group migrations, month-to-month migrations can also affect the results. Finally, catching methods may affect the results too being biased toward a certain social/age class group, for example. Thus, both haplotype and nucleotide diversity of the sample of the Shantar Seais higher than that found for Sakhalin Bay and Amur estuary belugas for 6 years. It may be a consequence of "less structured" sample: sampling all animals from a small entangled group (as it is done during beluga capture near Chkalova Island) as well as sampling from one location within a short period of time increases the possibility to sample the animals of same maternal lines, which obviously decreases the diversity found in analysis.

As a conclusion for mtDNA data, no significant genetics distance between belugas summering in Sakhalin-Amur area and belugas summering in the Shantar Sea were found. The difference in haplotype distribution between the two samples may be the consequence of mainly one year sampling from the Shantar Sea versus a background of year-to-year differences within Sakhalin Bay sample). Undoubtedly, at least 2-3 years of sampling and essential increase of sample size are necessary for the ultimate conclusion. For the Sakhalin Bay data collected for today, the sample size seems to be sufficient for the genetic description, but carrying on with collecting a limited number of samples seems to be reasonable to exclude the effect of year-specific beluga group migration.

TABLE 1. The mtDNA control region (1st-497th bp) haplotype occurrence and DNA diversity indices for belugas summering in the western part of Okhotsk Sea.

1-497 bp mtDNA control region haplotype frequencies, gene and nucleotide diversity indices	Sakhalin Bay (Chkalova and Baidukova Islands), 2004-2005, 28 animals*	Sakhalin Bay and Amur estuary, 2004-2009**, 83 animals	Shantar Sea, 2008-2009, 12 animals
sOkh01*	21.4%	19.3%	33.3%
sOkh03*	3.6%	1.2%	-
sOkh11*	25.0%	18.1%	-
sOkh22*	35.7%	37.3%	25.0%
sOkh51*	3.6%	7.2%	-
sOkh53*	7.1%	9.6%	-
sOkh63*	3.6%	4.8%	-
Okh706		1.2%	8.3%
Okh148	-	1.2%	16.7%
Okh130	-	-	8.3%
Okh247	-	-	8.3%
Haplotype diversity (*H*)	0.7831	0.7828*** (0.60-0.85)	0.8485**** (0.67 // 0.90)
Nucleotide diversity (π, %)	0.3369	0.3362*** (0.16-0.43)	0.4786**** (0.29 // 0.52)

* - in accordance to Meschersky et al., 2008. Fragments of 62-542 (481 bp) positions of the control region for the haplotypes are present in GeneBank (ac.no-s DQ503430- DQ503436)

** - data for 2004-05 as well as the data for Sakhalin-Amur belugas captured in 2009 (White Whale Program) are included

*** - for the total sample. Min and max values found in the samples for 6 years were analyzed separately and are given in parentheses.

**** - for the total sample.Values for Nikolaya Bay (n=7) // Udskaya Bay (n=5) samples were analyzed separately and are given in parentheses.

TABLE 2. Pairwise genetic distances (A. - FST) and their statistical significance indices (B. - FST P-values) between different years and different location samples. (Based on 1-497 bp mtDNA control region sequences). Statistically significant values ($P < 0.05$) are given in bold.

Sample legend: 1 - Chkalova Island, 2004 (n=10); 2 - Chkalova Island, 2005 (n=18); 3 - Chkalova Island, 2006 (n=15); 4 - Chkalova Island, 2007 (n=11); 5 - Chkalova Island and lower Amur Estuary, 2008 (n=12); 6 - Nikolaya Bay, 2009 (n=7) and Udskaya Bay, 2008-2009 (n=5) .

A. Samples pairwise FSTs

	1	2	3	4	5	6
1	*					
2	0.06250	*				
3	**0.15335**	0.00000	*			
4	0.00905	0.02287	**0.16379**	*		
5	0.02079	0.01787	**0.14766**	0.00000	*	
6	0.01008	**0.15670**	**0.33316**	0.00000	0.00000	*
7	**0.25170**	**0.17633**	**0.28426**	**0.20809**	0.10690	**0.32375**

B. FST P-values

	1	2	3	4	5	6
1	*					
2	0.10742	*				
3	**0.02930**	0.54004	*			
4	0.28418	0.23438	**0.02246**	*		
5	0.25977	0.25586	**0.00977**	0.98633	*	
6	0.29688	**0.04004**	**0.00684**	0.57910	0.47852	*
7	**0.01562**	**0.02637**	**0.00879**	**0.04199**	0.12207	**0.03027**

FIGURE 1. Median Joining network of 11 mtDNA control region (1st-497th positions) haplotypes found for belugas summering in the western part of Okhotsk Sea in 2004-2009. The circle diameter is proportional to haplotype frequency in the total sample (95 individuals). Blue color mark occurrence of the haplotype in Sakhalin Bay and Amur Estuary (83 individuals), and red color - in the Shantar Sea (12 individuals). Minimal branch length between 2 haplotypes is proportional to 1 mutated position.

FIGURE 2. Median Joining network of 39 mtDNA control region (1st-409th positions) haplotypes found for belugas summering in the Pacific and East Arctic (Eastern Chukchi Sea and Beaufort Sea). Large circles - haplotypes found in any samples for 15% or more animals. Blue color mark occurrence of the haplotype in Sakhalin Bay and Amur Estuary (Meschersky et al., 2008 and the present study), red color - in the Shantar Sea (ibidem), and yellow color - in North-American waters (O'Corry-Crowe et al, 1997). Due to length restriction, haplotypes sOkh03 and Okh130 are not shown. Minimal branch length between 2 haplotypes is proportional to 1 mutated position. Haplotype names used by the authors are given outside (for the Okhotsk Sea studies) or inside (for O'Corry-Crowe et al. study, for major haplotypes only) the circles.

Microsatellite DNA

As the mutational processes leading to microsatellite fragments length changes and global distribution of alleles are not clear, the data were analyzed based on only allele names, not on the real number of nucleotides. No statistically significant deviation from Hardy-Weinberg equilibrium were found for all 10 loci for 38 and 12 beluga samples from two compared locations (Tables 3 and 4), except for DlrFCB5 locus for which allele distribution was found to be nearly out of equilibrium (P=0.05782) for Sakhalin-Amur area Bay and Amur estuary. The same (P= 0.05010 for DlrFCB5 and P is between 0.18376 and 0.78495 for 9 other loci) was found for total sample of 65 animals (including 15 belugas captured in 2009 near Chkalova Island under White Whale Program). For some pairs of loci, a significant deviation from linkage disequilibrium was found for different samples (for total of 65 animals: DlrFCB4 and EV37, P= 0.01955; DlrFCB5 and EV94, P= 0.04106; DlrFCB5 and 464/465, P= 0.00782; EV37 and 464/465, P= 0.00684). Nevertheless, all loci were used in the present analysis.

Diversity indices for two locations are given in Tables 3 and 4. The samples (n=38 and n=12) were found to be genetically different: FST = 0.01399, P= 0.03223. The same (FST= 0.01730, P = 0.01758) was found for the total Sakhalin Bay sample (n=53 and n=12). For single loci, statistically significant difference between Sakhalin-Amur andShantar belugas was found only for "415/416" (P= 0.01509 for 38 animals, Sakhalin Bay sample) but not for other nine loci.

Nevertheless, model-based clustering method (Structure v 2.2 ; Pritchard et al., 2000) did not show any kind of heterogeneity within total beluga sample. The testing was done for K=1, and then – for K value increasing from 2 (assuming Sakhalin-Amur and Shantar belugas to belong to 2 different genetic groups) up to 6 – formally assuming that belugas captured each year in each location may be genetically separated. Admixture model assumes that each individual of the group has in its genome some fraction of genome of another group and shows approximately equal probability of each sample to belong to each “assumed” group. The smallest absolute value of estimated Ln probability of data was found for K=1. “No admixture model” assuming that individual genomes, if belong to different groups, are not “polluted” by other population genes shows more various results for each beluga samples, and “optimal” Ln Pr(XjK) was found for K=4. Nevertheless, no correlation between probability to belong to one group and the samples’ geography was found either for K=2 or K=4 (figure 3).

Thus, it may be concluded that the total sample of belugas captured in the western part of Okhotsk Sea is genetically homogenous. The significant FST level for the two geographical sites comparison may be explained by a possible bias in sample structure described in "mtDNA" section. Having compared the samples from different years and locations, we see that Nikolaya Bay sample significantly differ from only 2 of 3 Sakhalin-Amur samples, and Udskaya Bay sample - from none of Sakhalin-Amur samples (Table 5.).

Satellite telemetry results have shown that 4 Sakhalin-Amur belugas in 2007 and 5 in 2008 moved to Nikolaya Bay in autumn. If we include these belugas in Shantar sample analysis, we find genetic distance between the two locations to be negligible (population pairwise FST =0.00190 and P FST = 0.36937) for 53 Sakhalin-Amur and for 12+9=21 Shantar animals).

For a final conclusion, as in case with mtDNA data, more samples from the Shantar Sea should be collected.

TABLE 3. Genetic diversity and probability of deviation from Hardy-Weinberg equilibrium for alleles of 10 microsatellite loci from Sakhalin-Amur samples collected under current Project

Locus	Number of diploid genotypes	Number of alleles	Observed heterozygocity	Expected. heterozygocity	P-value
DlrFCB3	38	5	0.76316	0.73158	0.60525
DlrFCB4	38	11	0.73684	0.78491	0.31515
DlrFCB5	38	5	0.55263	0.60246	0.05782
DlrFCB17	38	9	0.76316	0.79860	0.25119
EV37	38	10	0.81579	0.74105	0.64010
EV94	38	4	0.68421	0.67333	0.37594
415/416	38	4	0.76316	0.74070	0.89792
417/418	38	10	0.68421	0.78421	0.09941
464/465	38	3	0.55263	0.60035	0.49624
468/469	38	5	0.78947	0.69649	0.64723
Mean		6.600	0.71053	0.71537	0.4602
SD		3.026	0.09283	0.07162	

TABLE 4.Genetic diversity and probability of deviation from Hardy-Weinberg equilibrium for alleles of 10 microsatellite loci the Shantar Sea samples.

Locus	Number of diploid genotypes	Number of alleles	Observed heterozygocity	Expected. heterozygocity	P-value
DlrFCB3	12	6	0.66667	0.67391	0.97891
DlrFCB4	12	9	0.91667	0.79348	0.43248
DlrFCB5	12	5	0.91667	0.77899	0.23327

DlrFCB17	12	6	0.66667	0.73913	0.45208
EV37	12	6	0.75000	0.81159	0.21129
EV94	12	4	0.66667	0.72826	0.67653
415/416	12	3	0.66667	0.67029	0.39911
417/418	12	5	0.75000	0.75725	0.75109
464/465	12	3	0.50000	0.58333	0.77495
468/469	12	3	0.66667	0.69203	0.39089
Mean		5.000	0.71667	0.72283	0.7836
SD		1.886	0.12546	0.06917	

FIGURE 3. Bar diagram of probability (0-1) of individuals of the total sample (2006-2009, 65 animals) to originate from one of K assumed separated genetic clusters. Sorted by Q. No admixture model. Belugas from the Shantar Sea are marked as “N” (Nikolyaya Bay) and “U” (Udskaya Bay). Additionally, individuals with Okh148 haplotype are marked as “v” in upper line.

A. K=2, Estimated Ln Prob of Data = -1908.7
B. K=4, Estimated Ln Prob of Data = -1897.2

TABLE 5. Pairwise distances (A. - FST) and their statistical significance indices (B. - FST P-values) between different years and different location samples. (Based on 10 microsatellite loci allele compositions). Statistically significant values (P< 0.05) are given in bold.

Sample legend: 1 - Chkalova Island, 2006 (n=15); 2 - Chkalova Island, 2007 (n=11); 3 - Chkalova Island, 2008 (n=11); 4 - Nikolaya Bay, 2009 (n=7); 5 - Udskaya Bay, 2008-2009 (n=5).

A. Sample pairwise FSTs

	1	2	3	4
1	*			
2	0.00980	*		
3	0.00627	0.00000	*	
4	0.01677	**0.03726**	**0.04083**	*
5	0.01160	0.01409	0.01075	0.03165

B. FST P-values

	1	2	3	4
1	*			
2	0.12793	*		
3	0.22852	0.49609	*	
4	0.08496	**0.00684**	**0.01270**	*
5	0.25000	0.29492	0.35156	0.14941

In conclusion, the data analyzed till present show no evidence that belugas summering in Sakhalin-Amur region from year to year belong to the stock (genetic group, population) different from the animals summering in the

Shantar Sea. To prove this conclusion, total sample size should be increased with additional samples collected from the Shantar Sea through several seasons.

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Genetic Analysis of Belugas (*Delphinapterus leucas*) Summering in Different Regions of Western Part of the Okhotsk Sea

Genetic analysis of belugas (*Delphinapterus leucas*) summering in different regions of Western part of the Okhotsk Sea

A report for Georgia Aquarium, Inc. done according to Agreement between A.N. Severtsov Institute of Ecology and Evolution of Russian Academy of Sciences and Georgia Aquarium, Inc., March, 2012.

Ilya G. Meschersky,
Ph.D., senior researcher of Molecular Diagnostic Center of A.N.Severtsov Institute of Ecology and Evolution of Russian Academy of Sciences, as a Principal Investigator
Maria G. Yazykova,
graduate student of K.A.Timiryazev Russian State Agrarian University , as an assistant.

Totally, 241 samples collected in 2006-2011 in Western part of the Okhotsk Sea were analyzed using control region of mtDNA sequencing (1-497 positions) and allele composition of 19 microsatellite nDNA loci.

The samples are deposited in A.N. Severtsov Institute of Ecology and Evolution RAS Animal Tissue Depository for DNA Analysis according to numbers:
0369-0383 – collected near Chkalov Island (Sakhalin Bay) in 2006;
1113-1122 – collected near Chkalov Island (Sakhalin Bay) in 2007;
0696-0705, 1112 – collected near Chkalov Island in 2008;
1111, 1131 – collected on Sakhalin Island Western coast (Sakhalin Bay) in 2008 and 2009;
1125-1130, 1326-1327 – collected in Nikolaya Bay in 2009-2010;
1329-1330 – collected in Ulbanskiy Bay in 2010;
2537-2607 – collected in Ulbanskiy Bay in 2011;
1370-1372 – collected in Tugurskiy Bay in 2010;
2655-2685 – collected in Tugurskiy Bay in 2011;
0706, 1148-1150, 1247 – collected in Udskaya Guba Bay in 2008-2009;
1282–1325, 1901 – collected in Udskaya Guba Bay in 2010;
2686 – 2775 – collected in Udskaya Guba Bay in 2011.

ANALYSIS OF NUCLEOTIDE SEQUENCES OF mtDNA CONTROL REGION (497 BP)

After excluding 15 samples found to be doubles (re-biopsied within one year/one region sample, see microsatellite section) and sample #2658 with some uncertain positions, 225 individuals:

38 from Sakhalin Bay (Chkalov and Sakhalin Islands) – “Chkalov” sample;

8 from Nikolaya Bay – “Nikolaya” sample;

63 from Ulbanskiy Bay – “Ulbanskiy” sample;

31 from Tugurskiy Bay – “Tugurskiy” sample;

85 from Udskaya Guba Bay – “Udskaya” sample

were used in the analysis.

The results are present in tables 1-4.

Table 1. Gene and nucleotide diversity indices for 5 samples (regions) based on mtDNA control region (497 bp) sequences

	Chkalov	Nikolaya	Ulbanskiy	Tugurskiy	Udskaya
No. of samples	38	8	63	31	85
No. of haplotypes	8	4	6	7	7
Gene diversity	0.743	0.750	0.385	0.828	0.721
Nucleotide diversity (%%)	0.321	0.431	0.144	0.429	0.389

Table 2. Occurrence of mtDNA control region (497 bp) haplotypes for 5 samples (regions). “Major” haplotypes (frequency exceed 15%) are given in bold. Haplotypes are given GenBank NCBI accession numbers. ***NOTE that entries JQ716342–JQ716348 are not released in GenBank until March of 2013***

Haplotype	**Chkalov**	**Nikolaya**	**Ulbanskiy**	**Tugurskiy**	**Udskaya**
DQ503433	**17 (44.70%)**	**2 (25.0%)**	**49 (77.80%)**	**9 (29.0%)**	**31 (36.50%)**
DQ503430	**9 (23.70%)**	**4 (50.0%)**	0	0	1 (1.20%)
DQ503432	4 (10.50%)	0	1 (1.60%)	0	0
DQ503434	2 (5.30%)	0	0	0	0
DQ503435	2 (5.30%)	0	0	0	0
DQ503436	2 (5.30%)	0	0	0	0
JQ716342	0	1 (12.5%)	7 (11.10%)	4 (12.90%)	0
JQ716345	0		0	3 (9.70%)	2 (2.30%)
JQ716346	0	0	0	1 (3.20%)	8 (9.40%)
JQ716347	0	0	0	0	1 (1.20%)
JQ716349	1 (2.60%)	0	1 (1.60%)	4 (12.90%)	12 (14.10%)
JQ716343	1 (2.60%)	0	2 (3.20%)	**8 (25.80%)**	**30 (35.30%)**
JQ716348	0	1 (12.5%)	3 (4.70%)	2 (6.50%)	0
Total	38 (100%)	8 (100%)	63 (100%)	31 (100%)	85 (100%)

Table 3. Comparisons of pairs of population samples. F-Statistics (Fst) from haplotype frequencies – values above diagonal and P (Fst) values below diagonal. Significant differences are given in bold.

	Chkalov	**Nikolaya**	**Ulbanskiy**	**Tugurskiy**	**Udskaya**
Chkalov	xxx	0.03107	**0.14395**	**0.08758**	**0.10929**
Nikolaya	0.19336	xxx	**0.36095**	**0.11966**	**0.18930**
Ulbanskiy	**0.00000**	**0.00195**	xxx	**0.21348**	**0.20484**
Tugurskiy	**0.00195**	**0.01172**	**0.00000**	xxx	0.00793
Udskaya	**0.00000**	**0.00879**	**0.00000**	0.20508	xxx

Table 4. Comparisons of pairs of population samples. Φst (distance method: pairwise difference) – values above diagonal and P (Φst) values below diagonal. Significant differences are given in bold

	Chkalov	**Nikolaya**	**Ulbanskiy**	**Tugurskiy**	**Udskaya**
Chkalov	xxx	0.03776	**0.13124**	**0.15051**	**0.16462**
Nikolaya	0.16504	xxx	**0.34398**	**0.18206**	**0.21818**
Ulbanskiy	**0.00000**	**0.00195**	xxx	**0.12302**	**0.16453**
Tugurskiy	**0.00000**	**0.00586**	**0.00000**	xxx	0.00000
Udskaya	**0.00000**	**0.00684**	**0.00000**	0.34180	xxx

The same picture was obtained (using population pairwise Φst comparison for 106 individuals for “Chkalov” region – after adding the data for 69 belugas biopsied near Chkalov and Baydukov islands in 2009–2010 for A.N.Severtsov Institute of Ecology and Evolution of Russian Academy of Sciences “White Whale Program”.

Conclusions

Only two pairs (Chkalov/ Nikolaya Bay and Tugurskiy / Udskaya bays) are not significantly different – both for haplotype frequencies and level of difference between haplotypes. All other samples are of high level of difference. So, the high level of philopatry and a distinct composition of maternal lines for the most of studied summering sites was confirmed. The absence of difference between Chkalov sample and Nikolaya Bay may be disputed due to insufficient sample size for the latter).

On the other hand, the similarity of composition of maternal lines in Tugurskiy and Udskaya bays is evident.

For Ulbanskiy Bay sample, apparently less gene and nucleotide diversity should be noted.

ANALYSIS OF 19 MICROSATLLITE LOCI ALLELES FREQUENCIES

Allelic composition of the following microsatellite loci was determined:

DlrFCB1, DlrFCB2, DlrFCB4, DlrFCB5, DlrFCB6, DlrFCB8, DlrFCB10, DlrFCB11, DlrFCB13, DlrFCB14, DlrFCB16, DlrFCB17 (*Buchanan et al., 1996)*, and
EV37Mn, EV94Mn, 415/416, 417/418, 464/465, 468/469 (Schlötterer et al., 1991; Valsecchi, Amos, 1996)

After excluding

14 samples found to be doubles (re-biopsied within one year/one region sample, see microsatellite section, sibling probability less than 5 x 10^{-06}: 2551; 2566; 2570; 2577; 2586; 2587; 2598; 2590; 2604; 2672; 2684; 2688; 2697; 2715),

one possible double (sample #2701 differs from another one biopsied in the same bay at the same period by 1 allele against a background of a lot of missing data for both samples), and 15 samples with less than 12 loci determined (1111; 1901; 2662; 2669; 2674; 2675; 2680; 2681; 2689; 2691; 2699; 2704; 2717; 2723; 2726),

211 individuals:

37 from Sakhalin Bay – “Chkalov” sample;
8 from Nikolaya Bay – “Nikolaya” sample;
63 from Ulbanskiy Bay – “Ulbanskiy” sample;
26 from Tugurskiy Bay – “Tugurskiy” sample;
77 from Udskaya Guba Bay – “Udskaya” sample

were used in the analysis.

The results are presented in tables 5-8 and on Figure 1.

Table 5. Population pairwise FSTs based on number of different alleles (above diagonal) and P (Fst) values below diagonal. Significant differences are given in bold.

	Chkalov	**Nikolaya**	**Ulbanskiy**	**Tugurskiy**	**Udskaya**
Chkalov	xxx	0.00201	**0.00764**	0.00000	0.00146
Nikolaya	0.34082	xxx	0.00000	0.00000	0.00000
Ulbanskiy	**0.00488**	0.60254	xxx	0.00000	0.00244
Tugurskiy	0.52539	0.70410	0.89648	xxx	0.00000
Udskaya	0.28027	0.59668	0.10742	0.96484	xxx

No significant difference was found for any pair of samples except Chkalov and Ulbanskiy Bay samples (table 5). In case of comparing the 5 samples for only 9 loci (cb4, cb5, cb17, ev37, ev94, 415/416, 417/418, 464/465, 468/469) and adding the data for 69 belugas biopsied near Chkalov and Baydukova islands in 2009–2010 for A.N.Severtsov Institute of Ecology and Evolution of Russian Academy of Sciences "White Whale Program" , no significant differences between any pairs of samples were found.

Table 6. The data for means of number of alleles, observed and expected heterozygosity as well as these indices and probability of deviation from Hardy-Weinberg equilibrium for each locus are given in Table 6.

For the total sample, significant deviation from Hardy-Weinberg equilibrium was found for 3 loci.

Table 6A. Total sample

Locus	**#Genot**	**#alleles**	**Obs.Het**	**Exp.Het.**	**P-value Arlequin**	**P-value Genepop**
cb1	208	6	0.62500	0.63983	0.20455	0.2132
cb2	202	4	0.28713	0.31899	0.14792	0.1444
cb3	193	8	0.69948	0.70780	0.37733	0.4413
cb4	209	11	0.77512	0.77219	0.28574	0.3549
cb5	209	6	0.68421	0.64350	0.41267	0.3848
cb6	195	10	0.71282	0.80931	**0.02149**	**0.0097**
cb8	209	7	0.69378	0.69181	0.74069	0.7029
cb10	206	7	0.74757	0.70688	0.82188	0.8355
cb11	207	3	0.23671	0.25468	0.32713	0.3382
cb13	208	3	0.21635	0.20520	0.89842	0.8830
cb14	208	5	0.73077	0.72890	0.96485	0.9663
cb16	205	6	0.60488	0.64040	0.46198	0.4923
cb17	207	10	0.70048	0.80242	**0.00465**	**0.0214**
ev37	197	10	0.75127	0.77076	0.33535	0.3386
ev94	209	5	0.67464	0.68155	0.19772	0.2135
415/416	208	4	0.70673	0.73161	0.53832	0.5485
417/418	207	10	0.69565	0.74581	**0.00277**	**0.0430**
464/465	206	3	0.50485	0.56250	0.30356	0.2925
468/469	202	6	0.63366	0.66235	0.18901	0.1691

Table 6B. Chkalov sample

Locus	**#Genot**	**#alleles**	**Obs.Het**	**Exp.Het.**	**P-value Arlequin**	**P-value Genepop**

cb1	37	5	0.54054	0.60496	0.62614	0.5966
cb2	36	4	0.30556	0.27504	1.00000	1.0000
cb3	37	5	0.75676	0.73269	0.63584	0.6838
cb4	37	11	0.75676	0.77860	0.15248	0.4080
cb5	37	5	0.54054	0.59052	0.07139	0.0851
cb6	37	9	0.75676	0.79637	0.37228	0.4281
cb8	37	7(1)	0.67568	0.73787	0.93832	0.9115
cb10	37	6	0.72973	0.68493	0.78485	0.7398
cb11	37	3	0.35135	0.34395	1.00000	1.0000
cb13	37	3	0.18919	0.17808	1.00000	1.0000
cb14	37	5(1)	0.86486	0.74454	0.23040	0.2126
cb16	37	4	0.48649	0.52092	0.80772	0.8060
cb17	37	9	0.75676	0.79637	0.32604	0.3950
ev37	37	10	0.81081	0.73862	0.57000	0.7014
ev94	37	4	0.67568	0.67234	0.41584	0.4163
415/416	37	4	0.75676	0.73936	0.85762	0.8734
417/418	37	9(1)	0.67568	0.78193	0.07614	0.0693
464/465	37	3	0.54054	0.60126	0.43802	0.4470
468/469	37	5	0.78378	0.69641	0.72762	0.7379
Mean		5.842	0.62917	0.63236		

Table 6C. Nikolaya sample

Locus	**#Genot**	**#alleles**	**Obs.Het**	**Exp.Het.**	**P-value Arlequin**	**P-value Genepop**
cb1	8	4	0.62500	0.69167	0.37861	0.3641
cb2	8	4	0.50000	0.44167	1.00000	1.0000
cb3	8	5	0.75000	0.67500	1.00000	1.0000
cb4	8	8	1.00000	0.84167	0.74594	0.6665
cb5	8	5	1.00000	0.75000	0.16010	0.1813
cb6	8	6(1)	0.87500	0.78333	0.82485	0.8135
cb8	8	3	0.87500	0.60833	0.31832	0.3336
cb10	8	4	0.50000	0.67500	0.50089	0.4903
cb11	8	1	-	-	-	-
cb13	8	2	0.25000	0.23333	1.00000	1.0000
cb14	8	4	0.75000	0.70000	0.43901	0.4760
cb16	8	4	0.87500	0.70833	1.00000	1.0000
cb17	8	6(1)	0.87500	0.78333	0.77129	0.8091
ev37	8	5	0.87500	0.80833	0.44020	0.4458
ev94	8	4	0.62500	0.77500	0.28020	0.3130
415/416	8	4	0.87500	0.77500	0.58822	0.6131
417/418	8	5	0.87500	0.71667	0.69485	0.6920
464/465	8	3	0.25000	0.59167	0.08713	0.0679
468/469	8	3	0.62500	0.67500	0.40297	0.4191
Mean		4.389	0.72222	0.67963		

Table 6D. Ulbanskiy sample

Locus	**#Genot**	**#alleles**	**Obs.Het**	**Exp.Het.**	**P-value**	**P-value**

					Arlequin	**Genepop**
cb1	60	4	0.75000	0.63768	0.52109	0.5416
cb2	59	4	0.35593	0.40721	0.12634	0.1432
cb3	58	6	0.74138	0.73058	**0.00119**	**0.0067**
cb4	61	10	0.73770	0.74800	0.92406	0.9249
cb5	61	4	0.62295	0.63731	0.96465	0.9487
cb6	60	9	0.78333	0.80784	0.49673	0.3671
cb8	61	6	0.68852	0.69408	0.44673	0.4888
cb10	60	6	0.85000	0.73501	0.29911	0.2936
cb11	60	3	0.23333	0.21345	1.00000	1.0000
cb13	61	3	0.22951	0.23181	1.00000	1.0000
cb14	60	4	0.73333	0.75168	0.80287	0.8034
cb16	58	5(1)	0.67241	0.71441	0.61188	0.6659
cb17	60	8	0.73333	0.79720	0.19307	0.1893
ev37	60	8	0.76667	0.75980	0.50634	0.4297
ev94	61	4	0.73770	0.72253	0.61990	0.6411
415/416	60	4	0.73333	0.73347	0.30010	0.2872
417/418	60	7	0.60000	0.70616	0.18089	0.1352
464/465	59	3	0.45763	0.53730	0.25208	0.2341
468/469	57	5	0.63158	0.67039	0.54683	0.5951
Mean		5.421	0.63467	0.64400		

Table 6E. Tugurskiy sample

Locus	**#Genot**	**#alleles**	**Obs.Het**	**Exp.Het.**	**P-value Arlequin**	**P-value Genepop**
cb1	26	4	0.57692	0.64932	0.50158	0.5102
cb2	26	3	0.34615	0.36275	0.35198	0.3776
cb3	24	7(1)	0.62500	0.67908	0.45485	0.5703
cb4	26	9	0.88462	0.81222	0.15020	0.0864
cb5	26	4	0.61538	0.63725	0.47129	0.4736
cb6	24	9	0.66667	0.85816	0.14208	0.0965
cb8	26	5	0.69231	0.65460	0.10297	0.0924
cb10	26	6	0.88462	0.77526	0.99495	0.9929
cb11	26	3	0.19231	0.27074	0.07604	0.0732
cb13	26	3	0.30769	0.27451	1.00000	1.0000
cb14	26	4	0.57692	0.70965	0.32149	0.3085
cb16	26	4	0.61538	0.59879	0.31970	0.3140
cb17	25	9	0.64000	0.82204	**0.02228**	**0.0388**
ev37	23	9	0.60870	0.80097	**0.00822**	**0.0271**
ev94	26	4	0.73077	0.66667	0.90129	0.9061
415/416	26	4	0.88462	0.73454	0.15119	0.1443
417/418	26	4	0.53846	0.66667	0.33178	0.3501
464/465	26	3	0.46154	0.56033	0.54366	0.5401
468/469	25	4	0.56000	0.66286	**0.03752**	**0.0498**
Mean		5.158	0.60042	0.64192		

Table 6F. Udskaya Guba Bay sample

Locus	**#Genot**	**#alleles**	**Obs.Het**	**Exp.Het.**	**P-value**	**P-value**

					Arlequin	**Genepop**
cb1	77	6(1)	0.58442	0.64850	0.20743	0.2140
cb2	73	4	0.17808	0.23581	**0.03337**	0.0549
cb3	66	7	0.65152	0.69165	0.08495	0.0887
cb4	77	9	0.75325	0.76513	0.86436	0.8169
cb5	77	6	0.79221	0.65733	0.08426	0.0902
cb6	66	9	0.62121	0.79904	**0.02000**	**0.0335**
cb8	77	6	0.68831	0.67397	0.45624	0.4709
cb10	75	7	0.65333	0.67096	0.68000	0.7607
cb11	76	3	0.22368	0.25837	0.23842	0.2271
cb13	76	3	0.18421	0.17184	1.00000	1.0000
cb14	77	4	0.71429	0.71615	0.97842	0.9780
cb16	76	5(1)	0.57895	0.64125	0.50465	0.5148
cb17	77	9	0.64935	0.80638	**0.02723**	**0.0383**
ev37	69	10	0.73913	0.78271	**0.02020**	0.0615
ev94	77	5	0.61039	0.63806	0.21673	0.2186
415/416	77	4	0.58442	0.73237	0.06594	0.0504
417/418	76	9	0.81579	0.78111	0.06931	0.1987
464/465	76	3	0.56579	0.56631	0.36881	0.3546
468/469	75	6	0.58667	0.64940	**0.01772**	**0.0161**
Mean		6.053	0.58816	0.62560		

Table 7. Allelic Richness per locus and population based on min. sample size of: 8 diploid individuals.

locus	Chkalov	Udskaya	Nikolaya	Ulbanski y	Tugurski y	All_W
cb1	3.320	3.911	4.000	3.498	3.484	3.624
cb2	2.638	2.349	4.000	2.986	2.759	2.733
cb3	4.619	5.007	5.000	5.049	4.915	4.990
cb4	6.185	5.235	8.000	4.877	6.282	5.507
cb5	3.626	3.782	5.000	3.532	3.756	3.710
cb6	5.807	5.840	6.000	5.896	6.807	6.011
cb8	4.667	4.328	3.000	4.293	4.207	4.353
cb10	4.201	4.555	4.000	4.676	5.104	4.632
cb11	2.577	2.376	1.000	2.215	2.245	2.379
cb13	2.155	2.045	2.000	2.026	2.429	2.109
cb14	4.146	3.901	4.000	3.964	3.896	3.955
cb16	3.442	3.875	4.000	4.140	3.767	3.866
cb17	5.807	5.899	6.000	5.537	6.037	5.833
ev37	5.590	5.845	5.000	5.790	6.367	5.827
ev94	3.857	3.850	4.000	3.898	3.508	3.855
415/41	3.932	3.924	4.000	3.924	3.926	3.915
417/41	5.662	5.639	5.000	4.576	3.508	5.180
464/46	2.958	2.750	3.000	2.700	2.782	2.784
468/46	3.895	3.471	3.000	3.492	3.528	3.547

Model-based clustering method shows extremely high level of heterogeneity of the total sample, but there is no any evidence that this heterogeneity is connectedwith different summering areas.

Table 8.
Estimated Ln Prob of Data for total data set testing different K by Admixture model. Length of burnin period 50 000, nubmer of MCMC reps after burnin 250 000, 3 iterations.

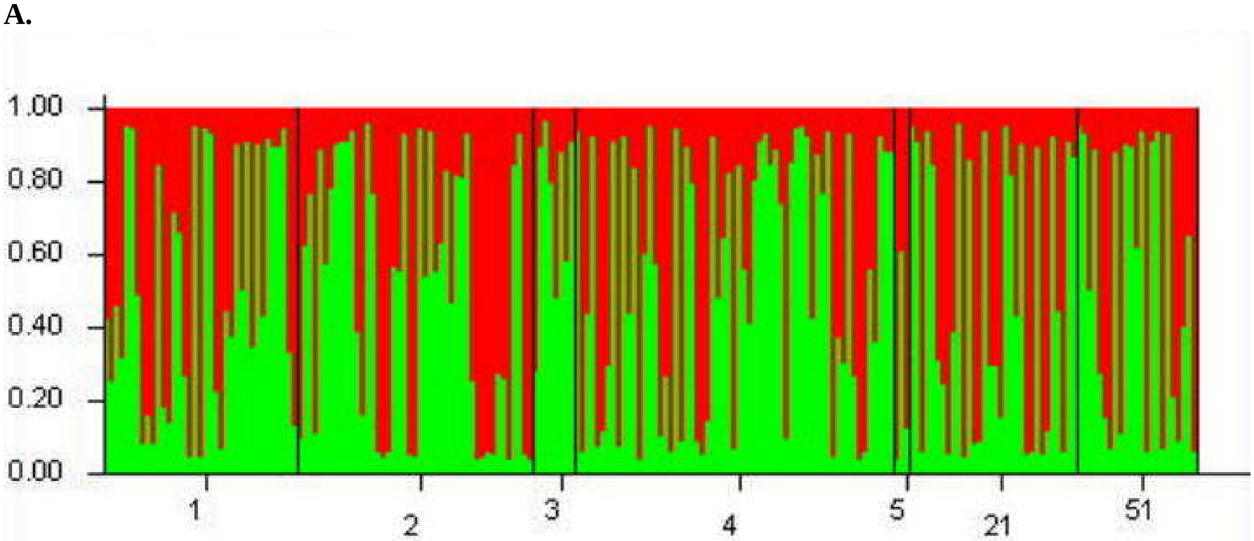
K	1	2	3	4	5	6
1st it-n	-10065.8	-9926.3	-9854.9	-9911.1	-10199.5	-9813.4
2nd it-n	-10065.5	-9922	-9851.2	-9888.9	-9838.9	-9815.6
3rd it-n	-10065.5	-9928.1	-9849.1	-9902.9	-9823.9	-9822.6
aver.	**-10065.6**	**-9925.47**	**-9851.73**	**-9900.97**	**-9954.1**	**-9817.2**

(Table 8 - continue)

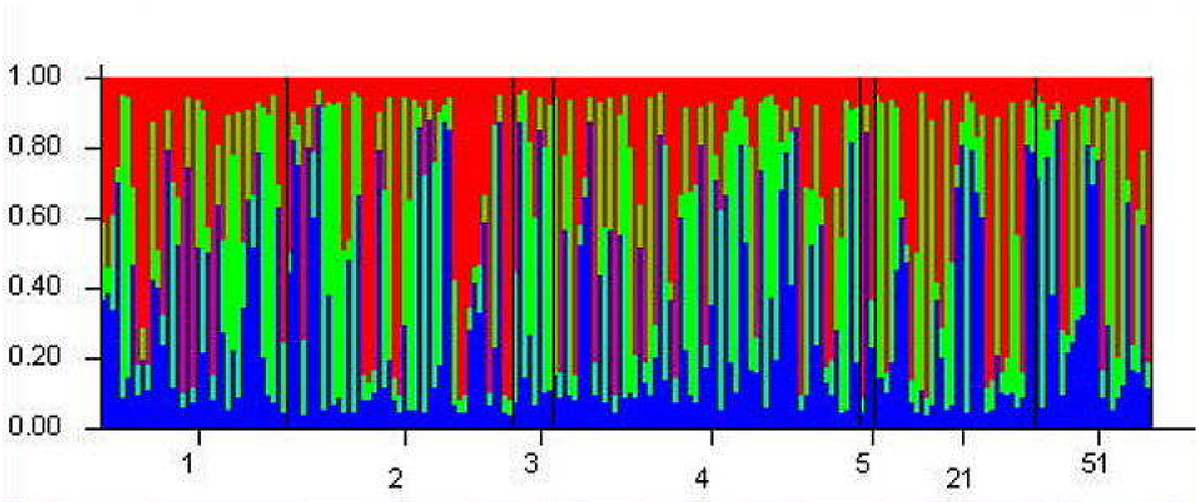
K	7	8	9	10	11	12
1st it-n	-9870.2	-10209.9	-10615.3	-10542.7	-10666.6	-10619.1
2nd it-n	-10457.4	-10274.5	-10224.4	-10483.2	-10529.1	-10588.2
3rd it-n	-9907.6	-10284.8	-10256.6	-10593.3	-10521	-10533.5
aver.	**-10078.4**	**-10256.4**	**-10365.4**	**-10539.7**	**-10572.2**	**-10580.3**

Figure 1. Bar diagram of probability (0-1) of individuals of the total sample to originate from *K* (number) different populations. Admixture model.
A. K=2
B. K=3
C. K=4
Samples: 1–Chkalov, 2 – Udskaya Bay before 2011, 21 – Udskaya Bay in 2011, 3 – Nikolaya Bay, 4 – Ulbanskiy Bay, 5 – Tugurskiy Bay before 2011, 51 – Tugurskiy Bay in 2011.
Note: the figures are also provided as K2.jpg, K3.jpg, and K4.jpg files

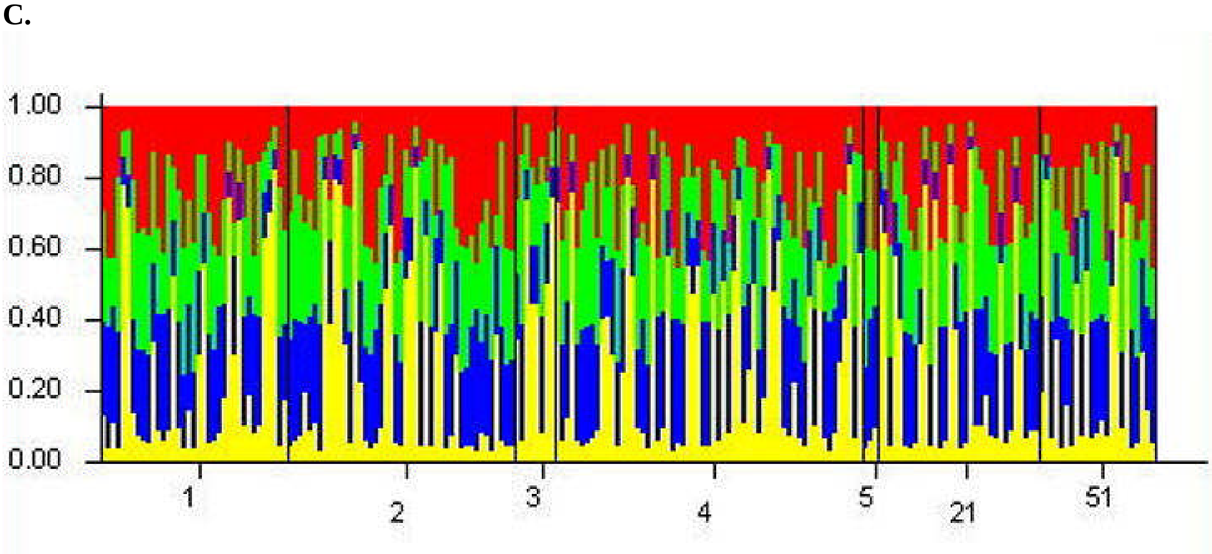
A.



B.



C.



Conclusion

All samples belong to a single population, probably subdivided into dems, but not into summering areas. Ulbanskiy Bay sample differs from Chkalov (Sakhalin bay) sample, but neither of these samples differs from any other.

Beluga (*Delphinapterus leucas*) Adult Life Expectancy: Wild Populations versus the Population in Human Care

Beluga (*Delphinapterus leucas*) Adult Life Expectancy: Wild Populations vs the Population in Human Care

Kevin Willis
Chair, Population Management Task Force
Alliance of Marine Mammal Parks and Aquariums

Life expectancy is a commonly used measure of the overall health and quality of life among human populations and within a human population over time (*e.g.*, the Center for Disease Control [2010], the World Health Organization [2011], and the Central Intelligence Agency [2011]). This measure can also be used for comparing the relative health and quality of life of populations of non-human animal species. The objective of this study is to use published values of life expectancy for beluga in the wild and beluga in human care to compare the relative health and quality of life of beluga in these two environments. There are two commonly used measures of life expectancy: the median and the average. The median life expectancy is the age to which 50% of individuals are expected to live. Thus, the median is the life expectancy of the typical individual. The average life expectancy is an estimate of how long individuals are expected to live on average. In most cases the average is greater than the median as it is more influenced by individuals that live very long lives.

Adult Life Expectancy of Wild Beluga

Determining the life expectancy of wild beluga is complicated by two factors. First, there are two hypotheses regarding the rate of deposition of tooth dentinal growth layer groups (GLGs). For many years, it was believed that two GLGs were deposited each year. Thus, the age of a wild beluga could be determined by removing a tooth, counting the number of GLGs, and dividing that number by two. This belief was based on a number of pieces of evidence including a comparison of teeth extracted from animals at the time of collection with other teeth extracted a number of years later [Sergeant 1973]. In later studies teeth were marked by treating beluga with tetracycline. Years later a tooth was removed and the GLGs formed subsequent to the treatment were counted [Brodie et al. 1990].

Stewart et al. [2006] concluded that only a single GLG was formed each year based on the radioactive signature of atomic bombs detonated in the late 1950s and early 1960s found in tooth GLGs of wild beluga. Although this result seems definitive, it does not directly refute the findings of earlier studies and does not address a possible difference in rates of GLG deposition in early age classes. A workshop held specifically to address this issue was unable to definitively conclude that the one GLG/year model was correct. Lockyer et al. [2007] stated that at the workshop "... it was not possible to reach consensus in the identification of GLGs or their deposition rates ..." but that "the results from this study clearly indicated that an annual deposition rate was most likely." Because the annual deposition rate is the more likely it will be assumed that it is correct in the calculations below. The implication is that the estimate based on one GLG/year should be considered the likely maximum age. That is, if it is later determined that multiple GLGs are deposited in some years then the estimates of adult life expectancy calculated below will be overestimates.

The second complicating factor for determining the life expectancy of wild beluga is that nearly all studies on the demography of wild beluga are based on estimated ages of beluga that were harvested. This creates a bias towards larger animals because typically only larger animals are harvested. This means animals in the first few age classes are under sampled or are entirely absent from the sample. The standard method for dealing with this bias is to assume that from a given starting age (usually one year) the probability of death is a constant. That is, the probability that a one year old beluga survives to its next birthday is the same as the probability that a 40 year old beluga survives to its next birthday. Thus, a single Annual Survival Rate (ASR) describes the survivorship of all animals over one year of age regardless of their age [DeMaster and Drevenak 1988].

Using the conclusion that one GLG/year is the more likely model alters the interpretation of demographic data in all studies of beluga published prior to 2006. The values reported in those publications must be updated to conform to the one GLG/year model. An ASR reported under the two GLGs/year model is actually an estimate of two year survival assuming the one GLG/year model is correct. Converting a two year survival rate into a one year survival rate (ASR) is accomplished by taking the square root of the reported value. The median adult life expectancy of an animal from a year of age can be calculated directly from the ASR value as *ln*(0.50)/*ln*(ASR), and the average adult life expectancy is calculated as -1/*ln* (ASR) [Seber, 1973].

Hobbs and Sheldon [2008] reviewed the literature on wild beluga demography and presented the ASR findings from five studies in their Table 2.3.3-1. Those reported values are presented in Table 1 below, along with a correction for a one GLG/year model and the corresponding median and average adult life expectancy.

Table 1: Adult Life Expectancy adjusted for a 1 GLG/year model from studies cited in Hobbs and Sheldon [2008].

Study	Reported ASR	ASR for 1 GLG/year	Median Adult Life Expectancy	Average Adult Life Expectancy
Oshumi, 1979	0.842	0.9176	8.06	11.63
Oshumi, 1979	0.905	0.9513	13.89	20.03
Braham, 1984	0.91	0.9539	14.70	21.19
Braham, 1984	0.92	0.9592	16.63	24.01
Burns and Seaman, 1986	0.9064	0.9521	14.11	20.37

Study	Reported ASR	ASR for 1 GLG/year	Median Adult Life Expectancy	Average Adult Life Expectancy
Beland, et al., 1992	0.96	0.9798	33.96	49.00
Beland, et al., 1992	0.97	0.9849	45.51	65.72
Lessage and Kingsley, 1998	0.935	0.9670	20.63	29.80

As seen in Table 1, there is large range in the estimates of median and average adult life expectancy reported in these studies. The reason is likely due to several factors including differences among the studied populations, sampling methodology (harvested versus stranded beluga), and the statistical methodologies used to derive the estimates. As an example of the latter, Burns and Seaman [1986] provided both an estimate of “mean annual mortality” as well as a life table. The life table approach yielded a value 50% larger than the value obtained by applying the ASR method to the same data. Beland et al. [1988, and reported again in Beland et al. 1992] based their estimate of ASR on the life table developed by Burns and Seaman [1986]. The life table approach to calculate an ASR likely led to values reported by Beland et al. [1988] and Beland et al. [1992] that appear well outside of the range of the other studies.

It should be noted that the review by Hobbs and Sheldon [2008] was not exhaustive. There are a number of more recent studies on the demography of wild beluga populations in which ASR is reported. For example, Heide-Jorgensen and Lockyer [2001] report ASR values for male and female beluga from populations in West Greenland and western Russia. Once adjusted for one GLG/year and converted into adult life expectancy, their estimates of the median age range from 4.4 to 10.8 years and estimates of the average age range from 6.3 to 15.6 years. This particular study is cited as it suggests that some of the variation in estimates of median life expectancy among studies (as seen in Table 1) may arise from natural variation among studied populations and between the sexes.

There is no single definitive answer to the question "What is the adult life expectancy of beluga in the wild?" It does not make sense to simply take an average of the values reported by Hobbs and Sheldon [2008] because the selection of studies could have a greater bearing on the outcome than the variable of interest (the general health and quality of life of wild beluga). Omitting the studies that reported the lowest [Oshumi 1979] and highest [Beland et al. 1992] values in Table 1 as being probably non-representative suggests that most wild populations would have a median adult life expectancy of somewhere between 15 and 21 years, and an average life expectancy of between 21 and 30 years. Note that the median and average values reported in Table 1 differ considerably. This difference is likely in part an artifact of the assumption that annual survival rates are constants. If the probability of survival decreases with advanced age in beluga populations (as it does in human populations), then the average based on the ASR method will be an overestimate.[1] On the other hand, the median would be largely unaffected. Therefore, the estimate of median life expectancy is likely to be the more accurate measure.

Adult Life Expectancy of Beluga in Human Care

Even though life tables are frequently used for demographic analysis of populations of animals in human care, to be directly comparable to estimates for wild beluga the ASR methodology must also be used for the population of beluga in human care. Estimation of life expectancy of beluga in human care is more straightforward than is the case for wild beluga. The complication of biased sampling resulting from harvesting beluga is not a factor, nor is the issue of one versus two tooth GLGs/year. The ASR method for animals under constant

[1] When calculating life expectancy from the Annual Survival Rate there is theoretically no maximum age limit. Although the calculated probability of a beluga living to, for example, 100 or more years is extremely small, it does add to the average life expectancy. In calculating a median the magnitude of the individual lifespans are not used. Therefore, the median life expectancy is not influenced by these only theoretically possible (i.e., never observed) life spans.

observation requires no estimate of the age of animals. All that is needed is the number of years each animal over the age of one year lived in human care and whether or not the animal is still alive.

Data on the population of beluga in human care in the United States are available in the National Marine Fisheries Service (NMFS) Marine Mammal Inventory Report (MMIR). These data have been used by many researchers to estimate the life expectancies of several marine mammal species. Table 2 contains the results of four studies on life expectancy of beluga in human care.

Table 2: Estimates of adult life expectancy obtained from analysis of data in the NMFS MMIR.

Study	Time Period	Reported ASR	Median Life Expectancy	Average Life Expectancy
DeMaster and Drevenak, 1988	1973-1985	0.94	11.20	16.16
Small and DeMaster, 1995	1973-1992	0.954	14.72	21.24
Woodley et. al, 1997	1973-1994	0.946	12.48	18.01
Innes et. al, 2005	1973-2003	0.97	22.76	32.83

Conclusion

There is very high variation in the estimates of life expectancy among studies of wild beluga populations for numerous reasons. Therefore, presenting a single estimate as being representative is not reasonable. The median life expectancy in wild beluga populations is likely between 15 and 21 years and the average life expectancy is likely between 21 and 30 years. Because all studies of beluga in human care are based on the NMFS MMIR, the estimates among studies are much more consistent. The range of values from those studies is almost identical to those reported for wild beluga. The range in median life expectancy for belugas in human care is from 11 to 23 years and the range for average life expectancy is 18 to 33 years. There is in fact complete overlap in these ranges. Therefore, based on life expectancy as a measure of the general health and the quality of life in a population, wild beluga and beluga in human care are effectively identical.

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Modeling the Population of Belugas (*Delphinapterus leucas*) in Alliance of Marine Mammal Parks and Aquariums Member Facilities

Modeling the Population of Belugas (*Delphinapterus leucas*) in
Alliance of Marine Mammal Parks and Aquariums Member Facilities

Kevin Willis
Chair, Population Management Task Force
Alliance of Marine Mammal Parks and Aquariums

Modeling how a population is likely to change in size over time is important for the responsible management of a population. Models allow determination of the likelihood that the population will persist over time. Models are used to plan the number births necessary to meet population size objectives. Models are used to determine whether and how many animals may need to be imported to stabilize a population. Models of growth of populations in zoos and aquariums are typically developed based on the history of the population: starting from the current population age/sex structure and projecting trends into the future using the historical population survival and fecundity rates. The objective of this study is to develop a model of the population of beluga in Alliance of Marine Mammal Parks and Aquariums (AMMPA) member facilities to determine whether the current population has the capacity to increase in size.

Modeling the future of the population of belugas in AMMPA member facilities is challenging because there have been relatively few belugas in human care. Small population size can result in significant gaps in the necessary data. As an example, based on the North American Regional Studbook for beluga [Woodie, 2011], nine year old beluga males in AMMPA facilities have a 100% chance of living until they are twelve years of age. What this really means is that no males have died between the ages of 9 and 12 in AMMPA member facilities. However, there is no biological reason to presume that this observation will be a valid description of beluga demography: given more time and a larger population a low rate of mortality in each age classes is expected. Therefore, instead of using the population data "as is" in the model, the data from the population will be altered to fit biological expectations and assumptions.

In addition to assumptions made necessary by small sample size there are also general assumptions necessary for the model. For example, the model used projects forward 30 years, and it is assumed that the age specific fecundity and survival rates are constants during that time period. Is this a realistic assumption? Innes et al [2005] examined the annual survival rates (ASR) in populations of nine marine mammal species in human care in the US over time. In six of the nine species the ASR increased significantly over the 30 year time period from 1973 to 2003. The three species that did not exhibit significantly increased survival rates were, not coincidently, species with some of the smallest total population sizes, beluga among them. A smaller sample size makes it more difficult to detect statistically significant change. That a significant difference was not detected does not mean that over time there has not been an increase, and given that the annual survival rates increased significantly in 6 of the 9 species studied suggests the rate will increase for all species over time.

It is also assumed that facilities will want to continue to exhibit beluga over the next 30 years. As of 30 March 2011 (the currentness date of the studbook data), the beluga population was composed of 37 animals in seven AMMPA member facilities. The maximum population size of 40 belugas was attained in the early 1990s, before the large facility at the Georgia Aquarium was built. It is not possible to know the number of beluga “spaces” in AAMPA facilities 30 years from now. No maximum population size was used in the model as this population has relatively low growth potential, and thus it is assumed that the current and possible future facilities that care for beluga would make space if the population was increasing.

When assumptions are violated there are consequences for the results of the model. In the case of the assumption that survival rates are constants, it is likely that the predicted future of the population will be somewhat pessimistic. That is, the real population is likely to have a more positive growth rate than is predicted by the model as the survival rates will likely increase over time.

Methods

The model used is an individual-based simulation. The model starts with the current population of 37 belugas listed as living in AMMPA member facilities in the 2010 North American Beluga Studbook [Woodie, 2011]. The model uses the current age, sex and reproductive status of each animal (with the exception of current pregnancies which are not reported in a studbook). Each “year” in the model the survival and fecundity rates described below are applied, and the model is continued for 30 years. Unlike a deterministic model which produces a single population trajectory, in individual based simulation the events of birth and death in the model are based on probabilities and occur randomly. Each time the model is run there is a different outcome and therefore a different population trajectory. Each run of the model, which starts with the current population of 37 beluga, is called an iteration. One thousand iterations of the model were conducted so that the likely range of population sizes over time could be determined.

Survival

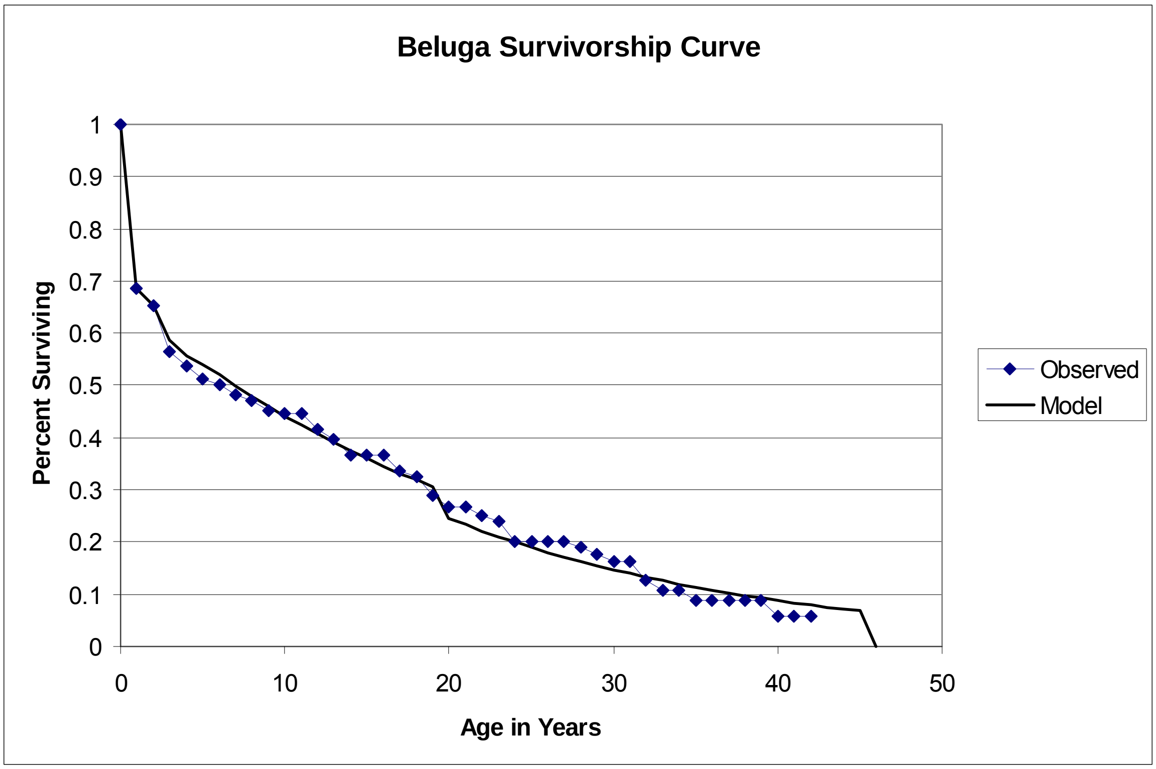
Because the North American beluga population is relatively small there is considerable variation in year to year survival. For the model the observed annual survival rates from the studbook data were first converted to life expectancies and then smoothed (Figure 1). The resulting “smoother” survival curve will more likely reflect annual survival rates once many more animals are born and die in the population.

Table 1: Survival Characteristics built into the model

	Comments
Males and Females	Although with additional data it may be that male and female survivorship curves will be found to differ; in the studbook there is not a significant difference.
Calf Survival	The studbook contains complete data (i.e., including stillbirths) from 1 January 1990 to the present. The observed first year survival including stillbirths in that time frame is 69%, and that is the value used in the model.

Age 1 to 2 Survival	95% - see Figure 1
Age 2 to 3 Survival	90% - see Figure 1
Age 3 to 20 Survival	96% per year - see Figure 1
Age 21 to 45 Survival	95% per year - see Figure 1
Life Span	The current longevity record is over 42 years of age, and this individual is still living. It was assumed that the maximum age for both males and females is 45.

Figure 1: Observed and modeled life expectancy with male and female data averaged. Model data are described in the Table 1.



As noted in the Table 1 it is assumed that male and female age specific survivorship does not differ. Based on the studbook data the median life expectancy for females is approximately 4 years longer than for males, but this difference is not statistically significant. Also, although the oldest animal in the studbook is a currently living 42 year old female, the oldest male is also currently living and is 41 years old. At this point there does not appear to be a difference in longevity between the sexes. What the longevity will be is not known, and the 45 years of age used in the model may eventually turn out to be a significant underestimate. As with all data and assumptions in a model, additional data and information can make the results of the model more accurate.

While it is not currently possible to set longevity based on data in the studbook, there are numerous studies of wild beluga populations that do estimate longevity. Estimates of longevity vary considerably, with reported estimates as high as 70 years.

The question then becomes what would be the impact on the capacity of the population to grow if longevity is underestimated by as much as 25 years? As will be seen in the Reproductive section below, it is assumed that there is reproductive senescence in beluga, with 35 years of age as the maximum at which a female could become pregnant. This means that while the total population size will be slightly underestimated in the model by assuming all animals have died by 45 years of age, the capacity of the population to grow is not affected because the capacity to grow is determined by the number of reproductive age females. If with additional data it is determined that 35 years is not the maximum age of reproduction in beluga, then the capacity of the population to grow will have been underestimated.

Reproduction

As with the survival data, the small sample size results in highly variable estimates of annual fecundity. Instead of smoothing the fecundity data as was done for survival data, it was assumed that females have a reproductive age period, and the probability of becoming pregnant is a constant throughout that period. Information on the youngest and oldest ages of giving birth, inter-birth interval, etc in Table 2 came primarily from the studbook data.

In not using age specific fecundity it becomes necessary to use a pregnancy rate. The pregnancy rate in this model is a percent of available females that become pregnant each year. Available females are defined as reproductive age females that are not already pregnant and do not have a calf less than three years of age. Each “year” in the model available females have a pre-set probability of becoming pregnant, and that probability is based on the past 5 years of data in the studbook.

Over the past 5 years there have been on average 3.2 births per year in this population. For the size of the population, which has been between 19 and 23 reproductive age females during that time, this number of births annually corresponds to a 45% reproductive rate. Note that this does not mean that only 45% of females are actively reproducing, it means that each year 45% of available females become pregnant. If fact, the 45% rate requires that nearly 60% of females in the population be either pregnant or have a calf under the age of 3 years age at any given time.

The model used the historical survival and fecundity rates to project future population growth. The estimates of future population sizes should therefore be interpreted as the likely population size if the population continues to be managed as it has been in the past. This means the addition of animals by importation would increase the total population size, but would not change the pre-set age specific survival or pregnancy rates. With only 45% of available females becoming pregnant each year, there is considerable potential to increase the rate of growth in this population.

Table 2: Reproductive characteristics built into the model

	Comments
Males	Although at times some facilities have had belugas of only one sex, the model treats this as a single population and it is assumed that a male will always be available to impregnate a female. This assumption is not unreasonable given that all

	facilities currently house both sexes and the growing successful use of artificial insemination in cetaceans.
Females: Reproductive ages	In the studbook the youngest age at which a female produced an offspring is 7 and the oldest is 33; although it should be noted those females were collected from the wild and thus their ages were estimated. It is likely that the oldest age of reproduction is higher than 35. In the model females can become pregnant from 6 to 35 years of age, thus they can give birth from 7 to 36 years of age.
Females: Gestation time	The model is an annual model, and for simplicity gestation time was set for 12 months. This is 2 to 3 months shorter than the actual gestation time, but the impact of this is accounted for in the inter-birth interval.
Females: Twinning	Although there is one reported case of twins, the model assumes a pregnancy will produce only a single offspring.
Females: Inter-birth Interval	A female in the model can become pregnant again when her calf is 3 years of age and thus the inter-birth interval is 4 years. If her calf does not survive a female can become pregnant the following year. This inter-birth interval roughly matches what is observed in the studbook. In a few cases the inter-birth interval after a successful calf was less than 4 years.
Calves:	It is assumed that the birth sex ratio is 50:50 male:female. The observed ratio of 55:45 based on 47 offspring of known sex is not significantly different than 50:50.
Calves:	In the model if a pregnant female dies the calf will not be born, and if a female with a one-year old calf dies her calf will also die.

Results

The model output in each of the 1,000 iterations includes the population size each year. Figure 2 contains the data for twenty iterations of the model which starts with the current population (age and sex of each animal) and projects forward thirty years. It should be noted that no females in the model are initially considered pregnant, and thus the population cannot increase from the first year to the second. If there are currently pregnant females in the population this would cause an initial underestimate of population growth potential. The data in Figure 2 should be considered the baseline.

As can be seen in Figure 2 there is considerable variation among the twenty iterations of the model. This is typical for populations as small as the North American beluga population. In order to better see the likely trend, Figure 3 shows the average population size per year over the 1000 iterations of the model. The High and Low values in Figure 3 are the 95% interval, that is, for each year 95% of the 1,000 population sizes fell between the high and low values.

Figure 2: Twenty iterations of the baseline model of the beluga population. Year 1 has the current population of 37 animals.

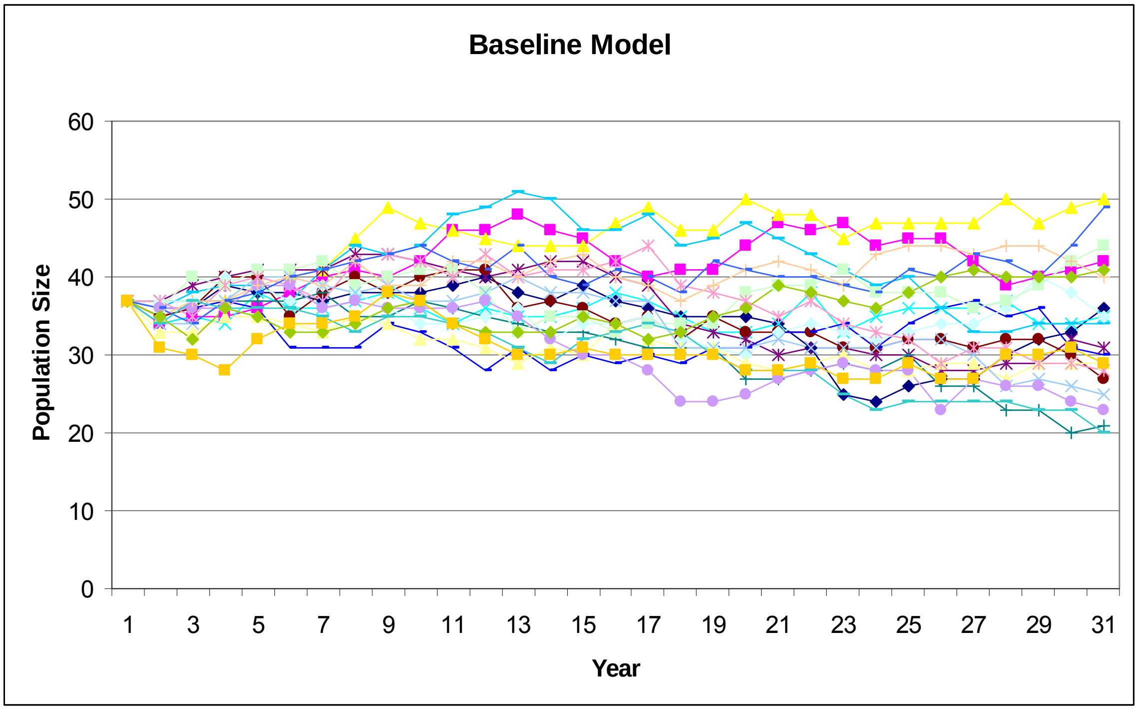
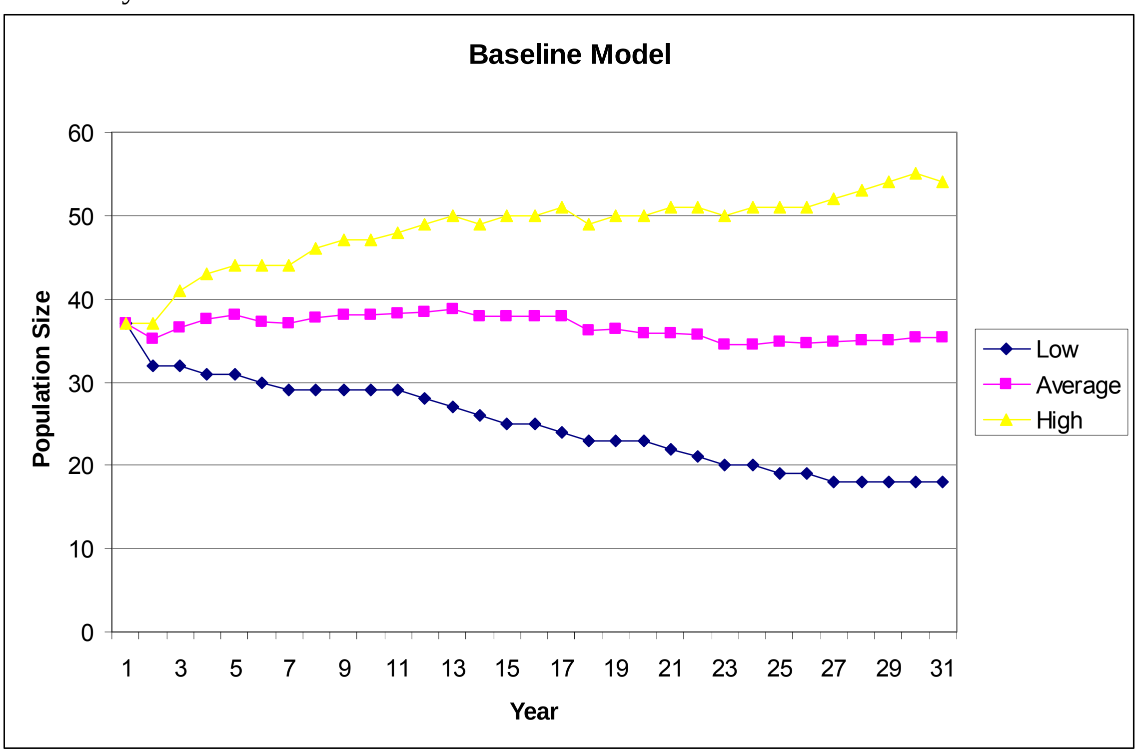
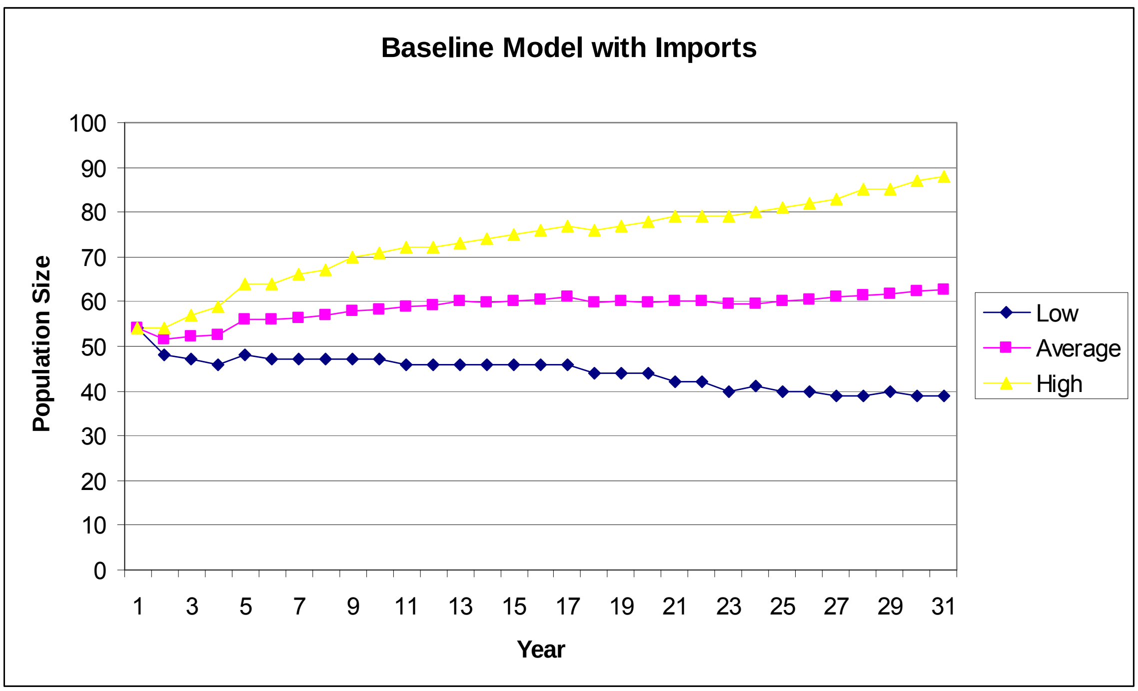


Figure 3: Starting with the current population of 37 animals, the population is projected to remain between the High and Low value 95% of the time, with the average being the most likely result.



The average line in Figure 3 suggests that if the reproductive rate remains constant this population will remain quite stable in size; however, this also means that in about 50% of the iterations the population declines over time. The reproductive rate for the past 5 years was higher than any time in the history of the captive population. This rate will need to be sustained indefinitely if this population is to persist. If a 45% reproductive rate is the maximum that can be achieved, this does not necessarily indicate that there is only about a 50% chance this population will persist well into the future. There is another, shorter-term reason why a population may not increase in size over time: too few reproductive age females in the current or starting population. In order to determine whether the lack of population increase could be attributed to too few reproductive age females, 17 animals were added to the current population: 6 males and 11 females, all 5 years of age.

Figure 4: The projected population size over time using the baseline scenario of a 45% reproductive rate but adding 6 male and 11 female 5-year old animals to the current population.



In Figure 4 the population appears to have a better than 50% chance of persisting as the average annual trend line indicates a slowing increasing population. As all of the new females are 5 years old at the start of the model, by 30 years they will be considered post-reproductive. Despite that, the population is projected to continue to increase. This suggests that the current demography of the population is in fact preventing population increase in the shorter-term.

Discussion

As of March 30 2011 the beluga population in AMMPA member facilities was 37 animals: 12 males and 25 females. The model projects that if the population continues to be managed as it has been for the past five years there is a 56% probability that the population will be smaller in 30 years than it is today. Part of the reason for this is that the current population has two females that are considered post-reproductive in the model and 10 more females are at least half way through their reproductive age period. Although in none of the 1,000 iterations of the model did the population completely die out, this is largely a function of the model duration: 30 years is not that long a time period relative to the life expectancy of the species. What is clear is that without change there is a high probability that this population will age and slowly decline over the next 30 years.

The situation is much improved if young animals are added to the population. There was a 74% probability that the population size in 30 years will be greater than the post-import population size of 54. Note that the importation did not change any of the age specific survival or reproductive values. The projected slight decrease over 30 years in the baseline model was therefore largely a function of the current age and sex structure of the population. If the baseline model were to have been run for many more than 30 years, the population would have eventually started to increase on average as the population attained a stable age structure. Sustainability in the very long term even without importation is therefore a possibility; however, increasing the number of years the model was run would also show that there is a probability that the population would have completely died out. Thirty years is a long time to be risking a permanent population decline. An importation now would have a very good chance of reducing that risk to a very low level.

Conclusions

On average the population of beluga in AMMPA member facilities is projected to decline at a slow rate over the next 30 years; although this is not a certainty. The likely decline is not the result of an insufficient rate of reproduction or of low survivorship. The current age/sex structure of the population essentially prevents the population from increasing. This result was demonstrated by adding a number of young animals to the population, which lead to an on average increase in the population size.

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Addendum to Modeling the Population of Belugas (*Delphinapterus leucas*) in Alliance of Marine Mammal Parks and Aquariums Member Facilities

Addendum to:

Modeling the Population of Belugas (*Delphinapterus leucas*) in
Alliance of Marine Mammal Parks and Aquariums Member Facilities

The major finding of the population modeling is that while the historical age/sex specific birth and death rates would be sufficient to maintain the population at some level, the current population's age/sex structure will very likely impede a population increase for at least the next 30 years. Without importation of young animals, the current population is likely to slowly age and decrease. Importation of young beluga significantly increases the probability that the population will grow beyond the post-importation population size over the next 30 years. The Georgia Aquarium is proposing to import eighteen belugas: eight males and ten females, ranging in age from 2.5 to 12.5 years of age.

The age and sex of each of the 18 animals the Georgia Aquarium proposes to import were added to the model input file with the same information on the 37 animals currently in the North American population. The information on the 18 animals proposed for import is given in Table A1. As can be seen in Table A1, although the animals range in age from 2.5 to 12.5, the average age is approximately 5.5, quite close to the age of the animals used in the model. Therefore, the results of the model using these animals can be expected to be very similar to the results of the model using 17 5-year old animals.

Figure 1A is a graph of the projected population size using the ages of the animals proposed to be imported by the Georgia Aquarium analogous to Figure 5 in the Report. As can be seen in Figure A1, the average line shows positive growth over the 30 year period. In 714 of the 1,000 iterations of the model (71.4%) the population size after 30 years was larger than the post-importation population size of 55 animals.

Table A1: Known information regarding the belugas proposed for importation with age estimated based on lengths and weights.

Sex	Length (cm)	Age Range Est. (1/1/12)
Male	266	2.5
Male	262	3.5
Male	273	3.5
Female	320	7.5
Female	240	2.5
Female	352	10.5
Female	294	6.5
Male	274	3.5
Male	290	4.5
Male	330	7.5
Male	322	7.5
Female	240	2.5
Female	292	4.5
Female	248	2.5
Female	270	3.5
Male	274	3.5
Female	380	11.5
Female	395	11.5

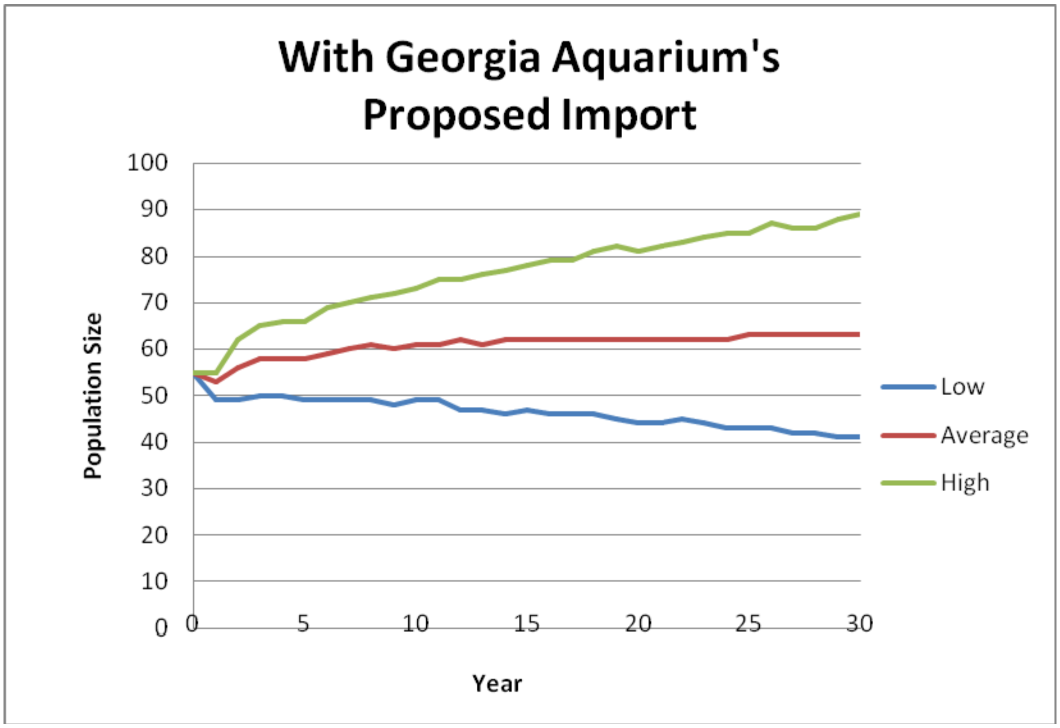
The 71.4% value obtained is very close to the 74.1% value obtained in the model using 11 females and 6 males all of 5 years of age. This difference is very small and is within the margin of error given the sample size of 1,000 iterations. The fact that there was one less female than was modeled previously likely had little to no impact because 5 of the females in the proposed import are currently of reproductive age, while all of the imported females in the model were one year younger than reproductive age. Therefore, quicker initial population growth compensated for one less female.

Conclusion

An importation of young animals, and in particular females, is necessary to help prevent the aging, decrease in size, and potential loss of the current population of beluga in North

American facilities. The importation proposed by the Georgia Aquarium is sufficient to greatly increase the probability that the North American beluga population will increase in size so that it can be managed for demographic stability.

Figure A1: The projected population size over time using the baseline scenario of a 45% reproductive rate adding the 18 animals proposed for import by the Georgia Aquarium listed in table A1.



APPENDIX G
THE SEA OF OKHOTSK MARINE ENVIRONMENT

Contents

Figures

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees °Fahrenheit
IUCN	International Union for Conservation of Nature and Natural Resources
PICES	North Pacific Marine Science Organization
UNEP	United Nations Environmental Programme

Chapter 1
Physical Characteristics

The Sea of Okhotsk (Figure 1) is a marginal sea separated from the Pacific Ocean by Kamchatka Peninsula, the Kuril Islands, and Hokkaido Island, and from the Sea of Japan by Sakhalin Island. It reaches a width of 1,500 kilometers (932 miles) and a length of 2,463 kilometers (1,530 miles) (United Nations Environmental Programme [UNEP] 2006). The Sea is surrounded by mountainous topography, with areas of low elevation occurring mostly along the Kamchatka coast, the Amur delta, and the Penzhinskaya Gulf (UNEP 2006). This mountainous topography provides the Sea of Okhotsk with varying depths, averaging around 821 meters (2,694 feet), and reaching a maximum of around 3,521 meters (11,552 feet) (Alekseev and Bogdanov 1991 in UNEP 2006; Dobrovol'sky and Zalogin 1982 in UNEP 2006). The 1.6 million-square-kilometer (618,000 square-mile) Sea overlays and essentially defines the Okhotsk tectonic plate, which is being compressed and extruded by the surrounding North American, Pacific, Eurasian, and Amurian plates. Kamchatka Peninsula and the over 20 islands making up the Kuril Archipelago are products of the subduction of the Pacific Plate under the Okhotsk Plate and together form a section of the "Pacific Ring of Fire."

The Sea of Okhotsk is composed of three parts: the shallow northwestern continental shelf, the deep Kuril Basin, and the continental shelf connecting the two. Although the Sea of Okhotsk has several deep water areas, roughly 40% of the water is within the shelf zone (Larina 1968 in Radchenko et al. 2010). Because of the combination of a productive shelf and the upwelling of deeper waters, the Sea of Okhotsk is one of the most productive seas in the world. The vertical mixing of nutrient-rich waters is most intense in the fall and winter, providing for high levels of productivity during the following spring months (Radchenko et al. 2010). In the western Sea of Okhotsk, biological productivity is also high during fall and winter months. Productivity in this area is highly influenced by the nutrients flowing into the sea from the Amur River (Andreev and Pavlova 2010 in Radchenko et al. 2010).

Significant hydrological interchange between the Sea of Okhotsk and the Pacific Ocean occurs via channels intersecting the Kuril Islands. Two of these channels, the straits of Bussol and Krustenstern, are approximately 2,000 meters (6,600 feet) deep as they connect the 2,500-meter-deep (8,200-feet-deep) Kuril Basin of the southern Sea of Okhotsk with the 10,000-meter-deep (32,800-feet-deep) Kuril-Kamchatka Trench in the North Pacific. Pacific water generally flows into the Sea of Okhotsk through the more northern Krustenstern Strait, forming a large, cyclonic (counter-clockwise) gyre in the Sea, and then exiting to the Pacific Ocean through the Bussol Strait. This gyre is modified in the north by cold water from the Siberian mainland.

Flow from the Sea of Japan also enters the Sea of Okhotsk from the relatively shallow Sakhalin and Soya Straits. The Soya Strait, which separates Sakhalin and Hokkaido islands, brings a strong warm water flow (the Soya Warm Current) into the Kuril Basin during the summer months. The West Kamchatka Current directs a northward cyclonic circulation pattern in the northeastern section of the Sea of Okhotsk, and the East Sakhalin Current directs a southward cyclonic circulation pattern in the western portion of the sea (Leonov 1960 in Radchenko et al. 2010; Moroshkin 1966 in Radchenko et al. 2010; Kitani 1973 in Radchenko 2010; Favorite et al. 1976 in Radchenko 2010). The flow rates of currents increase in the autumn. In the winter, currents flow south and southwest in areas that are free of sea ice.

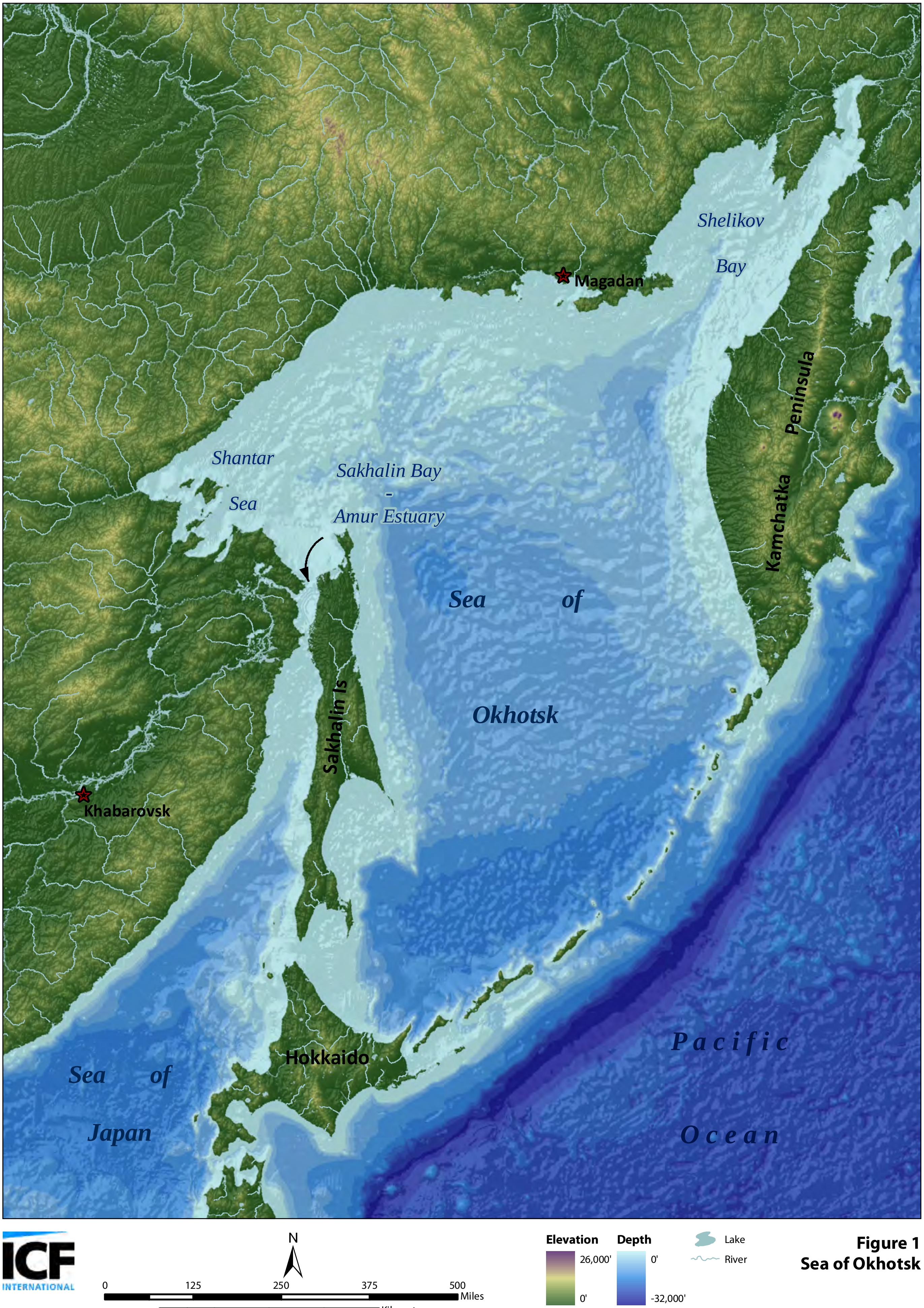


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Figure 1
Sea of Okhotsk

Although the Sea of Okhotsk occurs at temperate latitudes, it is considered a sub-Arctic sea, and is referred to as the "coldest of the Far-Eastern seas" (UNEP 2006). The winter is long and severe, with frequent wind and snow storms, especially in the northern Sea of Okhotsk. In the summer, high precipitation rates, mist, and fog are normal. The spring and autumn seasons are short and cold with frequent overcast skies (UNEP 2006). High precipitation rates are attributed to the monsoonal climate, while prevailing winds are attributed to both mainland Siberian winds and cyclones that traverse across the Sea of Okhotsk throughout the year. Average air temperatures in July range from 8 to 16 degrees Celsius (°C) (46.4 to 60.8 degrees Fahrenheit [°F]), while temperatures in January range from -32 to 8 ˚C (-25.6 to 46.4 ˚F) (Rostov et al. 2002 in UNEP 2006). The cold period lasts 120 to 130 days and 210 to 220 days in the south and in the north of the region, respectively (Rostov et al. 2002 in UNEP 2006).

In general, the southern Sea of Okhotsk is much warmer than the northern portion, which is cooled by the melting of seasonally extensive sea ice and by freshwater input from the Siberian mainland. However, extensive mixing during certain summer months may interrupt this temperature pattern. Average annual surface water temperatures are 5 to 7 °C (41 to 44.6 ˚F) in the north and 2 to 3 °C (35.6 to 37.4 ˚F) in the south (UNEP 2006). From May to November, average monthly water temperatures remain above freezing (UNEP 2006). Surface water temperatures drop to -1.0 to -1.8 ˚C (30.2 to 28.8 ˚F) in the late winter months (February and March), resulting in large formations of sea ice. In the Sea of Okhotsk, there is significant variability in water temperature between surface and sub-surface areas. The Sea is characterized by a layer whose core is -2 ˚C (28 ˚F) because of severe cooling on the northern shelf in winter. This cold intermediate layer can persist throughout the warm season and it is a feature unique to the Sea of Okhotsk (Radchenko et al. 2010).

During the summer months (May to September), 2 to 5 meters/second (5 to 11 miles/hour) winds from the south prevail, and can intensify to 20 meters/second (45 miles/hour) or greater during typhoons or cyclones. During the winter months, 5 to 10 meters/second (11 miles/hour) winds from the north prevail. Wind direction and speed differ across the sea, with maximum wind speeds reaching 25 to 30 meters/second (56 to 67 miles/hour) in the northeastern and western areas, 30 to 35 meters/second (67 to 78 miles/hour) in the eastern and central portion of the sea, and greater than 40 meters/second (90 miles/hour) in the southern portion of the sea (UNEP 2006).

The cold prevailing winds from the Siberian mainland result in severe winters and seasonal ice coverage similar to the Bering Sea. Significant ice coverage occurs between December and April with peak coverage in late February or early March when approximately 50% to 90% of the Sea of Okhotsk is ice covered. This period of annual ice coverage can last from a minimum of 110 to 120 days in the south, to a maximum of 290 days in the northwestern portion of the Sea (UNEP 2006). During exceptionally cold winter months, sea ice can cover up to 99% of the sea. Milder winter weather generally results in ice coverage of roughly 65% (UNEP 2006). Ice coverage first forms over the northwestern shelf and then moves southward. The same prevailing winds that bring cold temperatures also form coastal polynas (areas of open water amongst sea ice), via divergent ice drift, over the northwestern shelf. Other polynas, such as the large Kashevarov Bank polyna, are formed by strong internal tides. These polynas are important for the winter survival of local marine mammals and seabirds, especially in the northern portion of the Sea of Okhotsk. In addition to coastal polynas, the Sea of Okhotsk has an open water region near the western coast of Kamchatka (Radchenko et al. 2010). Although the Sea of Okhotsk has a large annual extent of sea ice, air-temperature increases documented over the past 50 years caused ice coverage in the sea to decrease by roughly 20% in the last 30 years (Radchenko et al. 2010).

Chapter 2
Ecological Characteristics

Because of the Sea of Okhotsk's productivity, temperate latitude, and southern tropical and northern polar influences, it supports a high variety of marine mammal species. At least 20 species of cetaceans (Doroshenko 2002) and seven species of pinnipeds (Trukhin 2009) inhabit the Sea, including temperate species such as harbor seals (*Phoca vitulina*) and sperm whales (*Physeter macrocephalus*), and Arctic species such as bowhead whales (*Balaena mysticetus*), beluga whales *(Delphinapterus leucas*), and ringed seals (*Pusa hispida*). Other cetacean inhabitants of the Sea of Okhotsk include the fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), humpback whale (*Megaptera novaeangliae*), gray whale (*Eschrichtius robustus*), northern Pacific right whale (*Eubalaena japonica*), orca (*Orcinus orca*), Dall's porpoise (*Phocoenoides dalli*), harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), bearded seal (*Erignathus barbatus*), spotted seal (*Phoca largha*), and the Baird's beaked whale (*Berardius bairdii*) (Radchenko et al. 2010). Eleven species listed as endangered by the International Union for Conservation of Nature (IUCN) are found within the Sea of Okhotsk, including the critically endangered Western Pacific gray whale (UNEP 2006). Over 60 species of mesopelagic fish inhabit the Sea of Okhotsk, with many of them being important components of regional food webs (North Pacific Marine Science Organization [PICES] 2004; UNEP 2006).

Biological resources in the Sea of Okhotsk face pressure resulting from fishing, oil and gas exploration, and pollution. Oil and gas exploration efforts occur throughout the Sea of Okhotsk, but are especially intense around Sakhalin Island. These activities are potential sources of environmental degradation and the risk of an oil spill has increased directly with the growth of the oil and gas industry in the region. Oil and gas exploration has disturbed roughly 40% of important salmon spawning grounds on the north side of Sakhalin Island (Heileman and Belkin 2010). Associated intentional and unintentional releases of oil and chemical products, as well as increases in associated ship traffic, pose threats to marine mammals in the region (UNEP 2006). The toxic waste products of drilling and oil production on the Sakhalin shelf are often discharged directly into the Sea in violation of Russian law, which causes changes in the structure of the benthic community (Shuntov 2001 in Heileman and Belkin 2010).

Contaminants and pollution entering the Sea of Okhotsk from the Amur River may also affect the biological resources of the Sea. A variety of heavy metals have been documented in the Amur River and, in 1997, fish caught in the lower Amur with tissue concentrations of cadmium, mercury, arsenic, and zinc exceeding allowable levels were documented (UNEP 2006). Barite, a chemical used in oil and gas exploration efforts, and wastewater from oil and gas drilling efforts is also found in the Sea of Okhotsk (UNEP 2006). In addition to pollutants, oil and gas exploration and drilling efforts increase turbidity within the water column. Studies in Russia estimate that suspended materials can be dispersed up to 40 kilometers (25 miles) from planned drilling platforms. This increase in turbidity can cause fish to alter their migration patterns in an attempt to avoid highly turbid waters (Gorbunova 1988 in UNEP 2006).

Chapter 3
Socioeconomic Characteristics

The population of the Okhotsk Sea sub-system, as defined by UNEP[11] (2006) is approximately 8.7 million, with approximately 2.7 million in Russia and approximately 6 million in Japan. The Russian coast—with the exception of Sakhalin Island—has a very low population density of approximately 1.5 people per square kilometer (3.9 people per square mile) (UNEP 2006). Yuzhno-Sakhalinsk, Magadan, Nikolaevsk-on-Amur, and Okha are the only Russian cities in the Okhotsk Sea sub-system with a population greater than 60,000 people (UNEP 2006). The Russian coastal areas of the Sea of Okhotsk have developed fishing, mining, and oil and gas industries.

The Sea of Okhotsk contains 46% of all marine biological resources in the northern Pacific and, with approximately 340 fish species, is considered one of the richest fisheries in the world (UNEP 2006). The Sea contains roughly 11 million metric tonnes (12.13 million tons) of biological resources, including approximately 7 million metric tonnes (7.7 million tons) of cod, 2.5 million metric tonnes (2.8 million tons) of herring, and about 1.5 million metric tonnes (1.6 million tons) of other seafood (Shuntov 2001 in UNEP 2006). The Sea's fishing industry is found in the cities of Kamchatka, Magadan, Okhotsk, Ayan, and Nikolaevsk-on-Amur (UNEP 2006).

Fishing activities by foreign fleets exacerbate the effects of the Russian fishing industry on fish stocks in the Sea of Okhotsk, causing certain fish stocks to become depleted or severely depleted throughout the Sea. Fish catches in the Sea have declined by one-third due to depleted stocks largely caused by overexploitation and the total catch exceeds the Total Allowable Catches of Russia by 2 to 10 times (UNEP 2006). It has been estimated that roughly 90% of commercially harvested stocks are either collapsed or overexploited (Heileman and Belkin 2010).

With significant oil and gas reserves assumed to be located on the Sakhalin and Kamchatka shelves and near the Amur River delta, hydrocarbon resources will be an important economic feature of the region for years to come. Some estimates indicate there are up to 324 million metric tonnes (357 million tons) of oil and 997 million metric tonnes (1.1 billion tons) of gas on Sakhalin Island and its shelf (UNEP 2006). Two of the most recognized oil and gas projects are the Sakhalin-1 Project and the Sakhalin-2 Project. The Sakhalin-1 Project consists of three fields off the northwestern coast of Sakhalin Island, while the Sakhalin-2 Project consists of two fields in the Sea of Okhotsk (Huff 2003). Together, these projects are estimated to contain total recoverable reserves of 465 million tons of oil and 975 billion cubic meters (34.4. trillion cubic feet) of gas (Huff 2003). These oil and gas reserves are anticipated to not only provide an economic uplift to the region, but to serve as a stable energy supply for neighboring countries such as Japan and the United States (Huff 2003).

There is great mining potential in the coastal areas where substantial mineral reserves, particularly of boron, antimony, and fluorspar are found. Large reserves of brown and hard coal have been discovered in Sakhalin (UNEP 2006).

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[11] The Okhotsk Sea sub-system includes the marine areas, the islands, and coastal areas of the Sea of Okhotsk. In the Regional Assessment of the Sea of Okhotsk, UNEP (2006) identified a second Amur River Basin sub-system including parts of China, Mongolia, Russia, and North Korea.

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APPENDIX H
GEORGIA AQUARIUM FACILITIES

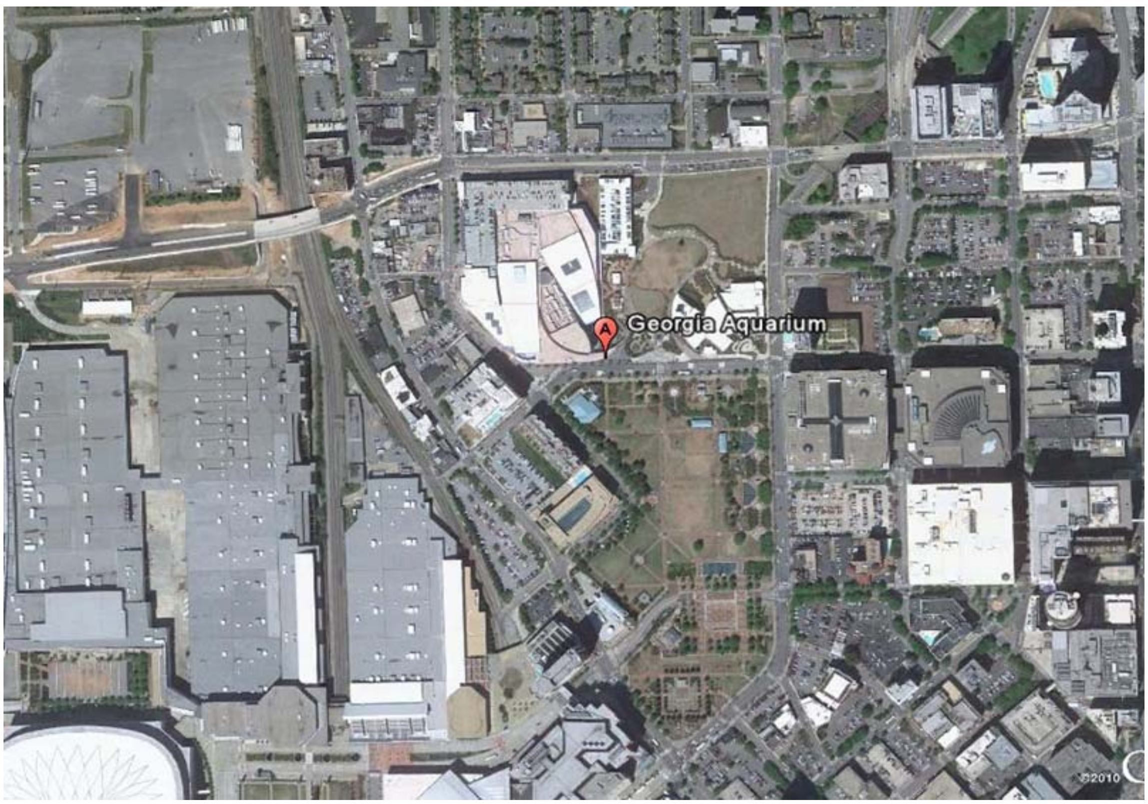
Contents

Tables and Figures

Chapter 1
General Setting

The Georgia Aquarium is the world's largest aquarium. The Georgia Aquarium is located in downtown Atlanta, Georgia, just north of Centennial Olympic Park. Within a short distance are the Georgia Dome, the Georgia World Congress Center, Philips Arena, and CNN Center. The Coca-Cola Company donated 9 acres of land to the site and opened a new World of Coca-Cola attraction called Pemberton Place on property adjacent to the Aquarium.

Figure 1. Aerial View of Georgia Aquarium Location



Chapter 2
Facility Hours of Operation and Cost of Admission

The Georgia Aquarium is typically open 365 days each year. The hours of operation for 2012 are provided in Figure 2.

Figure 2. Georgia Aquarium 2012 Hours of Operation

Regular Hours
Sunday–Friday: 10 a.m.–5 p.m.; Saturday: 9 a.m.–6 p.m.

Exceptions and Extended Hours
February 19–20: 9a.m.–6p.m.
March 24–31: 9a.m.–9p.m.
April 1-7: 9a.m.–9p.m.
May 4, 11, 18, 25: 10a.m.–9p.m.
May 26–27: 9a.m.–9p.m.
May 28–31: 9a.m.–6p.m.
June 2, 8, 9, 16, 22, 23, 29, 30: 9a.m.–9p.m.
June (all other days): 9a.m.–6p.m.
July 4, 5, 6, 7, 13, 14, 21, 27, 28: 9a.m.–9p.m.
July 20: 9a.m.–4p.m.
July (all other days): 9a.m.–6p.m.
August 3, 4, 10, 11, 17, 24, 31: 9a.m.–9p.m.
August 1–9 (excluding Friday and Saturday): 9a.m.–6p.m.
September 1: 9a.m.–7p.m.
September 7, 14, 21, 28: 10a.m.–9p.m.
October 20: 10a.m.–4p.m.
October 25: 10a.m.–4p.m.
November 21, 23, 24: 9a.m.–9p.m.
November 22: 9a.m.–4p.m.
December 22, 23, 26–30: 9a.m.–9p.m.
December 24: 9a.m.–4p.m.
December 25: 12p.m.–6p.m.
December 31: 9a.m.–6p.m.

The cost of general admission to the Georgia Aquarium is outlined below in Table 1. In addition to general admission tickets, the Georgia Aquarium offers a variety of packages allowing visitors to choose from attractions, exhibits, and special events.

Table 1. 2012 Admission Prices

	Adult	Child (age 3-12)	Senior (65+)
General Admission Weekdays	$29.95	$23.95	$25.95
General Admission Weekends and Holidays*	$34.94	$28.95	$30.95
Deepo Pass**	$39.50	$29.50	$39.50

*In this instance, weekends are considered to be Friday-Sunday, and holidays include major holidays as well as school vacations. During summer months (May 25 – August 12) all general admission is priced according to the weekend and holiday schedule. A comprehensive calendar with exact pricing schedules can be found at <http://www.georgiaaquarium.org/media/pdf/PricingCalendar2012Updated.pdf>.

**The Deepo Pass is an immediate entry general admission ticket that can be used on any given day of the year.

APHIS License

USDA

United States Department of Agriculture

Marketing and Regulatory Programs

Animal and Plant Health Inspection Service

Animal Care

EXPIRATION DATE: SEPTEMBER 1, 2012

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Animal Welfare Act

(7 U.S.C. 2131 et seq.)

Certificate No. 57-C-0220

Customer No. 32902

Deputy Administrator

Previous editions are obsolete.

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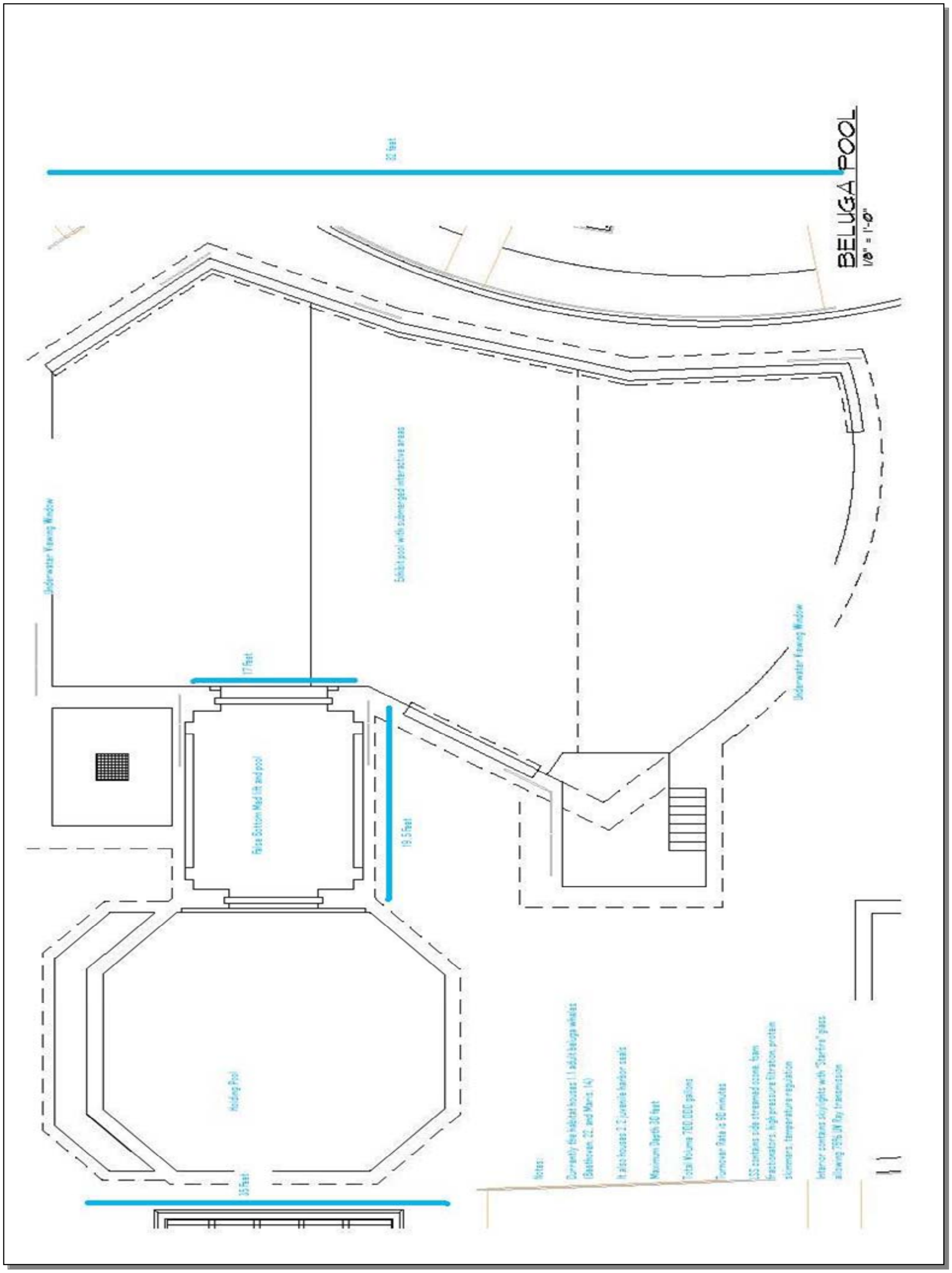
Chapter 4
Facility Diagrams

The Georgia Aquarium is the largest aquarium in the United States. It has more than 8.5 million gallons of marine and fresh water and 18,826 animal representing 683 species. In 2010, the aquarium was expanded with an 84,000-square-foot space and 1.3-million-gallon exhibit.

The area where belugas are housed is a three-pool, 800,000-gallon system (Figure 3). Presently, there are four beluga whales living at Georgia Aquarium; however, the facility is large enough to accommodate at least six beluga whales. The main exhibit pool includes a shallow-water swim-out where animals can be accessed without removing them from the water. The secondary pool meets Animal and Plant Health Inspection Service (APHIS) standards as a primary holding pool. The medical channel connecting the secondary and main exhibit pools includes a pneumatic-lift bottom allowing access to the animals within 2 to 5 minutes. An overhead crane rail system will allow any newly acquired animals to be placed in two of three pools upon arrival and also allows staff to place the animals on closed cell foam on the deck for veterinary access.

The life-support system for the beluga whale exhibit at the Georgia Aquarium comprises high rate sand filters, protein skimmers, ozonators, heat exchangers, and a denitrification system. The entire system's water is filtered every 60 minutes and the design temperature is 54 degrees Fahrenheit (^{o}F). The water in the system is a seawater mix with a combination of major salts as found in the ocean. The system is fully automated and can be monitored by technicians via the Internet. Laboratory technicians monitor various water chemistries daily including temperature, pH, salinity, oxidants, oxidant reduction potential (ORP), ammonia, nitrite, nitrates, and dissolved oxygen. The Georgia Aquarium lab also conducts weekly tests for coliform bacteria. In addition, the Aquarium's exhibit is indoor with a filtered and temperature-controlled air supply.

Figure 3. Georgia Aquarium Beluga Tank Facilities



Chapter 5
Educational Programs

The Georgia Aquarium educational experience is an opportunity for students to discover the aquatic realm in an immersive learning environment. The Aquarium's Education Department strives to make the educational experience an extension of the classroom.

All of the Aquarium's education programs are aligned with Georgia's state educational standards, the Georgia Performance Standards. Regardless of whether students enjoy one of the instructor-led education programs or explore the Aquarium on their own with a self-guided program, their experience will be informed by the underlying principles of the Georgia Performance Standards. The Georgia Performance Standards are a set of comprehensive curriculum standards that incorporate content, suggested tasks, sample student work, and teacher commentary. The performance standards identify the skills needed to use knowledge, problem solve, and make connections.

The Aquarium's 45-minute instructor-led programs (described below) provide a focused learning opportunity where students can expand their understanding of aquatic ecosystems. All programs are aligned to the Georgia Performance Standards, which provide a structured age-appropriate curriculum for teachers to follow and include a downloadable Teacher Guide with pre- and post-activities. Instructor-led programs are 45 minutes long and include admission to the aquarium and 4D Deepo Show.[12] Visitors have the remainder of their time at the Aquarium to explore the wonders of the aquatic world with the students.

Since opening in 2006, approximately 460,000 people have participated in Georgia Aquarium's educational programs. More than 200,000 of those participants have been enrolled in instructor led programs. For example, during the 2009-2010 school year, students from 88 counties and 7 states participated in educational programs at the Aquarium. Figure 4 lists student distribution within Georgia for this time frame. On average, the Aquarium hosts approximately 85,000 students per year for the instructor led and self-guided programs. Through April of the 2010-2011 school year, the Aquarium had approximately 69,200 student participants, 38,600 in the self-guided program and 30,500 in instructor led programs. Table 2 provides a precise breakdown of participants by grade level through April 2011.

[12] By combining digital projection, a high definition animated 3D film and unique special effects, the Georgia Aquarium's 4D Theater is designed to allow Aquarium guests to experience the underwater world from the point-of-view of an aquatic animal. The 4D Theater is one of the most advanced in the world, employing interactive seats and unique special effects that are built into the theater itself. By creating a set of "4D" effects that are synchronized to the film production, the 4D Theater adds a layer of sensory experience for audiences.

Figure 4. Student Distribution by Region

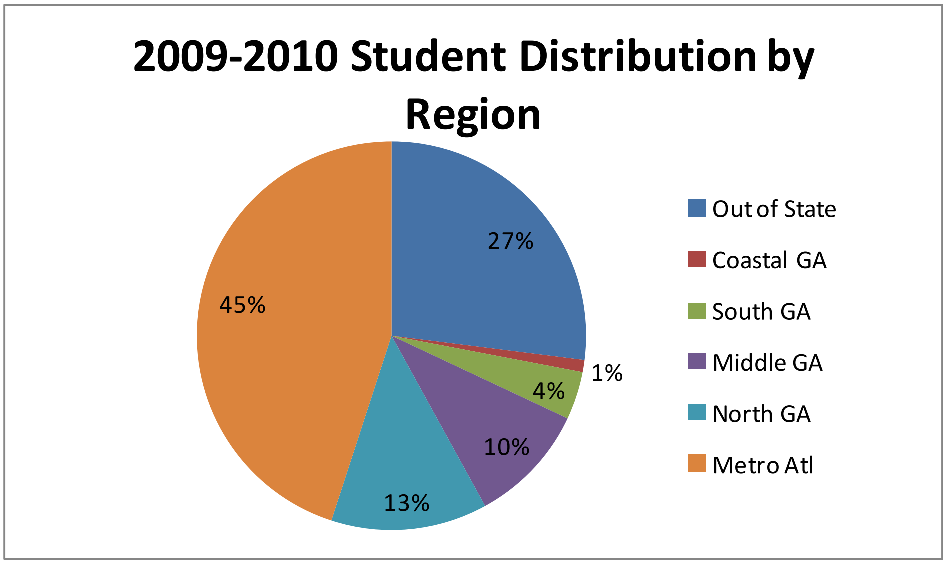


Table 2. 2010-2011 Program Student Attendance by Grade Level

2010-2011 School Year Through April 2011[a]			
	Fall	**Spring**	**Total**
Pre K	233	603	836
K-2	1,341	7,014	8,355
3-5th	3,498	6,484	9,982
6-8th	1,942	4,485	6,427
9-12th	1,879	2,838	4,717
College	141	123	264
Total Instructor Led	9,034	21,547	30,581
Aquatic Adventure	8,152	30,474	38,626
Total	17,186	52,021	69,207

[a] May has consistently been one of the busiest months for students at the Aquarium since 2006 so totals for the 2010-2011 school year would likely be larger.

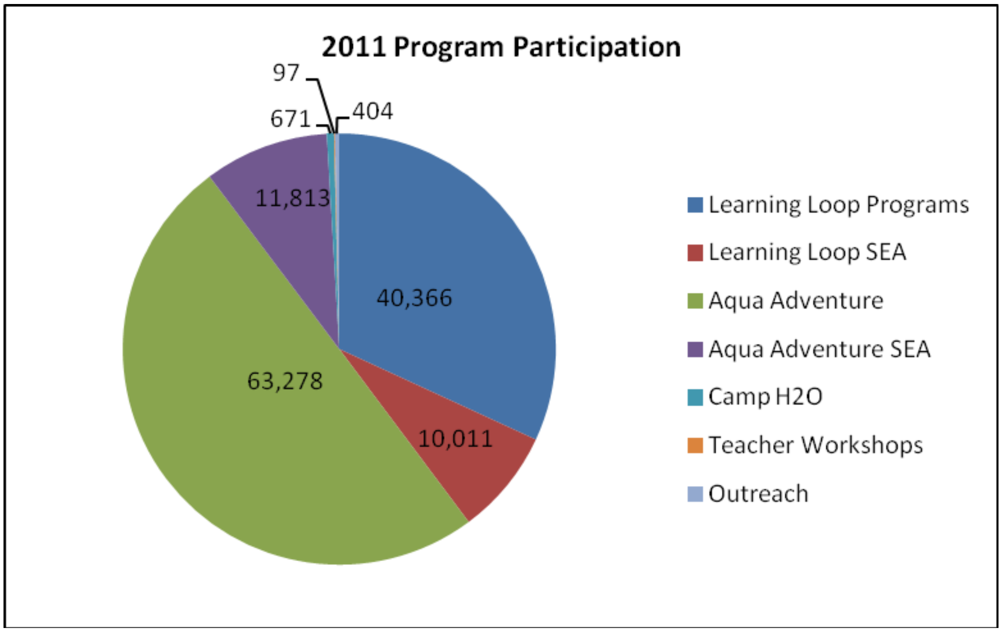
In 2011, the Georgia Aquarium had 126,640 total participants—including students, chaperones, campers, and teachers—in the educational programs described below. These programs included Learning Loop programs, Learning Loop SEA[13], Aqua Adventure[14], Aqua Adventure SEA, Camp

[13] The Learning Loop is the second floor of the Aquarium, which is dedicated to teachers and students. It has several themed galleries and learning labs designed to give students a truly in-depth experience relating to the aquatic realm. "SEA" refers to the Georgia Aquarium's *Sponsored Education Admissions* program, designed to ensure that diverse audiences, regardless of economic status, have an opportunity to participate in these unique educational experiences at a reduced rate or in some cases free of charge.

[14] Aqua Adventures refer to the self-guided educational programs available at the Georgia Aquarium. These programs are aligned with the Georgia Performance Standards at each grade level.

H2O[15], Teacher Workshops, and Education Outreach programs. Figure 5 provides the attendance breakdowns of these programs.

Figure 5. 2011 Program Participation



Instructor-Led Educational Programs

The Georgia Aquarium provides numerous educational programs for a variety of ages. Each program addresses numerous Georgia Performance Standards, and can be used to supplement classroom activities. These programs address a number of topics and each age category has at least one program that specifically addresses belugas. These educational programs teach students about beluga conservation efforts, habitat, diet, physiology, behavior, and population management, among others. Below is a general description of the Aquarium's programs. Instructor-led education programs that specifically address belugas are marked with an asterisk in the descriptions.

Pre Kindergarten

Hide & Seek

Join the Aquarium staff as we go on a hide and seek adventure searching for fascinating fish and their friends. Students explore the places and spaces our animals live and hide. While visiting some hidden treasures at the aquarium, students examine the traits, and adaptations that our animals use to survive in their watery worlds.

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[15] Camp H2O is a week-long summer day camp experience for children in grades rising 1st - rising 6th. This program provides campers with a unique experience at the Georgia Aquarium that involves animal encounters, behind-the-scenes tours, opportunities to meet the husbandry team and much more.

Aqua Tales*

Join Deepo, the Aquarium's mascot, on a wonderful storybook adventure! Students explore how animals move and survive in their aquatic homes. Throughout the interactive program, students discover the unique characteristics of some of our Aquarium friends.

Beluga Specific Characteristics: Students learn how to identify belugas, learn how they swim, and use flashcards to connect beluga behaviors to the animals.

Grades K through 2nd

Sea Life Safari*

Join us as we go on an aquarium safari. Search for lionfish, sand tiger sharks, and barracudas. On their aquatic expedition students explore the four basic needs of all animals and witness how their needs are met here at the Aquarium.

Beluga Specific Characteristics: Students learn the four basic needs of belugas, specifically focusing on their ability to survive in cold-water habitats.

Bite Size Basics*

Come discover what some of our Aquarium residents eat, how they eat, and how their food is prepared. Students identify that food is one of the basic needs of animals, identify similarities and differences in the ways that animals eat, and learn what an animal eats by observing the animal.

Beluga Specific Characteristics: Students learn how a beluga's physiology dictates what types and quantities of food the whales eat, what types of food they eat, and how they eat it.

Grades 3rd through 5th

Weird & Wild*

Come along on a "Weird and Wild" adventure at the Georgia Aquarium! Students explore some of our unique habitats to discover the "Weird and Wild" characteristics of our most unusual animals. The students visit some behind the scene areas while learning how our animals are able to survive in their habitats.

Beluga Specific Characteristics: Students learn how belugas meet their basic needs. They learn how belugas swim, breathe, keep warm in cold temperatures, and avoid predators. Students also learn about beluga adaptations such as dorsal fins, camouflage, swimming techniques, and pectoral flippers, among others.

Snack Attack

Come explore some of the predator-prey relationships found in aquatic ecosystems around the globe. Discover how some of our amazing animals catch their meals and how they keep from becoming a meal.

Grades 6th through 8th

Undersea Investigators*

Have you ever asked yourself, why does an animal behave the way it does? For example, how can you tell a juvenile beluga from an adult beluga? Through research we are able to seek answers to questions like these to better understand our animals and those in the wild. As an Undersea Investigator, students discover how research is conducted, while gaining insights about the underwater world.

Beluga Specific Characteristics: Students use an ethogram study to characterize beluga behavior patterns. Students and teachers discuss how beluga behavior might be different in captivity and in the wild, and how they might interact with other animals.

Sharks In-Depth

Wow, look at all of those teeth! Covering the sharks' entire body! There is much more to know about sharks than what we see on the surface. Acquire a deeper knowledge of sharks and how scientists learn about them. During this program students will examine how sharks impact their environment and how humans impact sharks.

Grades 9th through 12th

Aquarium 101*

How does the world's largest aquarium operate? Through an exploration of the Aquarium's exhibits and behind the scene areas, students are exposed to aquarium related careers, research efforts, conservation programs and how the Aquarium meets the diverse needs of our animals.

Beluga Specific Characteristics: Students learn about the Aquarium's veterinary services, conservation, and scientific research efforts, as they relate to belugas. Students are also taught to assess the design of the beluga pools, components of the exhibit, and reasons for training captive belugas. Students also learn about threats that belugas face in the wild, such as the bioaccumulation of toxics.

Animal Behavior

What is enrichment? Why do we train animals? Before animals can live in a zoological setting, biologists must understand what they need and how they behave. While participating in this exploratory experience, students discover how the Aquarium staff maintains the health of the animals as well as the training techniques used in the process.

Discovery Labs*

Discovery Labs are a unique opportunity for a class to dive into science. Through in-depth investigations, student explore the concepts of marine biology and oceanography. These interactive labs bring science to life and provide an opportunity for students to solve problems, engage in group discussions, and get their hands "wet."

Using the science of genetics and animal management, students learn the many ways marine mammal populations are managed in zoological settings. Discovery Labs are the perfect program for Biology, Environmental Science, Oceanography and Marine Biology classes or clubs.

Beluga Specific Characteristics: Students discover how biological traits are passed on to successive generations, and why biological diversity is critical to maintain healthy, viable populations. Students learn about the status of beluga populations around the world, and examine hypothetical wildlife management decisions of beluga populations by identifying factors that can affect population size.

College Groups

Behind the Waterworks

This program takes college students behind the scenes to explore our living collection, research programs, conservation efforts as well as some aquarium careers. This program serves as an enhancement to a variety of college courses where the professors can use the Aquarium as a living extension of their curriculum.

Beyond the Classroom

This program is designed to provide teachers with insights about how the Georgia Aquarium can enhance the classroom learning experience for their students. Throughout this program, teachers visit behind the scenes areas to see how our programs function, discuss some of the teaching methods utilized, and acquire helpful tips on how to integrate the Georgia Aquarium in their future classroom curriculum.

Home School Program

Georgia Aquarium offers educational programming to home school students through our instructor-led programs at 1:45 pm on select dates. These 45-minute Instructor-Led programs provide a focused learning opportunity where students can expand their understanding of aquatic ecosystems. All programs are aligned to the Georgia Performance Standards and include a downloadable Teacher guide with pre and post activities. All Instructor-Led programs include admission to the Aquarium and Deepo 4D Show.

Professional Development

Teachers can immerse themselves in learning while acquiring valuable content knowledge through hands-on experiences. Our professional development opportunities are designed for teachers to explore a wide range of topics related to the unique aquatic ecosystems found around the world.

Why Explore?

Join NOAA Education Staff as they introduce *The NOAA Ship* Okeanos Explorer *Education Materials Collection for Grades 5-12, Volume 1: Why Do We Explore?* During this professional development offering, participants learn how to use standards-based lessons and other online resources that guide classroom inquiries into modern reasons for ocean exploration including Climate Change, Energy, Human Health, and Ocean Health.

Rivers to Reef

During this week-long learning experience, teachers venture into the world of water as they learn about watersheds, water quality, current aquatic issues and a variety of aquatic ecosystems. This teacher experience takes participants from the headwaters of the Ocmulgee River through the diverse waters of Georgia and eventually to Gray's Reef National Marine Sanctuary.

Georgia Native Workshop

Come learn about some of Georgia's amazing aquatic habitats through interactive lessons from Native Waters and Project WET. Native Waters is an interdisciplinary set of environmental education lessons and over 55 activities that can be taught to students at the K to 12 level that inspires them to apply classroom knowledge to real-world situations through the investigation of many of Georgia's aquatic ecosystems, while also connecting how community values can impact these areas. Project WET facilitates and promotes awareness, appreciation, knowledge, and stewardship of water resources through the dissemination of classroom-ready teaching aids. The curriculum guide contains over 90 broad-based water resource activities that were developed and field-tested by over 600 educators and resource managers working with 34,000 students nationwide. The Georgia Native workshop includes a combination of hands-on activities, exhibit tours, and group discussions related to curricula content.

Creeks to Coast

During this week long summer institute, teachers are immersed in the Chattahoochee watershed as they discover the journey the river takes from North Georgia to the Gulf of Mexico. We examine the various uses of the river – recreations, hydropower, drinking water, and agriculture, while exploring how humans impact the river's journey.

Outreach Programs

Look what the tide brought in! Can't make it to the Aquarium? Let us float on over to you, so your class can get up close and personal with our animals without ever leaving school. Using live animals and biofacts, our educators provide students with an engaging ocean experience. Each program is aligned to the Georgia Performance Standards to help incorporate this unforgettable experience into the school curriculum.

Aqua Basics (K–2)

Prior to having an animal as a pet, one should know the basic needs of animals and how to care for it. This program explores what are the basic needs of some atypical pets and how we care for them.

Spineless Wonders (K–2)

Welcome to the no-bone zone! During this program, students are introduced to some of the spineless wonders that inhabit the Georgia coast. Students use their senses to explore some critters and compare the ways in which these animals meet their basic needs.

Georgia Journey (3–5)

Pack your bags, we are heading out to explore Georgia and its many habitats. Students examine the amazing adaptations these animals have to survive in unique habitats of Georgia.

Coastal Critters (3–5)

Come check out our Georgia coast! Students explore some different coastal animals and their coastal habitats. Students identify some adaptations these spectacular animals possess to help them survive and will also classify them into groups based on their similarities and differences.

Public Programs

Public programs are non-instructor-led programs that are open to the public. These programs contain educational aspects, and allow participants to explore the Aquarium from a point of view that is different from that provided by regular admission.

Ocean Odyssey (grades 2–5)

Join the Georgia Aquarium staff on an overnight adventure to explore the deep waters of the ocean and the beauty of our coral reefs. This program focuses on many of our amazing animals, including sharks and whales, while also addressing what you can do to help preserve these species and their habitats. Get ready to explore the Aquarium through a variety of special activities, tours, animal encounters and more!

Eco-Explorers (grades 6–8)

On a nighttime adventure, students gaze at the silhouette of our whale sharks and marvel at the majestic nature of manta rays, while exploring the physical and biological components of the ocean. Students participate in animal encounters, behind the scene tours and many other aquarium adventures. This program is also perfect for Boy Scouts earning their Oceanography badge.

Nautical Nights

Celebrate your birthday with belugas, whale sharks and otters! Nautical Nights is an amazing overnight adventure at the Georgia Aquarium. This experience includes behind the scene tours, cake, ice cream and much more. Nautical Nights is a great way to celebrate another amazing year.

Birthday Parties

Make a BIG Birthday splash at the Georgia Aquarium with your next party! Our birthday parties include close encounters with animals, crafts, and lots of fin-tastic fun. Select one of the party themes below and relax while the Aquarium staff creates an amazing birthday adventure for your child.

Ocean Party

Designed for children who love the ocean, this underwater party introduces party participants to sharks, sea stars and many of our ocean friends.

Island Princess

Take an island adventure and celebrate with a tropical experience at the Georgia Aquarium. This Polynesian celebration comes complete with leis, hula skirts and plenty of island fun.

Pirate Party

Ahoy Matey! Your child and their friends will be pirates on this high seas aquatic adventure. Party participants explore some of the hidden treasures at the Georgia Aquarium.

Deepo Party

Come and meet Georgia's favorite fish Deepo as he takes you on a birthday party adventure to explore the animals that call the Georgia Aquarium home. You will visit some of his aquarium friends while you journey through the world's largest aquarium.

Sea Scientist Party

What better way to celebrate your special day than as an aquarium scientist! Come step into the shoes of a biologist and explore the mysteries of water.

Behind the Scene Tours

Explore some of the mysteries of the Georgia Aquarium, while visiting places that most people can only imagine visiting. Discover some of our most popular exhibits from a view that only a Behind the Scenes tour can give you! Get closer to the stars of the Aquarium (our animals) and learn about what it takes to keep the world's largest aquarium operating.

Seakeepers Tour

Experience a one hour visit behind some of our closed doors to unlock the secrets of day-to-day operations at Georgia Aquarium. Seakeeper tour participants must be at least 10 years of age.

Quick Dip Tour

Take a 30 minute sneak -peek to explore the inner-workings of the Georgia Aquarium. During a Quick Dip Tour you will see many of our amazing animals from a whole new perspective. Quick Dip Tour participants must be at least 5 years of age.

Family Tour

Take your family on the tour of a lifetime as they learn fun facts, like why our smaller fish are not eaten by a whale shark, or why belugas are called canaries of the sea. All Family Tour participants must be at least 5 years of age.

VIP Tours

This tour provides you, and nine guests, with a once in a lifetime Georgia Aquarium experience. You experience behind the scene views of our Guinness Book of World Records exhibit, Ocean Voyager, our technologically advanced filtration system, and our animal care facilities.

Mommy and Me Program

Toddlers, Otters and Turtles (T.O.T.'s)

This imaginative program allows moms (or dads) to experience an aquarium adventure with their toddler. This program is filled with hands on activities, animal encounters and lots of fun.

Adult Programs

Sip, Splash, and Splatter

Guests enjoy the tranquil serenity of the Tropical Diver Reef or the Ocean Voyager Theater with a guided painting session complemented with short informative narrations of select aquatic animals. This is all done while enjoying the best offerings of local wineries. Sip, Splash, and Splatter is a relaxed, adult environment fit for learning about our amazing animals, the fundamentals of painting while taking home an aquatic themed piece de resistance at the end of the evening.

Making Waves: Adult Overnight (Must be 21 years of age to participate in this event)

A night like no other! During this overnight experience you explore the mysteries of the aquatic realm while learning about some adult aquarium content. During the evening you have dinner, an animal encounter, explore behind the scene areas, while enjoying some adult beverages. The night is sure to be a night you will never forget.

Immersion Program

Swim Program Description

Journey with Gentle Giants is the only opportunity in the world where you are guaranteed to swim with the largest fish in the world, the whale shark, in Georgia Aquarium's Ocean Voyager exhibit built by The Home Depot. Guests will swim at the surface with a floatation device and air supplied by either a small compressed air cylinder or a snorkel. The following equipment is provided: mask and snorkel, gloves, booties, wetsuit, floatation device and compressed air cylinder. Personal masks are permitted.

Price includes admission to the Aquarium, all equipment, the swim, certificate of participation, t-shirt and souvenir photo. All participants must be age 12 and older. Guests under the age of 18 must be accompanied by a participating adult. No diving/snorkeling experience required.

Dive Program Description

Journey with Gentle Giants is the only opportunity in the world where you are guaranteed to SCUBA dive with the largest fish in the world, the whale shark, in Georgia Aquarium's Ocean Voyager gallery built by The Home Depot. Open Water certified divers are eligible to participate in the SCUBA dive program with the following equipment provided: mask, fins, tank, buoyancy device, regulator, weights, booties and wetsuits. Personal masks are permitted.

Program price includes admission to the Aquarium, all equipment, the dive, certificate of participation, t-shirt and souvenir photo. All participants must be ages 12 and older. Guests under the age of 18 must be accompanied by a participating adult. Proof of Open Water SCUBA certification from a nationally or internationally recognized organization must be provided, along with photo identification.

Beluga & Friends Interaction

Georgia Aquarium's new Beluga & Friends Interactive Program is a never-before-offered opportunity for an exclusive encounter with Georgia Aquarium's beloved beluga whales! This inspirational, educational program allows guests to don Aquarium wetsuits and wade into the water to interact with the animals alongside Aquarium beluga whale trainers. Guests will also get a chance to meet some of the other animals that live in the Georgia-Pacific Cold Water Quest gallery. With only eight slots per session, it's an intimate experience you and your family will never forget.

Chapter 6
Conservation Programs

The Georgia Aquarium is a leading facility for aquatic animal conservation and research. The Georgia Aquarium conducts research to improve husbandry methods, develop innovative and exciting new exhibits, contribute to the understanding of the underwater world, and apply new discoveries to the conservation of aquatic life. Every day, researchers in the Aquarium's exhibits and labs are learning more about marine life in order to develop new methods of animal care and veterinary medicine. By combining field research with the study of on-site animals in a controlled environment, the Aquarium is contributing to the advancement of human knowledge in the area of animal science.

Belugas

With its National Marine Fisheries Service (NMFS) partners, Georgia Aquarium helped pioneer health assessments for beluga whales in Alaska in 2008, using methods developed in the aquarium setting. Georgia Aquarium has also placed a focus on understanding beluga nutrition and on research on whales in Bristol Bay relative to the population in Cook Inlet, which was recently listed as endangered. In particular, researchers are studying what belugas eat based on stable isotopes in their blood and biopsies, as well as test for any exposure to pollution. These health assessments, which will continue through the fall of 2012, will provide a holistic image of the health of Bristol Bay beluga whales by testing a wide variety of health indicators. Georgia Aquarium will also support research in this area to study stranded whales.

Georgia Aquarium has also performed a pilot study to compare fertility potential in beluga whales from a presumed-healthy population (Bristol Bay) and the recently listed population in Cook Inlet, and is assessing the fertility potential of beluga whales as a species. In addition to research on whales in Alaskan populations, Georgia Aquarium has also researched beluga migration patterns and genetics in the Sea of Okhotsk.

Following previous research in the Sea of Okhotsk that it supported, Georgia Aquarium will support research in the 2012 field season to further examine beluga stock presence and movements in the area. Research will include health assessments, documentation of reproductive status, and observation of movement and location patterns. Researchers will focus on determining beluga presence in the lower Amur estuary and Tartar Straight, Chkalova and Baydukova Islands, and Academy Bay and Tugursky Bay.

Dolphins in Florida

Bottle-nosed dolphins in the Indian River Lagoon are excellent sentinels of environmental health because they are permanent residents of the lagoon and are at the top of the food chain, so they can indicate problems below them in the ecosystem. Senior Vice President Dr. Greg Bossart has been heavily involved in understanding the health of these animals for many years. They face a number of threats from pollution and emerging infectious diseases, so the Georgia Aquarium has continued research efforts in partnership with Florida Atlantic University and the federal Government. This research takes full advantage of the Georgia Aquarium Conservation Field Station in St. Augustine. Research topics include:

- an Ecosystem-based Approach to Evaluating the Burden and Effects of Dietary Mercury on Atlantic Bottlenose Dolphins;
- bottlenose dolphin health assessment in Sarasota Bay, Florida;
- West Florida Shelf Bottlenose Dolphins: Population Structure, Health, Oil Spill Impacts; and
- an Ecosystem-based Approach to Conducting Standardized Health Surveillance and Hearing Measurements in Wild Atlantic Bottlenose Dolphins (*Tursiops truncatus*).

Penguins in South Africa

The Georgia Aquarium has partnered with non-profit wildlife rehabilitation group SANCCOB to study, for the first time anywhere, the health of free ranging African penguins, like those in the Aquarium's Cold Water Quest gallery. Sampling has been done off the coast of Namibia, on the western side of South Africa. Research topics include:

- Correlation of Swimming Behaviors and Activity with Feeding Methods in the Captive African Black-footed Penguin (*Spheniscus demersus*);
- Sexing penguins by beak length; and
- African Penguin Health Survey.

Whale Sharks in Mexico

The Georgia Aquarium has been involved in field research on whale sharks since 2005. The current focus is in Mexico where whale sharks gather annually in the shallow coastal waters of the Yucatan Peninsula, not too far from Cancun. So far the Aquarium has asked: How many whale sharks are there? Why do they come? Where do they go? Research efforts and topics include:

- Whale Shark Population Study, Cancun, Mexico;
- Functional Morphology and Feeding Behavior of the Whale Shark;
- Whale Shark Proteomics;
- Plankton analysis on whale shark feeding grounds and afuera aggregation in Mexico;
- Whale shark IgM purification;
- Georgia Aquarium whale shark research in Quintana Roo, Mexico;
- Georgia Aquarium whale shark research and conservation program 2011; and
- Whale Shark Genome Project 2011.

Nesting Turtles in Georgia

Many people are unaware that the endangered loggerhead turtle nests in several wildlife refuges on the Georgia Coast. Georgia Aquarium is partnering with the Fish and Wildlife Service and the Caretta Research Project to survey these turtle nesting areas in Georgia so that researchers can better understand the needs of both adults and offspring, and how to protect them. Research topics include:

- Survey and Monitoring of Loggerhead Sea Turtle Index Nesting Beaches on Southeastern National Wildlife Refuges for Landscape Management and Global Conservation; and
- Evaluation of the Nutritional Health in Free-ranging Healthy and Ill Loggerhead Sea Turtles (*Caretta caretta*) in conjunction with the establishment of a long-term conservation program for Nesting Loggerhead Sea Turtles and their nesting habitat on Jekyll Island, Georgia.

Right Whales in Georgia

Highly endangered, the right whale is an important species on which to focus research and conservation efforts. These large baleen whales breed every year in the warm waters of the South Atlantic Bight, which includes the Georgia coast. The Aquarium has partnered with scientists from Woods Hole to monitor right whale populations in our state. These monitoring efforts have been carried out with the help of a volunteer-based citizens' network.

Spotted Eagle Rays in Florida

With their graceful polka-dotted wings, eagle rays are found in all the tropical oceans of the world, but only recently has it been realized that they reproduce in the coastal waters of Florida. In partnership with the Shark Research group at Mote Marine Laboratory, Georgia Aquarium staff are studying the population size, make-up and movements near Sarasota, to build vital knowledge about these poorly understood but beautiful creatures.

Manatees in Mexico

Among other tropical places, manatees occur in the shallow coastal waters of Quintana Roo, Mexico, but little is known about their health, so the Georgia Aquarium has begun a project to understand whether manatees in this area show any signs of heavy metal contamination. In addition to this work in Mexico, the Aquarium is also conducting a health assessment of manatees in Florida.

Correll Center

The Georgia Aquarium is a leading facility for aquatic animal conservation and research. Our state-of-the-art animal health facility and research and conservation activities are part of the programs hosted through the Correll Center for Aquatic Animal Health. Within the Aquarium building, its 10,000 square foot space incorporates a surgery suite, commissary, scrub rooms, life support and maintenance tech rooms, pathology records room, water quality lab, treatment and quarantine space, and diagnostic lab. The space was designed by world class veterinarian professionals and conservation organizations. The facility provides the only integration of an aquarium and an aquatic veterinary medicine intern training program. On a more global scale, the Georgia Aquarium Correll Center efforts support, conducts and leads research on environmental and conservation issues.

Special features of the Correll Center include state-of-the-art diagnostic imaging technology, digital and computed radiography, mobile/portable ultrasound, digital endoscopy, mobile gas and waterborne anesthesia systems, in-house diagnostic tools, digital microscopy, complete surgical suite with instrument sterilization features and a custom computerized medical records system. The Correll Center for Aquatic Animal Health can be viewed on behind-the-scenes tours at Georgia Aquarium.

The Correll Center for Aquatic Animal Health is a partnership between Georgia Aquarium and the University of Georgia College of Veterinary Medicine. UGA faculty and graduate students research and train at the Correll Center, the first aquatic veterinary teaching hospital integrated into an aquarium.

4R Program

The 4R Program, which stands for rescue, rehabilitation, research, and responsibility, encompasses, supports and funds Georgia Aquarium efforts in the areas of rescue, rehabilitation, research and responsibility. Within the Aquarium, the 4Rs are seen in virtually every exhibit, from our beluga whales to our loggerhead sea turtles, to our living coral reef and sea otters.

Behind the scenes at the Aquarium, the 4R Program plays an active role by funding work through the Correll Center for Aquatic Animal Health, the integration of a novel postdoctoral veterinary residency program in clinical medicine and pathology; our state-of-the-art commissary; our biologists' daily activities; and in research as far away as Alaska, Mexico, Russia and South Africa.

4R Key Projects

Rescue–Southern Sea Otters

Georgia Aquarium is committed to the rescue and rehabilitation of stranded Southern sea otter pups off the coast of California and Alaska. Only 25% of pups survive the first year, and when pups are separated from their mothers, the odds of survival drastically change. By working with groups like The Alaska SeaLife Center and Monterey Bay Aquarium's Sea Otter and Research Conservation programs, we are able to aid in the rescue of sea otter pups and rehabilitate them in our newly renovated Southern sea otter exhibit in Georgia-Pacific Cold Water Quest.

Rehabilitation–Sea Turtles

Through Georgia Aquarium's 4R Program, we are able to rehabilitate and release loggerhead sea turtles into their natural habitats. We are also able to provide satellite tagging for turtles, which allows them to be tracked after their release.

Research–Whale Sharks

Georgia Aquarium has been carrying out research on whale sharks since 2003 with a number of partners. In past years, the Aquarium's field research has focused on where whale sharks migrate, what they feed on, and where they go when they leave. Additionally, having whale sharks in an aquarium setting is a unique research opportunity so we continue to study the whale sharks in the Ocean Voyager exhibit, including their growth, behaviour, health and genetics.

Responsibility–Georgia Aquarium Conservation Field Station

Located in Marineland, Florida, Georgia Aquarium's Conservation Field Station (GACFS) was established in 2008 as part of Georgia Aquarium's ongoing research and conservation efforts through our 4R Program. The field station is dedicated to furthering our understanding of dolphins, marine mammals and aquatic species found along our coast through the 4Rs: **R**escue, **R**esearch, **R**ehabilitation and **R**esponsibility.

Georgia Aquarium Conservation Field Station

Founded in April of 2008, Georgia Aquarium's Conservation Field Station (GAI-CFS) is a joint venture between the Georgia Aquarium and Marineland's Dolphin Adventure.

Funded by donations and grants, our vision is to increase public awareness and contribute to scientific study through conservation. GAI-CFS is a 501(c)(3) non-profit organization dedicated to research and rescue of dolphins and small whales in Northeast Florida.

Marine Mammal Stranding

The Georgia Aquarium's Conservation Field Station (GAI-CFS) is an active member of the National Marine Fisheries Service's Marine Mammal Stranding Network. Upon entering into a Stranding Agreement in April of 2009, GAI-CFS is authorized to respond in the event of dead or live marine mammal strandings (whale and dolphin) in Flagler County, Florida. As a member of the South East Region, GAI-CFS also plays a supportive role in stranding and rescue events with neighboring network participants.

Georgia Aquarium's Dolphin Conservation Field Station (DCFS) research programs will not only help our understanding of marine mammal strandings, but also the health of our oceans. GAI-CFS research programs are now documenting the cause of marine mammal strandings and the identification of emerging diseases in these species. Special emphasis will be placed on the study of the gross and histopathologic characterization of diseases. There is a present concern about the health of our oceans based on emerging diseases that suggest infectious, toxic and human-related etiologies.

The GAI-CFS will nurture conservation outreach programs already established in Mexico, Belize, Guyana, Dubai and at Colombian and Brazilian Amazon sites. This component of the GAI-CFS program involves providing veterinary care to aquatic mammal species, while at the same time training local caregivers to provide future care on their own. At present, conservation outreach programs involving Antillean manatees (*Trichechus manatus manatus*) and Amazonian manatees (*Trichechus inunguis)* are ongoing in Mexico, Guyana, Colombia and Brazil and with dugongs (*Dugong dugon*) in Dubai.

Atlantic Bottlenose Dolphin Photo Identification

Georgia Aquarium's Conservation Field Station (GAI-CFS) personnel and investigators from Harbor Branch Oceanographic Institute are conducting a population assessment study in Northeast Florida Intracoastal Waterways and Atlantic Seaboard. This research focuses on collecting baseline information regarding the identification of individual Atlantic bottlenose dolphins using photos of dorsal fins. A catalog of information will be created for animals in the area and will be compared with other known animals from other research areas on the East coast of the United States. Information such as habitat usage, home ranges and estimated population size will help lay the foundation for continuing research in the area.

Attachment A

Educational Programs Brochure

ready to dive in?

GEORGIA AQUARIUM

at Pemberton Place®

Reservations

- To make a reservation call 404-581-4121 or complete the "Request More Information" form found on our website at www.georgiaaquarium.org under the program of your choice.
- Reservations should be made at least 30 days prior to the visit date.
- A $100 non-refundable deposit is due at time of reservation for education programs.
- Bus parking fee $25.00 (per bus).

Pricing

- Instructor-Led Programs - $12 per student
- Aqua Adventures Self-Guided program - $11 per student

Chaperone Policy

- Grades Pre-K through 2 allows 1 free chaperone per every 5 students.
- Grades 3 through 12 allows 1 free chaperone per every 10 students.
- Chaperones include teachers and school officials as well as parents.

Sponsored Education Admissions Program

- Georgia Aquarium developed the Sponsored Education Admissions (SEA) Program in an effort to ensure that diverse audiences, regardless of economic status, have an opportunity to participate in these unique educational experiences.

Call 404.581.4121
for educational program information.

225 Baker Street, NW • Atlanta, GA 30313 • georgiaaquarium.org • 404-581-4000

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Education & Guest Programs Guide
2011-2012

GEORGIA AQUARIUM

at Pemberton Place®

Dear Educators and Parents,

When I first envisioned the Georgia Aquarium, I knew it had to be educational, entertaining and it must help future generations gain an appreciation for our oceans and the organisms that live there. The Georgia Aquarium has become a remarkable resource serving to promote conservation and awareness to nearly 10 million people. By using the Aquarium as a true learning environment, guests are exposed to the many wonders of the rivers and oceans that surround us.

For teachers and students, we offer an entertaining, innovative and interactive learning experience. Using the Learning Loop and the main Aquarium, students in grades kindergarten through twelve will explore aquatic ecosystems and their inhabitants while learning to conserve and protect our most valued natural resources. Our education programs can be considered extensions of the classroom, as they are designed to meet Georgia Performance Standards. Our goal is to aid teachers in providing students with learning experiences that will inspire future environmental stewards.

The Aquarium also offers many unique experiences for families, including Behind The Scene Tours, Birthday Parties, Camp H_2O and Animal Interaction Programs. Behind The Scenes Tours are fun for all ages and sleepovers bring out the inner child within us. Georgia Aquarium, the world's largest, most magical aquarium truly is a great place for imaginations to play, learn, explore and more.

The Georgia Aquarium is constantly growing, evolving and changing. Contact our staff or visit our website, georgiaaquarium.org, for more information.

On behalf of the Aquarium board of directors, staff and thousands of volunteers, we look forward to having you with us.

Bernie Marcus
Founder and Chairman

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school group programs

instructor led program

$12 per student

includes admission to the aquarium and 4D theater

self-guided program

$11 per student

4D theater may be added for $2

Instructor Led Educational Experience

Our Instructor-Led programs provide focused learning opportunities where students can expand their understanding of aquatic ecosystems. All programs are aligned to the Georgia Performance Standards (GPS) and include a downloadable Teacher Guide with pre- and post-visit activities. All Instructor-Led programs are 45 minutes in length. You will have the remainder of your time at the aquarium to explore the wonders of the aquatic worlds with your students.

Aqua Adventure Self-Guided Programs

Our self-guided tour for students in grades Pre-K-12 is an aquatic adventure on the main floor of the aquarium. Just download the Aqua Adventures Learning Guides from our website and have fun!

AT&T Dolphin Tales Show admission may now be added to the above programs for an additional $4.00 per person.

Elementary School Programs

***Hide and Seek* – Grade Pre-K** Come and find what's hiding at the Georgia Aquarium. Students will explore the different places our animals call home and examine why and where they hide.

Performance Indicators addressed: LD1, LD3, LD4, MD1, MD4, SD1, SD2, SE3, CD2.

***Aqua Tales* – Grade Pre-K** Join Deepo, the aquarium's mascot, on a wonderful storybook adventure! Students will explore how animals move and survive in their aquatic homes. Throughout this interactive program, students will discover the unique characteristics of some of our aquarium friends.

Performance Indicators addressed: LD1, LD4, LD5, MD1, MD2, MD4, SD1, SD2, SD3

***Sea Life Safari* – Grades K-2** Join us as we go on an aquarium safari. Search for lionfish and sand tiger sharks. On their aquatic expedition students will explore the four basic needs of all animals and witness how their needs are met here at the aquarium.

Georgia Performance Standards addressed: SKCS1, SKCS2, SKCS5, SKL2, ELAKLSV1, S1CS1, S1CS2, S1CS5, S1L1, ELA1LSV1, M2M1, M2M3

Common Core Standards: KCC2, KCC4, KMD1, KMD2, 1MD2, 2 MD1, 2MD2, & 2MD3

***Bite Size Basics* – Grades K-2** All animals have certain basic needs, including food. Come discover what some of our aquarium residents eat, how they eat, and how their food is prepared.

Georgia Performance Standards addressed: SKCS1, SKCS5, SKL1, SKL2, ELAKLSV1, S1CS1, S1CS5, S1L1, ELA1LSV1, MKM1, MKP4, M1M1, M1P4, M2M1, M2P4

***Weird and Wild* – Grades 3-5** Come along on a "weird & wild" adventure through the Georgia Aquarium! During this program students will explore some of our galleries to discover the "weird & wild" characteristics of our unique animals. The students will visit some behind the scene areas while learning how these animals are able to survive in their habitats.

Georgia Performance Standards addressed: S3CS4, S3L1, ELA3LSV1, S4CS4, S4L1, S4L2, ELA4LSV1, S5CS4, S5L1, ELA5LSV1

***Snack Attack* – Grades 3-5** Come explore some of the predator-prey relationships found in aquatic ecosystems around the globe. Discover how some of our amazing animals catch their meals and how they keep from becoming a meal.

Georgia Performance Standards addressed: S3CS4, S3L1, S3L2, ELA3LSV1, S4CS4, S4L1, S4L2, ELA4LSV1, S5CS4, S5L1, ELA5LSV1

For more information visit us at georgiaaquarium.org

Middle School Programs

Undersea Investigators – Grades 6-8

Why are juvenile belugas grey? Through research we are able to seek answers to questions like these to better understand our animals and those in nature. As an Undersea Investigator, students will discover how research is conducted, while gaining insights into the underwater world.

Georgia Performance Standards addressed: S6CS1, S6CS8, S6CS9, S6E3, ELA6LSV1, M6D1, S7CS1, S7CS5, S7CS8, S7CS9, ELA7LSV1, S7L4, M7D1, M8D4, ELA8LSV1

Common Core Standards: 6SP5 & 7SP2

Sharks In-Depth – Grades 6-8

Wow, look at all of those teeth!.... Covering the sharks' entire body! There is much more to know about sharks than what we see on the surface. Acquire a deeper understanding of sharks and how scientists learn about them.

Georgia Performance Standards addressed: S6CS8, S6E4, ELA6LSV1, S7CS5, S7CS8, S7L1, S7L4, ELA7LSV1, S8CS8, S8P3, ELA8SV1, S6CS5, S6CS6

High School Programs

Aquarium 101 – Grades 9-12

Through an exploration of the aquarium's exhibits and behind the scene areas, students will be exposed to aquarium related careers, research efforts, conservation programs and how the aquarium meets the diverse needs of our animals.

Georgia Performance Standards addressed: SCSh1, SCSh6, SB4, SZ5, SEV5

Animal Behavior – Grades 9-12

Before animals can live in an aquarium biologists must understand what they need and how they behave. Students will discover how the aquarium staff maintains the health of the animals as well as the training and enrichment techniques used in the process.

Georgia Performance Standards addressed: SCSh1, SCSh6, SZ4, SZ5

new! *Discovery Labs* – Grades 9-12

Discovery Labs are a unique opportunity for a class to dive into science. Through in-depth investigations, student will explore the concepts of marine biology and oceanography. These interactive labs will bring science to life and provide an opportunity for students to solve problems, engage in group discussions, and get their hands wet.

Minimum of 20 students, max of 50 students, 75 minutes in length depending on the topic.

Perfect program for Biology, Environmental Science, Oceanography and Marine Biology classes or clubs.

new! College Programs

Behind the Waterworks

Students will explore our galleries and learn more about research and conservation efforts that are currently underway. This program serves as an enhancement to a variety of college courses, where professors can use the aquarium as a living extension of the classroom curriculum.

Beyond the Classroom

Pre-service teachers will gain insight about how the Georgia Aquarium can enhance the classroom learning experience for their students. Throughout this program, pre-service teachers will visit behind the scenes areas to see how our programs run, discuss some of the teaching methods we use and acquire helpful tips on how to integrate the Georgia Aquarium into their future classroom curriculum.

Home School Programs

Georgia Aquarium offers home school students the opportunity to participate in the Instructor-Led programs. The Instructor-Led programs are available throughout the year at select times and dates.

For more information visit us at georgiaaquarium.org

new!

outreach program

Look what the tide brought in! Can't make it to the Aquarium? Let us float on over to your school. Using live animals and biofacts, our educators will provide your students with an engaging ocean experience. Each program is aligned to the Georgia Performance Standards to help you incorporate this unforgettable experience into your curriculum.

Program descriptions:

- Aqua Basics (K-2) – Ever wondered how we are able to care for so many animals? It comes down to understanding and meeting their basic needs. During this program students will explore what are the basic needs of some of our organisms and how we care for them.
  Georgia Performance Standards addressed: SKCS6, SKL2, ELAKLSV1, S1CS7, S1L1, ELA1LSV1, S2CS7, S2L1, M2M3
- Spineless Wonders (K-2) - Welcome to the no-bones zone! During this program, students will be introduced to some of the spineless wonders that inhabit the Georgia coast. Students will use their senses to examine some organisms and compare the ways in which these animals meet their basic needs.
  Georgia Performance Standards addressed: SKCS6, SKL2, ELAKLSV1, S1CS7, S1L1, ELA1LSV1, S2CS7, S2L1, M2M3
- Georgia Journey (3-5) – Pack your bags, we are heading out to explore Georgia and its many habitats. Students will examine the amazing adaptations these animals have to survive in the habitats of Georgia.
  Georgia Performance Standards addressed: S3CS4, S3L1, S3L2, ELA3LSV1, S4CS4, S4L2, ELA4LSV1, S5CS4, S5L1, ELA5LSV1
- Coastal Critters (3-5) – Come check out our Georgia coast! Students will explore some of our coastal animals and their coastal habitats. Students will identify adaptations these animals possess to help them survive and classify them into groups based on their similarities and differences.
  Georgia Performance Standards addressed: S3CS4, S3L1, ELA3LSV1, S4CS4, S4L1, S4L2, ELA4LSV1, S5CS4, S5L1, ELA5LSV1

professional development

The fun is not just for your students! Teachers can immerse themselves in learning and acquire valuable content knowledge through hands-on learning experiences. Our professional development opportunities are designed for teachers to explore a wide range of topics related to the unique aquatic ecosystems found around the world.

Why Explore? (1 PLU) Join NOAA and the Georgia Aquarium Education Staff as they introduce The NOAA Ship *Okeanos Explorer* Education Materials for Grades 5-12. During this professional development offering participants will learn how to use standards-based lessons and other resources to explore topics related to Climate Change, Energy, Human Health, and Ocean Health.

Rivers to Reef (4 PLU's) During this week-long learning experience, teachers will venture into the world of water as they learn about watersheds, water quality, current aquatic issues and a variety of aquatic ecosystems. This teacher experience takes participants from the headwaters of the Ocmulgee River through the diverse waters of Georgia and eventually to Gray's Reef National Marine Sanctuary.

Georgia Native Workshop (1 PLU) Come learn about some of Georgia's amazing aquatic habitats through interactive lessons from Native Waters and Project WET. This workshop will include a combination of hands-on activities, exhibit tours, and group discussions related to curricula content.

new! **Creeks to Coast** During this week long summer institute, teachers will be immersed in the Chattahoochee watershed as they discover the journey the river takes from North Georgia to the Gulf of Mexico. We will examine the various uses of the river while exploring how humans impact the river's journey.

For more information visit us at georgiaaquarium.org

overnight adventures

Ocean Odyssey (Grades 2-5) Join the Georgia Aquarium staff on an overnight adventure to explore the deep waters of the ocean and the beauty of our coral reefs. This program focuses on many of our amazing animals, including sharks and whales, while also addressing what you can do to help preserve these species and their habitats. Get ready to explore the Aquarium through a variety of special activities, tours, animal encounters and more!

Eco-Explorers (Grades6-8) On a nighttime adventure, students will gaze at the silhouette of our whale sharks and marvel at the majestic nature of manta rays, while exploring the physical and biological components of the ocean. Students will participate in animal encounters, behind the scene tours and many other aquarium adventures. This program is also perfect for Boy Scouts earning their Oceanography badge.

Time: 7 p.m. - 9 a.m. Cost: Members: $71.95 per person; Non-members: $95.95 per person. Sales tax will be added.

new!

Nautical Adventures

Celebrate your birthday with belugas, whale sharks and otters! Nautical Nights is an amazing overnight adventure at the Georgia Aquarium. This experience will include behind the scene tours, cake, ice cream and much more. Nautical Nights is a great way to celebrate another amazing year.

Times: Monday -Friday 7pm-10am Cost: Members $112 Non-member $150 per person

Who: All party participants must be at least 7 years of age. Minimum group size 10, maximum group size 30.

birthday parties

Make a BIG Birthday splash at the Georgia Aquarium with your next party! Our birthday parties include close encounters with animals, crafts, and lots of fin-tastic fun. Select one of the party themes below and relax while the aquarium staff creates an amazing birthday adventure for your child. (Program appropriate for Ages 3-5).

Party Themes:

- Deepo Party
- new! Dolphin Party
- Island Princess
- Mermaid's Party
- Ocean Adventure
- Pirate Party
- new! Scientist Party
- Shark Party

Times:

Saturdays	Sundays
10:00am-11:30am	11am-12:30pm
12:30pm-2:00pm	2:00pm-3:30pm
3:00-4:30pm	

Cost: Member: $539.95, Non-Member: $599.95

Meals are available for party participants. If you are interested in adding a meal to your party please ask for details when you book your reservation.

For more information visit us at georgiaaquarium.org

public programs

new!

Toddlers, Otters and Turtles (T.O.T.'s)

This imaginative program allows moms (or dads) to experience an aquarium adventure with their toddler. This program is filled with hands on activities, animal encounters and lots of fun. **When:** T.O.T. programs occur every Tuesday, Thursday and Saturday at 11:15 a.m. Each program lasts approximately 45 minutes. This program is designed for children ages 2 to 5.

camp H2O

A week long Underwater Adventure!

During Camp H2O children will experience marine life and aquatic adventures at the world's largest aquarium. Campers, ages 6-11, will experience unique and exciting opportunities at every twist, turn and tunnel. In addition to exploring the galleries of the Georgia Aquarium students are able to meet fishy friends up close, go behind the scenes to examine how the aquarium works, meet biologists, divers, and much more. Camp H2O is offered three times during the year. Spring and summer camps are week-long adventures. Winter camp can be a daily or weekly adventure, it's up to you.

Camp Dates:

Winter Break Camp	December 26 - 30, 2012 (Daily or Weekly option)
Spring Break Camp	April 2 - 6, 2012 (Weekly option only)
Summer Camp	Starting Week of June 11 - Week of July 30, 2012 (Weekly option only)

Camp H2O

behind the scene tours

Explore some of the mysteries of the Georgia Aquarium, while visiting places that most people can only imagine visiting. Discover some of our most popular exhibits from a view that only a Behind the Scenes tour can give you! Get closer to the stars of the Aquarium (our animals) and learn about what it takes to keep the world's largest aquarium operating.

Seakeepers Tour

Experience a one hour visit behind some of our closed doors to unlock the secrets of day to day operations at Georgia Aquarium. Seakeeper tour participants must be at least 10 years of age. **Tour Times:** 12 pm, 1 pm, 2 pm, 3 pm and 4 pm daily. **Cost:** General admission plus $48 per person (Non- Annual Pass Members) General admission plus $24 per person (Annual Pass Members) **SeaKeepers Tour Length:** 1 hour

Quick Dip Tour

Take a sneak-peek to explore the inner-workings of the Georgia Aquarium. During a Quick Dip Tour you will see many of our amazing animals from a whole new perspective. Quick Dip Tour participants must be at least 5 years of age. **Tour Times:** Every 30 minutes beginning 30 minutes after opening until 4 p.m. daily **Cost:** General Admission plus $14 per person (Non-Annual Pass Members) General Admission plus $12 per person (Annual Pass Members) **Quick Dip Tour Length:** 20 minutes

Family Tour

Take your family on the tour of a lifetime as they learn fun facts, like why our smaller fish are not eaten by a whale shark. All Family Tour participants must be at least 5 years of age. **Tour Times:** 4 p.m. Monday – Friday and 11 a.m. Saturday-Sunday **Cost:** General Admission plus $34 per person (Non-Annual Pass Members) General Admission plus $17 per person (Annual Pass Members) **Family Tour Length:** 45 minutes

VIP Tours

This tour will provide you, and five guests, with a once in a lifetime Georgia Aquarium experience. You will experience behind the scene views of our Ocean Voyager exhibit, our technologically advanced filtration system, and our animal care facilities. **Weekdays:** 1 p.m. and 3 p.m. **Weekends:** 10 a.m., 1 p.m. and 3 p.m. If you would like to book a VIP Tour outside of the scheduled times, one week notice is required. **Cost:** $550 plus tax on top of admission for up to six guests, $75 plus tax for each additional guest, 10 guests total. All guests must be at least 5 years old. **VIP Tour Length:** 90 minutes

For more information visit us at georgiaaquarium.org

new!

adult program

Making Waves

Adult Overnight (Must be 21 years of age to participate in this event) A night like no other! During this overnight experience you will explore the mysteries of the aquatic realm while learning about some adult aquarium content. During the evening you will enjoy dinner, an animal encounter and explore behind the scene areas while enjoying adult beverages. The night is sure to be a night you will never forget.

animal INTERACTION

Journey with Gentle Giants

Swim

Become immersed in Georgia Aquarium's Ocean Voyager exhibit, built by The Home Depot. Here you will have an opportunity to swim with the largest fish in the world. Guests will swim at the surface with a flotation device and air supplied by either a small compressed air cylinder or a snorkel. The following equipment is provided: mask and snorkel, gloves, booties, wetsuit, flotation device and compressed air cylinder. Personal masks are permitted.

Dive

Dive in for the only opportunity in the world where you are guaranteed to SCUBA dive with the largest fish in the world, the whale shark, in Georgia Aquarium's Ocean Voyager gallery built by The Home Depot. Open Water certified divers are eligible to participate in the SCUBA dive program with the following equipment provided: mask, fins, tank, buoyancy device, regulator, weights, booties and wetsuits. Personal masks are permitted.

DIVE GEORGIA AQUARIUM

BELUGA & FRIENDS

Beluga & Friends Interaction

Georgia Aquarium's new Beluga & Friends Interactive Program is a never-before-offered opportunity for an exclusive encounter with Georgia Aquarium's beloved beluga whales! This inspirational, educational program allows guests to don Aquarium wetsuits and wade into the water to interact with the animals alongside Aquarium beluga whale trainers. Guests will also get a chance to meet some of the other animals that live in the Georgia-Pacific Cold Water Quest gallery.

For more information visit us at georgiaaquarium.org

Attachment B

Letters of Support

The following letters are provided as an illustrative sample of the widespread support for, and beneficial impact of, the educational and outreach programs of the Georgia Aquarium. These include handwritten letters, notes, and emails.

10 Annabelle Court
Greer, SC 29650

April 18, 2012

Customer Service Representative
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Dear Sir or Madam:

As a returning guest to the Georgia Aquarium, I would like to praise you for the level of excellence you have reached.

Our family made our first visit to the Georgia Aquarium in December of 2005, just a month after you opened your doors to the public. Needless to say, we were beyond satisfied. The aquarium had a fun and educational environment suitable for children, and there was such a large variety of exhibits to explore. We returned time after time and were fortunate enough to watch the aquarium evolve.

Our most recent visit to the Georgia Aquarium was on April 7, 2012. We were able to walk through the newest exhibit, Frogs: A Chorus of Colors, and it was quite an experience. The panels were informational without being dull, and the array of different frogs was amazing.

Furthermore, the AT&T Dolphin Tales show was extremely enjoyable. The performers, trainers, and dolphins were all top-notch. Deepo's Undersea 3D Wondershow was also entertaining and fun to watch.

Moreover, we loved the beluga whales, African penguins, and Southern sea otters from the Georgia-Pacific Cold Water Quest gallery. The bright and vibrant colors of the seahorses and jellyfish in the Tropical Diver gallery were stunning as well, and the SunTrust Georgia Explorer gallery's touch tanks were very enjoyable. The manta rays and whale sharks from the Ocean Voyager gallery were also magnificent; the acrylic tunnel and viewing window further enhanced the experience.

Thank you so much for working tirelessly to improve the Georgia Aquarium. Our family has had many positive educational experiences there, and I hope that your facility will continue to remain as outstanding as it has been since it first opened.

Sincerely,

Lilly Meng

Lilly Meng

Shirley C. Franklin

Spelman College
350 Spelman Lane
Atlanta, GA 30314

April 24, 2010

Mr. Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

On behalf of Georgia Aquarium, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Conservation Education Programs.

As a former Mayor of Atlanta, Georgia, I am well aware of the positive impact the Georgia Aquarium has on education in our community. I was very proud to have served as Mayor when the Aquarium opened its doors in 2005, and even more proud when learning of the education programs offered by the Aquarium. In fact, an entire level of the Aquarium is dedicated to the "Learning Loop," where instructor-led programs allow for focused learning opportunities where students from Pre-K through 12th Grade can expand their understanding of aquatic ecosystems.

The Georgia Aquarium has served the educational community in our city and state in innumerable positive ways. Both the Aquarium's Instructor-Led Education Experience and its Self-Guided Aqua Adventures Educational Tour have been developed to align with Georgia State Educational Performance Standards (GPS) at each grade level. I have been told that thousands of children each year are served by these extraordinary programs.

It is my firm belief that educational opportunities enjoyed by students visiting the Georgia Aquarium have positive impact on Atlanta's children.

With these thoughts in mind, I respectfully submit this letter of support.

Sincerely,

Shirley Franklin

JOHN LEWIS
5TH DISTRICT, GEORGIA

SENIOR CHIEF DEPUTY
DEMOCRATIC WHIP

COMMITTEE ON
WAYS AND MEANS

CHAIRMAN,
OVERSIGHT SUBCOMMITTEE

INCOME SECURITY
AND FAMILY SUPPORT

Congress of the United States
House of Representatives
Washington, DC 20515–1005

WASHINGTON OFFICE:
343 CANNON HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–1005
(202) 225-3801
FAX: (202) 225-0351

DISTRICT OFFICE:
THE EQUITABLE BUILDING
100 PEACHTREE STREET, N.W.
SUITE # 1920
ATLANTA, GA 30303
(404) 659-0116
FAX: (404) 331-0947

April 22, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

I am pleased to write this letter of support and appreciation for Georgia Aquarium's Education Programs.

As a Member of the U.S. House of Representatives from Georgia's Fifth District, I understand the impact that facilities like Georgia Aquarium can have on our youth. I continue to be impressed by the programs you produce and the many and varied educational experiences your institution offers to students and guests.

I salute your facility's efforts to ensure that the Georgia Aquarium's education programs are an extension of the classroom, and that its programs are aligned with the Georgia Performance Standards (GPS) at each grade level, Pre-K through Grade 12.

Knowing this, it pleases me that thousands of Georgia students visit the Aquarium each year on learning field trips, where they have the ability to see and learn about the many thousands of species of mammals and other aquatic animals at the Aquarium. I understand the number of students who have gathered knowledge from these visits is nearing the half-million mark, which I think is extraordinary given the fact your facility has been open less than five years.

Further, I am impressed that an entire level of the Aquarium is dedicated to the "Learning Loop," where instructor-led programs allow for focused learning opportunities in which students from Pre-K through Grade 12 can expand their understanding of aquatic ecosystems.

The Georgia Aquarium is an institution which places great importance on ensuring the ongoing quality of the education experiences it offers to students and guests. Clearly, you and your team are dedicated to furthering the education goals and standards for our community and for our state. I am proud to say that such a world-class institution calls the State of Georgia its home.

Therefore, I respectfully submit this letter of support for the Georgia Aquarium and its education programming.

Sincerely,

John Lewis
Member of Congress

JL:rr

ANDREW YOUNG
FOUNDATION

COMMUNICATING POSSIBILITIES
DEVELOPING LEADERS

April 24, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

On behalf of Georgia Aquarium, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Education Programs.

As a former Mayor of Atlanta, Georgia, (as well as former Congressional Representative from the 5th District and former United Nations Ambassador), I can speak firsthand about the positive impact the Georgia Aquarium has on education in our community and state. I, personally, enjoyed a highly educational experience recently at the Georgia Aquarium. I am very proud to say that such a world-class facility calls Atlanta its home.

It is my understanding that thousands of students visit the Aquarium each year on learning field trips, where they have the ability to see and learn about the many thousands of species of mammals and fish on display at the Aquarium.

I salute your facility's efforts to ensure that the Georgia Aquarium's education programs are an extension of the classroom, and that its programs are aligned with the Georgia Performance Standards (GPS) at each grade level.

I participated in the Georgia Aquarium's Dive Immersion Program (DIP), on April 16, 2010. Every single aspect of this experience was educational, from the pre-instruction I received, to the facts I learned and the awe I felt swimming and diving with amazing aquatic animals in the Aquarium's 6.3 million gallon Ocean Voyager habitat. This is an extraordinary program and proof that learning never ceases during one's lifetime.

With these thoughts in mind, I respectfully submit this letter of support for the Georgia Aquarium and its education programming.

Keep Faith,

Andrew Young

JOHNS CREEK Arts Center

6290 Abbotts Bridge Road • Bldg. 700 • Johns Creek, Georgia 30097 • 770-623-8448 • JohnsCreekArts.org

April 22, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Dear Mr. Godfrey,

I am pleased to write this letter of support and appreciation for Georgia Aquarium's Education Programs.

As the Executive Director of the Johns Creek Arts Center, I applaud the efforts of the Georgia Aquarium to reach beyond the walls of the facility to impact students in the local and surrounding community. Johns Creek Arts Center's mission is to inspire artistic development for youth and adults by embracing community and corporate relationships that stimulate creative and educational growth and opportunity.

During the summer of 2008, JC Arts Center's Visual Arts campers had the opportunity to partner with the Aquarium to create and install an art exhibit fashioned after the guitar fish (a recent addition to the Aquarium's collection at the time). The theme for our summer camp was "Under the Sea" and while the children worked to create the wire and papier-mache guitar fish structure, they also had the opportunity to learn about marine biology and research the guitar fish species during the process. Your education staff was ever so helpful in providing our group with the resources needed to foster a connection beyond the visual arts to the environment and its precious animals.

We are extremely proud that our kids' work is still on display on your Learning Loop, a center unlike any I've ever seen in an Aquarium facility. What a hallmark accomplishment for a child, to have a piece of their art in the world's largest aquarium! Now two years later, parents still comment about the experience and the enrichment it afforded their children. Even greater for me is the fact that thousands of students are exposed to it every day, further linking art and science as a tool for education.

I cannot say enough how vital the Georgia Aquarium and your Education programs are to the Georgia community, for students and the general public alike.

Undoubtedly the earth connections fostered at the Georgia Aquarium will have a lasting impact far beyond one visit or summer camp experience.

Best Regards,

Gail Hisle

Gail Hisle
Executive Director
Johns Creek Arts Center

Georgia Council for the Arts — Fulton County Arts Council

Major funding for this organization is provided by the Fulton County Board of Commissioners under the guidance of the Fulton County Arts Council

SAXBY CHAMBLISS
GEORGIA

AGRICULTURE

AGING

ARMED SERVICES

INTELLIGENCE

RULES

United States Senate

WASHINGTON, DC 20510-1007

April 26, 2010

Mr. Anthony Godfrey
President and Chief Operating Officer
Georgia Aquarium
225 Baker Street, NW
Atlanta, Georgia 30313

Dear Mr. Godfrey:

I am pleased to write this letter of support for Georgia Aquarium's Conservation Education Programs.

From the moment one enters Georgia Aquarium the educational mission is apparent, translated by the excellent staff and volunteers. Whether taking a Behind the Scenes Tour, exploring the exhibits, participating in a lecture, or visiting with a classroom, guests leave Georgia Aquarium inspired and educated. As a global leader we have the resources to educate our youth both in and out of the classroom and I firmly believe that organizations like Georgia Aquarium play a vital role in enhancing that potential growth of our youth.

In total, Georgia Aquarium has welcomed over 250,000 students through scholarships and over 11 million guests from around the globe. It seems only natural that this type of innovative and interactive education would continue.

Through the Correll Center for Aquatic Animal Health, a joint Ph.D. program with The University of Georgia College of Veterinary Medicine, students are able to study with veterinary staff and learn hands-on about hundreds of aquatic animal species.

This educational experience also impacts to an area dedicated solely to education, aptly named the "Learning Loop," where students are welcomed into the facility on scholarships to experience math, physics, biology, and conservation in a whole new way. Teachers and students alike, from pre-K through high school, are invited to learn about the wonders of the oceans and leave with a sense of encouragement about conserving our blue planet.

The Sponsored Education Admissions (SEA) Program was created in an effort to ensure that diverse audiences, regardless of economic status, have an opportunity to participate in unique educational experiences, through partial and full scholarships. Funded through the generous contributions of local and national individuals, foundations and corporations, Georgia Aquarium is able to provide Title I schools (Pre-K - 12) and nonprofit organizations serving underprivileged children, located within the State of Georgia, an opportunity to experience innovative educational programs designed to amuse, teach, and enlighten.

It is my firm belief that the educational opportunities afforded to students, and guests, by visiting Georgia Aquarium have had a positive impact on the State of Georgia and beyond. Such work should continue and I look forward to a bright future with organizations like yours making an impact.

With these thoughts in mind, I respectfully submit this letter of support.

Very truly yours,

Saxby

Saxby Chambliss

SC:rge

1489 Idlewood Rd
Tucker, GA 30084
April/12/2010

Dear Ms. Marris-Zamekee,

On April 1, 2010 We visted the Georgia Aquarium. While I was there, I enjoyed watching the balooga whales with their entertaining flips and pale white skin. And that sting rays are very pretty & spectaculous. This is why I enjoyed the trip.

Sincerely,
Desyrae

1484 Idlewood Rd
Tucker, Ga 30084

Dear Ms. Harris ~ Zametke

April 2 2010 K~Kids Visited
the Ga. Aquarium. We Were gald
to be there i Learned a Lot
of stuff about the Whale's
Being at the Ga. Aquarium
Was a dream come true.
We hope to come back
an join you soon.

Thanks for reading my letter.

Amber Farmer

CITY OF ATLANTA

KASIM REED
MAYOR

55 TRINITY AVE. S.W
ATLANTA, GEORGIA 30335-0300

TEL (404) 330-6100

April 24, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

On behalf of Georgia Aquarium, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Conservation Education Programs.

As Mayor of Atlanta, one of the nation's largest cities, I can speak firsthand about the positive impact the Georgia Aquarium has on education in our community. I am very proud to say that such a world-class facility calls Atlanta its home.

It is my understanding that many thousands of students from Atlanta and Fulton County Public Schools visit the Aquarium each year on learning field trips, where they have the ability to see and learn about the many thousands of species of mammals and other aquatic animals on display at the Aquarium. As a former student of the Fulton County Public School system, I can attest to the value that such quality learning field trips can provide to students.

Taking this a step further, I am impressed that the Georgia Aquarium developed the Sponsored Education Admissions Program in an effort to ensure that diverse audiences, regardless of economic status, have an opportunity to participate in unique educational experiences, most free of charge to the student. Through the generous contributions of local and national individuals, foundations and corporations, the Aquarium is able to provide Title I schools (Pre-K - 12) and nonprofit organizations serving Title I children, located within the state of Georgia, an opportunity to experience innovative educational programs designed to amuse and enlighten. It is my understanding that more than 250,000 children have been served by this extraordinary program.

It is my firm belief that educational opportunities enjoyed by students visiting the Georgia Aquarium have positive impact on our city and state.

With these thoughts in mind, I respectfully submit this letter of support.

Sincerely,

Kasim Reed
Mayor

SENATOR DON BALFOUR
District 9
453 State Capitol
Atlanta, Georgia 30334
(404) 656-0095
Fax (404) 656-6581
Email: ss9balfour@aol.com

COMMITTEES:

Chairman, Rules Committee
Appropriations
Education and Youth
Health and Human Services

The State Senate
Atlanta, Georgia 30334

April 20, 2010

Mr. Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Dear Mr. Godfrey:

On behalf of Georgia Aquarium, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Conservation Education Programs.

I currently serve on the Senate Education and Youth Committee, and I am actively working to improve our education system for generations to come. As we look to society to educate our youth outside of the classroom, I firmly believe that organizations like Georgia Aquarium make a vital difference.

An educational experience is created from the moment one enters Georgia Aquarium. Through the Correll Center for Aquatic Animal Health, a joint Ph.D. program with The University of Georgia College of Veterinary Medicine, students are able to study with veterinary staff and learn hands-on about hundreds of aquatic animal species.

This educational experience also impacts the Learning Loop Educational Programs, where students are welcomed into the facility on scholarships. Teachers and students alike, from pre-K through high school, are invited to learn about the wonders of the oceans and leave with a sense of encouragement about conserving our blue planet.

I am impressed to learn Georgia Aquarium developed the Sponsored Education Admissions (SEA) Program in an effort to ensure that diverse audiences, regardless of economic status, have an opportunity to participate in unique educational experiences, through partial and full scholarships.

Georgia Aquarium has welcomed over 250,000 students through scholarships and over 11 million guests from around the globe. It encourage this type of innovative and interactive education to continue.

With these thoughts in mind, I respectfully submit this letter of support.

Sincerely,

Senator Don Balfour
State Senate District 9

The University of Georgia

Office of the President

April 23, 2010

To Whom It May Concern:

On behalf of The University of Georgia, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Conservation Education Programs.

As President of the University of Georgia in Athens, Georgia, I can speak firsthand about the positive impact the Georgia Aquarium has on education in our community. I am very proud to say that the University of Georgia has an outstanding and unique partnership with the Georgia Aquarium, which benefits our students and faculty on a professional and personal level. The UGA College of Veterinary Medicine, founded in 1946, is dedicated to training future veterinarians, providing services to animal owners and veterinarians and conducting investigations to improve the health of animals as well as people. UGA competes each year for the best and brightest students in the country, and our unique relationship with Georgia Aquarium provides us with an exclusive advantage.

Through Georgia Aquarium's Correll Center for Aquatic Animal Health, a joint Ph.D. program with The University of Georgia College of Veterinary Medicine, students have educational opportunities outside of the normal classroom. The Correll Center, made possible through the generous donations of community individuals, is a state-of-the-art facility that provides the veterinary diagnostic, medical treatment and surgical services found in the best veterinary teaching hospitals. UGA's partnership with the Georgia Aquarium allows the Aquarium to provide complete aquatic animal pathology programs while training veterinary residents, interns and students. The Aquarium's facilities have the capacity to change the face of aquatic animal medicine, and it is a privilege to provide our students with the amazing opportunity to be a part of the efforts.

It is my firm belief that educational opportunities enjoyed by our students at the Georgia Aquarium have a positive impact on our university, state, region and beyond. Wherever these students choose to go and make a difference, their experience with UGA and the Georgia Aquarium goes with them.

With these thoughts in mind, I respectfully submit this letter of support.

Sincerely,

Michael F. Adams

Michael F. Adams
President

The Administration Building • Athens, Georgia 30602-1661 • Telephone 706-542-1214 • Fax 706-542-0995
An Equal Opportunity/Affirmative Action Institution

The University of Georgia

Office of the Dean

College of Veterinary Medicine

Athens, Georgia 30602-7371
Telephone 706-542-3461
Fax 706-542-8254

April 23, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Dear Mr. Godfrey:

On behalf of Georgia Aquarium, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Conservation Education Programs.

As Dean of the University of Georgia College of Veterinary Medicine in Athens, Georgia, I can speak firsthand about the positive impact the Georgia Aquarium has on education in our community and at our university. The College of Veterinary Medicine has a longstanding tradition of excellence in teaching, research, and service. I am proud to say that the University of Georgia (UGA) has an outstanding and unique partnership with the Georgia Aquarium, which benefits our students and faculty on both the professional and personal levels.

Through a partnership between the Georgia Aquarium's Correll Center for Aquatic Animal Health, and UGA's College of Veterinary Medicine, students receive educational opportunities outside of the normal classroom setting. A product of this partnership is a combined Ph.D./residency program in aquatic animal pathology at the Georgia Aquarium that has been in place since before the Aquarium opened its doors to the public in November 2005. University of Georgia post-DVM graduate students in their third and fourth years of residency training have received unprecedented access to the Aquarium's animal collection while receiving first-hand training in the management of aquatic species, including marine mammals. These students study under the guidance of Dr. Al Camus, an expert in aquatic animal pathology, whom we recruited to the College to serve as a mentor for this graduate program and the partnership with the Georgia Aquarium. The post-graduate experience these veterinarians have received through this partnership is unique and first-class, making them more well-rounded and educated professionals acquiring skills available at few other veterinary colleges.

The success of the pathology residency has prompted us to do more with the Georgia Aquarium. Currently, we are working with the Aquarium on the formalization of a clinical residency program in zoological medicine, a program that will extend substantial opportunities to students in this discipline. Two Georgia Aquarium veterinarians are adjunct faculty in the Department of Veterinary Pathology and provide lectures and seminars on aspects of marine mammal and fish medicine. In addition, the Aquarium has funded two research projects related to aquatic animal health in the College.

The Georgia Aquarium's Correll Center also provides student externships, which are open to all veterinary students. Individuals from around the country can apply for the positions and take advantage of an amazing opportunity to spend 4-8 weeks at the Georgia Aquarium, earning credit toward their program and furthering their training. The experience they receive at the Georgia Aquarium is unlike anything they can receive in the classroom and only strengthens their training and skills.

It is my firm belief that educational opportunities enjoyed by our students at the Georgia Aquarium have a positive impact on our university, state, region and on the veterinary profession as a whole. Wherever these students choose to go and make a difference, their experience with UGA and the Georgia Aquarium goes with them.

With these thoughts in mind, I respectfully submit this letter of support.

Sincerely,

Sheila W. Allen

Sheila W. Allen, DVM, MS
Dean

SWA/tcc

OFFICE OF THE PRESIDENT

P. O. Box 3999
Atlanta, GA 30302-3999

Phone: 404/413-1300
Fax: 404/413-1301

April 22, 2010

Georgia State University

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

On behalf of Georgia Aquarium, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Conservation Education Programs.

As the President of Georgia State University and a Georgia Aquarium board member, I'd like to share my thoughts on Georgia Aquarium's impact on the education of the students at Georgia State, as well as on thousands of K-12 students in Atlanta and the state of Georgia.

Georgia State University Researchers and Educators have been working with the Georgia Aquarium to design innovative laboratory-based, hands-on educational modules for students K-12 who visit the Georgia Aquarium. As part of this effort, we now have a student internship program for GSU students to work at the Aquarium. The program teaches and reinforces scientific inquiries, research concepts and techniques. It provides an environment that stimulates learning in an innovative laboratory setting, incorporating activities and behavioral studies with fish, molluscs, and crustaceans. Studies include swimming responses, defensive mechanisms, social stress/dominance behavior and activity rate/metabolism. The program also integrates science and math curriculum for the K-12 students who meet the objectives from the Georgia Performance Standards.

GSU has also created a Marine Biology course and Aquarium internship classes. Participants are trained to lead the education program at the Georgia Aquarium. This program promotes science education, providing students majoring in biology an experience in education; likewise, it provides education majors exposure to the field of science. The unique experiences that these students have at the Georgia Aquarium will undoubtedly carry forward to positively impact the young people whom our participating students will instruct in years to come.

It is my firm belief that educational opportunities enjoyed by students visiting and working in collaboration with the Georgia Aquarium have a positive impact on Georgia State University. I am very proud that I am able to speak on behalf of not one, but both of these prestigious institutions.

With these thoughts in mind, I respectfully submit this letter of support.

Warm Regards,

Mark P. Becker, Ph.D
President

DEPARTMENT OF THE ARMY
DWIGHT DAVID EISENHOWER ARMY MEDICAL CENTER
300 Hospital Drive
Fort Gordon, GA 30905-5650

April 24, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

On behalf of the Georgia Aquarium, I am pleased to write this letter of support and appreciation for Georgia Aquarium's Conservation Education Programs.

As a Chaplain serving our Wounded Warriors in the Southeast region through numerous visits to Georgia Aquarium, I can speak firsthand about the positive impact the Georgia Aquarium had in educating and inspiring Soldiers on marine life and conservation.

The mission of the Wounded Warrior retreats were to honor and empower soldiers wounded and injured in the combat theater of operations in Iraq and Afghanistan. We provide unique spiritual intensive adventure activities to meet the needs of severely injured service members to prepare them to return to home or back to duty. The educational experience at the Georgia Aquarium helped affirm each individual's value and importance, while renewing their faith in God and country.

The Georgia Aquarium welcomed more than 60 soldiers with physical disabilities to participate in their Journey with Gentle Giants swim and SCUBA diving program. Your highly trained staff gave my participants an experience they still share with family and friends! The spiritual and emotional healing environment of the Aquarium was particularly enhanced by the team of professional divers and staff who educated Soldiers on the living creatures that call the Aquarium home. In each swim Soldiers were tasked to discover an animal which best represented their idea of freedom, to communicate a message of hope to their dive buddy, and find something that caused them to celebrate life and the significance of God in their recovery. Despite wounds and suffering many expressed a renewal of faith which challenged them to do more they just survive; they learned the significance of life and how to live with meaning and purpose. The Georgia Aquarium is not only a sanctuary for these beautiful animals, but was an important educational resource to our Soldiers and families.

It is my firm belief that educational opportunities enjoyed by some of my soldiers and the millions of other guests which visit the Georgia Aquarium have a positive impact which reaches far beyond the city of Atlanta and the State of Georgia. Our Soldiers will carry the stories of their spiritual journey of swimming with the giants in the world's most magnificent aquarium to their homes across this nation. And only time will tell how this experience impacted their view of life, their renewed faith in God, and their reunion with their loved ones. Please do all you can to ensure this important resource endures for generations to come.

With these thoughts in mind, I respectfully submit this letter of support.

Warm Regards,

Steve Munson
Chaplain, Major, US Army

Children's
Healthcare of Atlanta

Donna W. Hyland
President & CEO

1600 Tullie Circle NE
Atlanta, Georgia 30329
404-785-7000
404-785-7027 Fax
www.choa.org

April 23, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

I am pleased to write this letter of support and appreciation for Georgia Aquarium's educational programs and community involvment.

As the President and Chief Executive Officer of Children's Healthcare of Atlanta, I am proud to speak firsthand about the impact that institutions like Georgia Aquarium can leave with the families in our community. I continue to be impressed by the programs you produce and the exceptional level of educational experiences your institution offers to our patients and guests alike.

As one of the top children's hospitals in the nation, we are fortunate enough to have the world's largest aquarium in our backyard and are thankful for the relationship that developed between us. Together with the Aquarium, we share our passion for providing world-class service to families and giving back to the community.

The Fish Wish program, and the donation of several hundred tickets annually to our patients and their families, is a prime example of Georgia Aquarium's commitment to giving back to the community. This program is intended to provide children who would not otherwise be able to visit the Aquarium, due to their prognoses, physical or financial limitations, the opportunity to do so. Not only is the Aquarium providing families with the chance to see things they have never seen before, but it provides them a stress-free environment where the entire family can escape from their everyday pressures. For most, this is truly a unique and educational, life-altering experience especially for many of the children facing terminal illnesses.

In addition, we commend the Georgia Aquarium for leading the industry with the inauguration of the Special Needs Summer Camp, the only one of its kind. This interactive and comprehensive program gives children with special needs the unique occasion to receive the same animal and camp experience as other children, with a specialized curriculum and expert-trained staff. This hits particularly close to home for us as our Marcus Autism Center, funded by Bernie Marcus, founder and benefactor of the Aquarium, played a key role launching this program with special needs children in mind.

The Georgia Aquarium has touched the lives of so many children and families and afforded them the opportunity for life-changing experiences that many will never have the chance to travel and see on their own. I am positive that your mission to conserve and protect our oceans, while educating guests will continue to impact families for years to come.

Therefore, I respectfully submit this letter of support for the Georgia Aquarium and its education programming.

Sincerely,

CC: Douglas J. Hertz, Chair, Children's Healthcare of Atlanta Board of Trustees
Don Mueller, Executive Director, Marcus Autism Center

SHEPHERD
CENTER
A Catastrophic
Care Hospital

2020 Peachtree Rd., NW
Atlanta, GA 30309-1465
Tel (404) 352-2020
www.shepherd.org

April 26, 2010

Anthony Godfrey
President & COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Dear Mr. Godfrey:

On behalf of the Georgia Aquarium, I am pleased to write this letter of support and appreciation for the Georgia Aquarium's Conservation Education Programs.

As the chairman and co-founder of Shepherd Center, ranked by *U.S. News & World Report* among the top 10 rehabilitation hospitals in the nation, I can speak firsthand about the positive impact the Georgia Aquarium has on education in our community. I am very proud to say that such a world-class facility calls Atlanta its home.

Shepherd Center is a not-for-profit hospital specializing in medical treatment, research and rehabilitation for people with spinal cord injury and brain injury. Patients at Shepherd Center get more than just medical care; they get an experience that brings healing and hope. We work with each person to draw up a blueprint for rehabilitation, tapping into state-of-the-art medical care and comprehensive educational services. At Shepherd Center, we are a family, working together to help patients and their families obtain the care they need plus so much more.

The Georgia Aquarium has allowed us to take some of our patients outside of the normal hospital environment for their rehabilitation sessions by participating in the Aquarium's Journey with Gentle Giants swim and SCUBA diving program. These interactions have an incredible therapeutic benefit by allowing the patient to encounter first-hand so many species of aquatic animals from very small to the largest in the world. Our patients, who have recently experienced a dramatic change in their physical abilities, are able to draw the comparison of the importance of adapting to the environment. The message of the importance of all species, including themselves, and our responsibility to protect and conserve them is ever present.

It is my firm belief that educational opportunities enjoyed by some of my patients and the millions of other guests that visit the Georgia Aquarium have positive impact on our city, state and society.

With these thoughts in mind, I respectfully submit this letter of support.

Warm Regards,

James H. Shepherd, Jr.
Chairman

/jch

GEORGIA
DEPARTMENT OF
EDUCATION

Office of the State Superintendent of Schools

Kathy Cox, State Superintendent of Schools

April 22, 2010

Anthony Godfrey
President and COO
Georgia Aquarium
225 Baker Street NW
Atlanta, GA 30313

Mr. Godfrey,

As Georgia's State Superintendent of Schools, I can speak firsthand about the positive impact the Georgia Aquarium has on education in our state. The Georgia Aquarium's education programs are excellent examples of how instruction in the life sciences can be extended beyond the classroom. Through the different educational programs that the Georgia Aquarium supports, Georgia students have the opportunity to learn firsthand about thousands of species of aquatic animals, and the best way to protect and preserve the environments that they inhabit.

The Georgia Aquarium has been an important partner in the implementation of the new Georgia science curriculum, the Science Georgia Performance Standards (GPS), by aligning its programs and exhibits with the instructional expectations set forth by the Science GPS. It is indeed an asset to visiting students that an entire level of the Aquarium is dedicated to the "Learning Loop," where instructor-led programs allow for focused learning opportunities in which students from Pre-K through 12th Grade can expand their understanding of aquatic ecosystems, and increase their interest in science through hands-on engagement.

Equally important for Georgia students is the effort that the Georgia Aquarium makes to assure that all students have the opportunity to visit its exhibits and benefit from its programs. The Sponsored Education Admissions Program that provides funding for Title I schools (Pre-K - 12) and nonprofit organizations serving Title I children located within the state of Georgia, is a good example of this effort. Programs like this one ensure that diverse audiences, regardless of economic status, have an opportunity to participate in unique educational experiences, most free of charge to the student.

Clearly, the Georgia Aquarium is a facility which puts a great deal of time, effort and resources into ensuring the ongoing quality of the education experiences it offers to students and guests. With these thoughts in mind, I respectfully submit this letter of support for the Georgia Aquarium and its education programming.

Sincerely,

Kathy Cox

Kathy Cox

2066 Twin Towers East • Atlanta, GA 30334 • (404) 656-2598 • Fax (404) 651-8737 • www.gadoe.org

COBB COUNTY
SCHOOL DISTRICT

P.O. Box 1088
Marietta, GA 30061
Telephone: (770) 426-3300
www.cobbk12.org

April 23, 2010

Joseph Handy
Vice President, Guest Experience
Georgia Aquarium, Inc.
225 Baker Street NW
Atlanta, GA 30313

Dear Mr. Handy,

The Cobb County School District is delighted to have the Georgia Aquarium in our backyard, so to speak. On behalf of Cobb, I am pleased to write this letter of support and appreciation for the Georgia Aquarium's Conservation Education programs. Our partnership with the Georgia Aquarium provides our students with much-needed and well conceived science educational experiences. As the second largest school system in Georgia, the Cobb County School District is responsible for educating more than 106,000 students in a diverse, constantly changing suburban environment.

This year over 5000 Cobb students were able to participate in an educational program at the Georgia Aquarium. These programs support on-going academically rigorous classroom instruction of the Georgia Performance Standards. In order to achieve mastery of state standards, our students must be given the opportunity to move beyond the textbook or lab simulation. They need to see, touch, question, and interact with real world. The students who participated in the behind the scenes educational tours were given such a chance. Students were able to see how scientists study animal behavior and make observations of their own. They were also able to see real world examples of how conservation efforts impact aquatic wildlife.

Perhaps the most powerful impact of the Georgia Aquarium visit was the sense of wonder and experience it created in the minds of our youngest visitors. Most of our children had never seen a fish larger than a goldfish. Then suddenly they are standing in a glass tunnel with giant whale sharks swimming majestically over head. The delighted shrieks of awe and excitement didn't fade away after the students boarded the buses for home. To the contrary, their observations and experiences spilled over into their writing, math analogies, and even lunchtime conversations. The teachers reported that this experience improved the quality of their writing. For example, one student wrote, "Jimmy was so excited; you would think a whale shark just swam by or something!" Another student wrote, "Kila danced around the classroom like a sea otter playing in the water."

The experiences afforded by this partnership help bring the science curriculum to life and strengthened the overall scientific literacy of our students. Cobb is excited to partner with the Georgia Aquarium again next year. We look forward to ensuring that even more of our students are given the opportunity to experience what life is like in the deep blue sea.

Please let us know how else we might be able to support this project.

Kind Regards,

Sally Creel
Science Supervisor
Division of Curriculum and Instruction
Cobb County School District

Clayton County Public Schools

Department of Teaching and Learning

1058 Fifth Avenue, Jonesboro, Georgia 30236 (770) 473-2700

EDMOND T. HEATLEY, Ed. D.
Superintendent of Schools

DIANA DUMETZ CARRY, Ed. D.
Chief Academic Officer

Joseph Handy
Vice President, Guest Experience
Georgia Aquarium, Inc.
225 Baker Street, NW
Atlanta, GA 30313

Mr. Handy:

I am most pleased to be given the opportunity to voice my support of the educational programs offered at the Georgia Aquarium. I coordinate the elementary education science instructional programs for Clayton County Public schools. Our school system educates more than 50,000 of Georgia's finest students.

Clayton County most certainly values the Georgia Aquarium as an educational resource in our community. It is evident that much care and consideration is put into the programming at the Georgia Aquarium. Each program is tailored to the grade level and the Georgia Performance Standards related to the life sciences and conservation to focus the students learning while observing the animals. Students are provided the opportunity to learn how the marine ecosystems are connected to their daily lives and how their conservation efforts today will affect future generations in these environments.

In partnership with the Georgia Aquarium, our fifth grade students have learned about the unique adaptations our animals, such as beluga whales, have to survive in the ocean and how to classify different species based on common characteristics. Our ninth graders also reap the benefits of our partnership and learn about the conservation of biodiversity and how humans positively and negatively impact aquatic life through the Aquarium 101 program.

Through our partnership this year there is also a Reading Incentive Challenge sponsored by the Aquarium that was put in place at the two elementary schools in the county that did not meet Adequate Yearly Progress on the state CRCT test. The Challenge highlights books in the Accelerated Reader computerized program that cover aquatic environments. Students read the books that interest them and then take a quiz on the computer. Students earn points based on how many questions they answer correctly. Whichever class earns the most points wins a trip to the Aquarium to see their principal swim with a whale shark!

Our county is considered a Title I School District which services students at risk of failure or who are at or below the poverty level. If not for our partnership with the Georgia Aquarium, many of our students would never have had the experience of visiting the Aquarium and the chance to connect with marine life. Our two-year partnership with the Georgia Aquarium has afforded this opportunity to over 8,000 fifth and ninth grade students.

The educational programs at the Georgia Aquarium provide the young people of Clayton County with valuable experiences that they will cherish for a long time. We enthusiastically look forward to our continued partnership.

Vicki Jacobs
Clayton County Public Schools
Elementary Science Coordinator
Educational Specialist
National Board Certified Teacher
Presidential Awardee

The Lovett School
4075 Paces Ferry Road N.W.
Atlanta, Georgia 30327-3099
Tel. (404) 262-3032 Fax [illegible]
www.lovett.org

To Whom It May Concern: 4/23/10

On behalf of The Lovett School, I am pleased to write this letter of support and appreciation for The Georgia Aquarium's Education Programs.

My name is Dan Dalke and I have been in partnership with the Georgia Aquarium since 2004, prior to the opening of the facility. I have had students in my marine biology course at The Lovett School doing year long projects since the Fall of 2005. Students in the 11th and 12th grades apply and interview for four positions where they maintain and work on aquariums in their classroom and spend afternoons and weekends at the Georgia Aquarium doing research projects that are approved by the education and husbandry staff. Mentors from the husbandry staff are selected to help the students come up with a scientific proposal suitable for the goal of the project, a timeline to complete the project, and help them put together a final presentation given to the aquarium staff, volunteers, faculty and administration from the school, and family members.

The student interns have been able to work with several of the different exhibits, such as the Tropical Diver exhibit and Ocean Voyager. They have worked with manta rays, whale sharks, black tip reef sharks, cuttlefish, sea nettles, and many other animals in these exhibits. Some of the students have gone on to major in marine studies in college and are now entering graduate programs. They always mention their experience with the Georgia Aquarium as one of the reasons for their passion in science.

This partnership has not only had an effect on my student interns, but all the students in my class. They learn so much from their peers and myself to make their projects in the classroom that much better. The impact on my program at Lovett has been significant for the twenty five or so students I teach each year, but also on me. Every year the aquarium staff and myself are coming up with better and more interesting projects.

If you have any further questions, please fee free to contact me at ddalke@lovett.org.

Sincerely,

Dan Dalke
Upper School Science
The Lovett School

Marietta city schools

Marietta Center for
Advanced Academics
311 Aviation Road
Marietta, Georgia 30060

Phone: 770-420-0822
Fax: 770-420-0839
Karen Smits, Principal

April 22, 2010

Joseph Handy
Vice President, Guest Experience
Georgia Aquarium Inc
225 Baker Street NW
Atlanta, GA 30313

Dear Joe,

As the level of accountability rises for public schools across the state, educators must look for ways to reach out to others to provide challenging and relevant educational opportunities for their students. As a STEM (Science, Technology, Engineering and Math) Program in the state of Georgia, we understand the importance of reaching out to others in order to provide those hands-on, enriching experiences.

As a result of that, over the last three years we have been blessed to have the active involvement of the Georgia Aquarium in many facets of student and teacher development. Your interest and involvement in our school has afforded us many experiences for professional development and student learning

Over the last three years, the aquarium provided free or reduced entry for all of our students in order to complete real world, research based studies of various species of animals. Students were able to attend classes at the aquarium, interview experts and gather research to complete a digital project. Approximately fifteen hundred students were able to take this experience and learn and grow in a way that we never thought possible.

As a result of our field experience trips, students have been able to visit the aquarium to observe the animals, learn more about their natural habitats, their place in the food web and the impact people have on the animals Students learn best by experiencing learning, not by reading about it in a book. Our trips to the aquarium, learning from the animals in their environment has been extremely beneficial. Our students also gained from each of our trips because they were able to see a multitude of species of animals. From the penguins of Africa to beluga whales to the angel fish.

Having a powerful educational resource, like the Georgia Aquarium, in our own backyard has been a tremendous asset to learning for our students. All exhibits and classes we participated in were tied to the Georgia Performance Standards. In addition, the aquarium provided pre and post teaching activities that we could use as an extension once the hands-on viewing of the exhibits had taken place

The aquarium has also offered support to our staff. Last summer, a teacher at MCAA experience the "Rivers to Reefs" educational program that was be 100% sponsored by the aquarium. This teacher spent a week traveling and learning about water and animals and was able to take these valuable lessons back into the classroom to share with our students

We know and understand that is imperative for schools and members of the community to forge relationships to provide enriching opportunities for students in an effort to help them grow. We have been fortunate enough, with the help of the Georgia Aquarium, to do just that.

Sincerely,

Jennifer Hernandez

Jennifer Hernandez, Ed.S
Assistant Principal, MCAA
Administrator for Middle Grades Magnet Curriculum, MSGA and MMS

Learning without Limits

BOARD OF COOPERATIVE EDUCATIONAL SERVICES
First Supervisory District of Monroe County

Mr. Daniel White; *Superintendent*
Monroe #1 BOCES
41 O'Connor Road
Fairport, New York 14450
(585) 377-4660
www.monroe.edu

To Whom it may concern:

The Bathysphere Underwater Biological Laboratory or BUBL Project™ is the only virtual underwater learning environment in the United States today. We study both the environmental and ecological impacts of the Lake Ontario on the Western New York Region. The BUBL Project™ is a part of the New York State Cooperative Educational Service. As a BOCES program, we serve 19 school districts in Western New York. Students from 5th grade through college work in our lab in a real-life setting as they explore the Great Lakes.

The BUBL Project™ has been actively involved in distance learning and video conferencing for 4 years. The distance learning technology now allows us to interact and teach students in any part of the United States and beyond. This year, we had the pleasure of working with the Georgia Aquarium, in order to provide the students in Western New York a unique opportunity. Students in 17 local school districts swam with me, as I swam with the Whale Sharks. This had never been attempted before, and because of the program, more than 700 students in received an educational opportunity that will never be forgotten. All of this was accomplished in one morning, by using technology, and unparalleled collaboration amongst educators.

My experience with the education department and dive staff at the Georgia Aquarium was remarkable. As an educator, I gained new information and knowledge that I now share with students here in New York. The educational information aligned to all of the the National Learning Standards and far exceeded my expectations. The staff at the Georgia Aquarium worked with me for several months in order to assure that I would be prepared to teach about such elegant but endangered animals. Not only do I have a new found respect for these magnificent animals, but the students do as well. The animals we studied included some of the most endangered animals in the ocean's today. Under normal circumstances, it would be impossible for a student from the inner city in Rochester, New York to witness first-hand a Whale Shark, a Giant Hammerhead Shark, or a Manta Ray. However, with the help of the Georgia Aquarium, Monroe#1 BOCES, and local teachers that see value in learning, we changed that for our children.

As a first time visitor to the Georgia Aquarium, I was amazed at the amount of time the staff dedicate to their profession. These animals are loved, nurtured and monitored daily. The Whale Sharks were saved from being slaughtered. The Manta Ray, was saved from a shark net, and the stories of conservation and rescue go on and on. I watched as the Whale Sharks and other animals were fed. I saw the extreme caution used in handling and protecting the animals. Everything that I witnessed has encouraged me to continue my work with the Georgia Aquarium, but further, it has motivated me to expand and reinforce our collaboration.

This was a pilot program and much of our work will evolve as our interactions increase. It is essential that we build strong personal relationships with each other. The technology is nothing more than a tool. The focus is truly upon people working and learning with each other. Although our students may possess some excellent technical skills, it is worthless if it cannot be applied and used to educate others. This collaborative effort will benefit everyone involved and it will encourage our youth to explore and preserve the world that they live in.

Respectfully,

Peter E. Robson
Coordinator; The BUBL Project™
Bathysphere Underwater Biological Laboratory
www.bubl.org
peter_robson@boces.monroe.edu
Office: 585-242-5059
Cell: 585-506-2550

ATLANTA PUBLIC SCHOOLS
Making A Difference

NORTH ATLANTA HIGH SCHOOL
2875 NORTHSIDE DRIVE, NW
ATLANTA, GA 30305
(P) 404-802-4700
(F) 404-802-4799

April 23, 2010

Dear Ms. Morris-Zarneke,

On February 11, 2010 eighty students in the 10th grade Center for the Arts at North Atlanta High School visited the Georgia Aquarium. Before the trip the student's core subject teachers prepared them for the experience by connecting the aquarium to topics in the 10th grade curriculum. The mathematics class compared two populations using 2 samples and compared samples to populations. The science class studied the chemical processes of maintaining the aquarium water. The English class read the *Old Man and The Sea* (Hemingway) and discussed the changing ecology of the oceans and the size of fish. The Social Studies class investigated the economic impact of fishing in American history.

After the trip students reflected on the experience in an open forum. An emergent issue was the ethics of keeping animals in captivity. The students were surprisingly empathetic with the animals. Several students debated the pros and cons of keeping animals in captivity. The pros that were suggested were that "endangered animals would be able to reproduce and be protected from predators"(Connor), that "humans would build up feelings for ocean animals and would be more likely to protect wild animals from pollution and fishing," (Arthur) that "people can not travel into the ocean to see the fish in their native habitat and that the aquarium is the only way for most people to see the fish,"(Laynesia) that the aquarium experience "equalizes the access to the ocean, to be able to see ocean animals"(Fatima). Most of my students are economically disadvantaged—as defined by receiving free or reduced lunch. They said that they do not expect to visit an ocean, swamp, or coral reef in person (Ahna, Macy, Akeria).

The cons that students proposed were "having people look at you all the time"(Macy), being "restricted to a small space"(Folorunsho), "suffering from lack of freedom to do what you want to do" (Brie). An interesting rebuttal that was proposed was that "the fish in the aquarium help wild animals have a better life. The captive animals are representing the wild animals. The captive animals can be studied to find ways to help the wild animals"(Danielle).

I was surprised by student debate about this topic. The subject of ethical treatment of animals arose in a natural way from their experiences, something that could not have happened from studying a textbook in the classroom setting. The day of the trip the students were awed by the experience. They walked around the aquarium with their mouths open, gaping at the animals. They were very excited, running from one exhibit to the next—they continuously grabbed my hand to show me the next exciting display. These urban teenagers put up a front of being too cool at school, but they were not too cool to learn from the aquarium! It was wonderful to see them fully engaged in the experience and emphatically responding to the animals they saw. Once again, thank you for the excellent learning experience.

Patricia Daniel
Mathematics Teacher, North Atlanta High School

FULTON COUNTY BOARD OF EDUCATION

Woodland Elementary Charter School
1130 Spalding Drive
Atlanta, GA 30350

Dr. Ruth L. Baskerville, Principal Barbara Liptak, Asst. Principal Timothy Doherty, Asst. Principal

May 15, 2008

To Whom It May Concern:

We would like to take this opportunity to say thank you for allowing the students in our special needs program to visit the Georgia Aquarium. It was not only a fascinating, but exciting experience for the students.

Because these students have many intellectual disabilities, they find it hard to grasp the in depth knowledge about aquatic animals. They comprehend through the use of visual and sensory stimulating objects. The students had the opportunity to touch some of the animals and highly engage themselves with the many attractions that were there.

We would also like to recognize and say thanks to the Allstate foundation for making the sponsored admission possible. Because of your generosity in giving, our students were able to experience the aquatic life of many animals. You will never know how much this opportunity meant to the students. Thank you for fulfilling many of their dreams.

Sincerely,

Special Education Department
Woodland Elementary Charter School

Phone: 770-551-5890 Fax: 770-673-4091
www.fultonschools.org/school/woodlandes/main

From: "Clough, Sharon E"
Received: 11/20/11 6:23:02 PM EST
To: "visitorservices@georgiaaquarium.org"<visitorservices@georgiaaquarium.org>
Subject: Beluga Whale Interactive

Hi to all at the Georgia Aquarium

I recently travelled from Australia to Atlanta for a conference. I went to your magnificent Aquarium intending to spend the day just looking at your fish but purely by chance I discovered your Beluga and Friends Interactive program.
I want to tell you most sincerely that it was the most wonderful experience I have ever had. I have always been an animal conservationist and supporter of animal rights and welfare but the experience your magnificent staff gave me that day (I think it was Nov 3) will remain with me for my whole life. To my knowledge we don't have any Belugas in human care here in Australia so it was for me a 'once in a lifetime' experience. I wish to praise the GA staff who looked after me that day. Nicky my host was just gorgeous, kind, and a great educator. I came away able feel that I had learned a lot about Belugas and the GA as a whole. Erin , the trainer who took me into the pool and trusted me to interact with 'her' very special whales was an inspiration to me. I never felt any fear or trepidation and just was overwhelmed with awe and emotion for her skill and patience and her obvious love for her 'students' and her job.
I will never forget my Beluga and Friends experience and, thanks to Ben's fantastic photography I have been able to share it with everyone in my life.

Thank you Georgia Aquarium.

Sharon Clough

Nickie Funk
Animal Interactive Program Specialist
Georgia Aquarium
225 Baker Street
Atlanta, GA 30313

February 22, 2012

Dear Nickie,

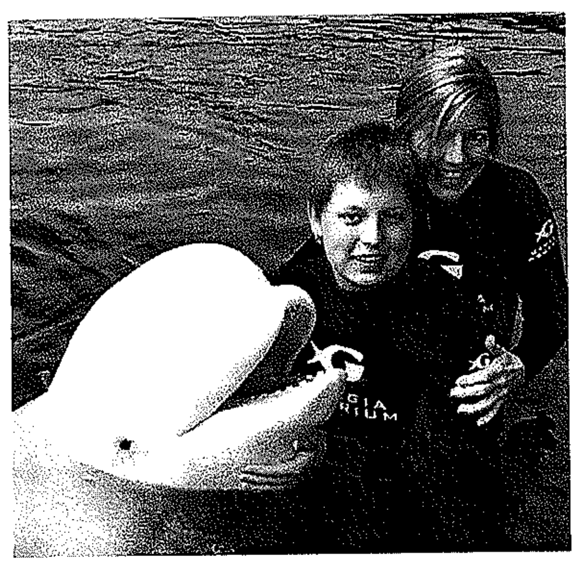
I got your name and address from the Beluga and Friends Confirmation email. I wanted to drop a quick note to express my absolute satisfaction with our experience and return the survey.

Everything from the locker rooms and supplies to the trainer and employees was fabulous! Amanda was our initial facilitator and she was very knowledgeable. We were fortunate enough to be the only two participants on the morning of 2/21. Everything was amazing from the moment we were met outside until the moment we said good-bye.

My son is very special having been adopted at age 7 from Russia with physical 'challenges'. A year ago, he was paralyzed by a surgery 'gone wrong.' I have tried to make all our moments count while nurturing his desire to someday work with sea mammals like the Beluga or dolphins. We have actually done dolphin encounters at Miami Seaquarium and Atlantis. Your facilities were better than I have experienced. The time with the Belugas and the overall experience exceeded our expectations. We were thrilled to have the bonus of seeing the harbor seals! Awesome all the way round!!

Love and Blessings to Amanda, Brian and all the folks there! So proud to be from Georgia and proud of our aquarium!

Amy and Vania Butler



From: Leslie Blalack
Sent: Saturday, April 21, 2012 5:02 PM
To: Nicole Dawson
Subject: great experience!

Hi Nicole,
My husband and I participated in the Beluga Whale and Friends program last weekend. I wanted to let the aquarium know what an awesome experience it was! Nickie led the orientation part, and she is very kind, knowledgeable, and professional. Sam, the trainer in our group, was amazing! Thanks to everyone who had a part in this incredible interactive program.
Leslie Sprenkel

From: Maureen Vandiver

Sent: Sunday, September 25, 2011 8:31 PM

To: Animal Interactive Progam

Subject: Re: Beluga & Friends Interactive Program Confirmation

I would just like to tell you what a WONDERFUL TIME my son , two grandchildren and I had yesterday with the Beluga whale interactive program . My grandchildren will never forget that day.

It will make them better stewards of our oceans rivers and our world. ALL of your staff from beginning to end were extremely knowledgeable and explained everything in a way understood by every age.

They were fun and made it more fun for us! What a great thing you are doing. I hope it in no way endangers the whales. To feel a connection to such a vibrant creature is like no other experience. It was a once in

a lifetime experience and we all thank you for you patience and for setting the boundaries ahead of time. The educational component was also excellent, well presented and helped us to understand more about

these beautiful mammals. We will never look at them in the same way again.

From: Lindsay Simpson

Sent: Monday, October 31, 2011 10:00 AM

To: Animal Interactive Progam

Subject: Wonderful time!!

Hi,

My name is Lindsay Trott. On Friday 28 October at 10.00 am, my husband William, friend Mike Smith and I participated in the Beluga Whale interaction. I have got to tell you that I had the most fantastic time (so did the guys). The whales are the most amazing creatures and I love the positive enforcement training you practice.

It was one of the most amazing experiences of my life and I am so pleased I got the opportunity to do it.

Regards,

Lindsay Trott

5005 SW 75th Street

Gainesville, FL 32608

March 12, 2012

Mr. David Kimmel

225 Baker Street NW

Atlanta, GA 30313

Dear Mr. Kimmel:

I am writing to notify you of your wonderful aquarium. When I went there five years ago, I was awed by the really cool animals. I liked the whale sharks and the otters, but my favorites were the Beluga Whales. I even bought a Beluga Whale stuffed animal and named her Georgina

Even though you have the largest aquarium in the whole world to deal with, you keep it very organized. There were signs everywhere so it was impossible to get lost. We had time to walk through the whole aquarium and see everything because we didn't have to deal with figuring out where all the tanks were.

Also, you had very smart, knowledgeable workers. Everywhere we went, they were there too, spitting out facts and answering questions. It's nice to know that you don't take just anyone to work at your aquarium, but people who know what they're talking about. It might have been a little while since I've seen your fine aquarium, but the experience I will always remember because it was stupendous!

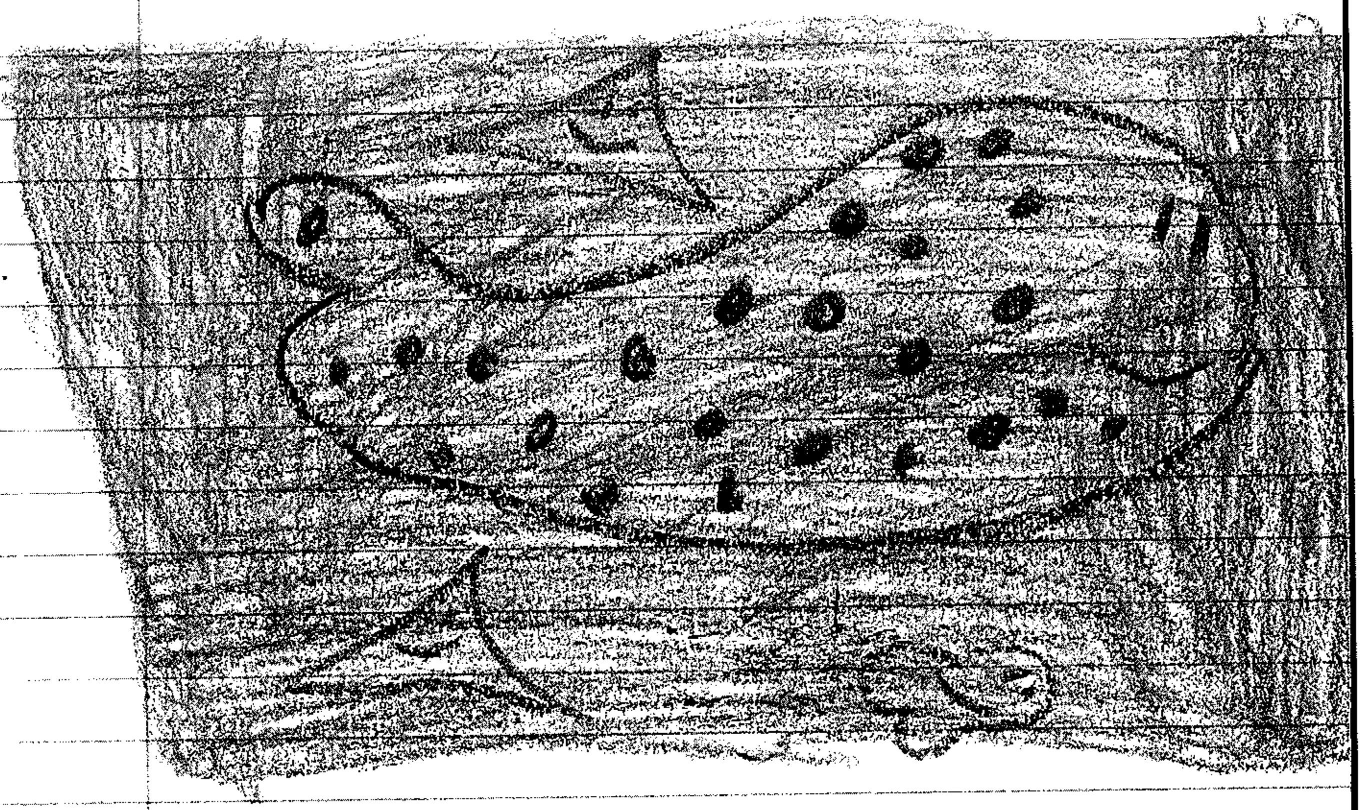
Respectfully Yours,

Erin Vaudreuil

Ms. Sutfin's Language Arts Class, Kanapaha Middle School

Kyra (12) 11/18/11

Thank-you for our trip to the Georgia Aquarium. We learned that a whaleshark is the biggest fish in the world. We learned that Beluga Whales have blubber and a blowhole. Whalesharks eat fish, shrimp and krill. My favorite part was the Beluga Whales. She was pregnant.



Angel Savage
East Hall M.S.
4120 East Hall Rd.
Gainesville, GA 30507

Friday May 6, 2011

Georgia Aquarium
225 Baker St. NW
[illegible]

Dear Georgia Aquarium,

Thankyou for hosting our school. It was an amazing trip for me. Because I learned a lot of new stuff I never knew about the sharks, and the beluga whales. The most experiance I had is the cold water place. I had a good learning expirience.

My favorite Thing in the aquarium was the Pretty places. The dolphins was my favorite though. Because one of them kept swimming into the glass trying to get out. My friend kept talking to the dolphins in the dolfin language. I had a good favorite place and I will keep my favorite place in my mind.

I plan to return in the summer hopefully. I hope to get to snorkel or to dive shortly. I am recommending all my friends and family. They will have a great time like I did. I hope y'all do keep it open for a while so I can come back shortly.

thank you again for letting schools come to see the aquarium.

Sincerely,

Angel Savage

Erykah Case
East hall M.S.
4120 East hall Rd.
Gainsville, Ga, 30507

May, 10, 2011

Georgia Aquarium
225 Baker St, N.W.
Atlanta, Ga, 30313

Dear Georgia Aquarium,
thankyou for Hosting our school, your aquarium was breath'takeing. Even though I've been there before It's like there's always something New there for us to see. Your 4D Movie was awesome!
→ My favorite part was seeing the buluga wales & Studying their Habitat And Makeing sure that they were acting Normal. Also I'd like to thankyou for the aquarium itself because

everything in there was beau4iful, I saw creatures that I didn't know exsisted. I liked the food so thankyou for that & also thankyou for the behind the scences tour. I liked how when you were looking at the fish you felt like you could just fall in the water like you could just jump in through the glass? I don't know but it seemed cool to me. Well before I go I just want to say thankyou so much for all the trouble you went through to get our school in the aquarium. I am definently coming again.

Sincerley,
Erykah
Cole

Chase mullins
East Hall Middle School
4120 East Hall Rd.
Gainesville, Ga. 30507

May 10th, 2011

Georgia Aquarium
225 Baker St. N.W.
Atlanta, Ga. 30313

Dear Georgia Aquarium,

Thank you for hosting our School to have a trip to the aquarium. It was a fun and educational trip, I learned about so many things While there, for example the Whale Shark is the biggest fish in the ocean, and that manta ray's Swim in a Summersalting motion to eat. I learned that the Stone fish is the most poisonous fish in the ocean. We Got to go backstage and See all of the exciting fish there, and learned all the behaviors of the Baluga whales. The most exciting part was when we got to see the baby seahorses.

I had a great time and saw alot of cool animals. I had a few favorites in the Aquarium. One of my favorite things was the touch zone. Another was the whale sharks because they are very cool and are big. Is like being apart of history because only 3 aquariums [illegible] whale sharks [illegible]. My last and most favorite part was the tunnel because [illegible] [illegible] eye perspective.

The person I would like to take would be my sister. She has never been and I think it would be a amazing experience for her. She love animals but mostly fish. She is a fish love and thats why I would take her.

Thank you for giving us the free tripe [illegible] everything else. Our whole 7th grade loved it [illegible] [illegible]

Sincerely,

[illegible]

Nov. 3, 2011

Dear Georgia Aguarium,

Yes, we are finaly at the Georgia Aguarium!!!

I can't whait to see the beluga whale.
There it is! LOOK at them there my favorit. Eewa it smells so fishy. Oh! I love the Georgia Aguarium. It's way better than Gatlenburg Aguaium. Where going behind the sens. Cool there even mor my favorit one is the big one! That Boeaven..

I apirtc how you let us get to be at the aguarum. We could not be there if it wasn't for you! Thank You so much for let us go!

Your Frined,
Preslee Hix

[illegible]

Dear [illegible]

Have [illegible]

[illegible]

With [illegible]

[illegible]

White [illegible]

Same [illegible]

[illegible]

[illegible],

Louise

APPENDIX I
OTHER AQUARIA FACILITIES

Contents

Tables and Figures

Chapter 1

Introduction

This document describes the other aquarium facilities where the imported beluga whales may be transferred under breeding loans. Where it has been obtained, information is included regarding general setting, hours of operation, cost of admissions, beluga tank facilities, and beluga-specific education and recreation programs.

Chapter 2
Shedd Aquarium

General Setting

Shedd Aquarium is located at 1200 South Lake Shore Drive, in Chicago Illinois. It is situated on the Lake Michigan shoreline adjacent to the Field Museum. The facility is the legacy of philanthropist John G. Shedd, who in the early 1920s advocated for the development of a world-class aquarium. When it officially opened in 1930, the Shedd was the first inland aquarium with a permanent saltwater collection. The facility doubled in size with the addition of the Oceanarium and Wild Reef exhibits, completed in 1991 and 2003, respectively. Today the aquarium covers approximately 422,000 square feet.

Shedd Aquarium is operated as a non-profit institution supported by the people of Chicago through the Chicago Park District and from revenues from admissions, memberships, programs, donations, facility rentals and proceeds from on-premises gift stores and restaurants. The average annual attendance is approximately 2 million visitors.

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Beluga Facilities

The Secluded Bay exhibit in the Abbot Oceanarium houses the aquarium's collection of beluga whales and other Pacific Ocean marine mammal species. The Oceanarium was remodeled in 2009 to recoat all pool surfaces, conduct long-term maintenance, and upgrade animal life-support and temperature management systems. Based on USDA requirements, Shedd has the capacity to house 36 belugas. However, Shed Aquarium currently houses only seven beluga whales. The Secluded Bay exhibit has a total capacity of 400,000 gallons, with access to a supporting 35,000 gallon veterinary pool. Water temperatures in the exhibit are maintained at 55°F. Air temperatures are maintained at 68°F.

Facility Hours of Operation and Cost of Admission

Shedd Aquarium hours of operation are detailed in Figure 1.

Figure 1. Shedd Aquarium 2012 Hours of Operation

Regular Hours
Fall and winter hours
9:00 a.m.–5:00 p.m. Monday through Friday
9:00 a.m.–6:00 p.m. Saturday and Sunday
Spring and summer hours
9:00 a.m.–6:00 p.m. daily

Exceptions & Extended Hours:
Open every day of the year except Christmas.

Shedd Aquarium ticket prices including access to the Oceanarium are provided in Table 1.

Table 1. Shedd Aquarium Admission Prices

Ticket/Package	Description	Price
General Admission	Includes access to the Caribbean Reef, Waters of the World and Amazon Rising exhibits. Does not include: Wild Reef, Abbott Oceanarium, Polar Play Zone, Jellies special exhibit, aquatic show tickets or 4-D Experience tickets. Jellies and the aquatic show cannot be added to the General Admission ticket	Adults $8.00 Children $6.00
Total Experience Pass	Access to all exhibits plus a ticket to the 4-D Experience and a ticket to Shedd's aquatic show. Access to Waters of the World, Caribbean Reef, Amazon Rising, Wild Reef, the Abbott Oceanarium, Polar Play Zone and Jellies Special Exhibit.	Adults $34.95 Children $25.95
Shedd Pass Plus	Access to all exhibits plus to a 4-D Experience feature of your choice. Access to Waters of the World, Caribbean Reef, Amazon Rising, Wild Reef, the Abbott Oceanarium and Polar Play Zone. Add Shedd's aquatic show for $4 per person. Or add Jellies Special Exhibit for $3.00 per person.	Adults $32.95 Children $23.95
Shedd Pass	Access to the Abbott Oceanarium and Polar Play Zone, Wild Reef, Amazon Rising, Caribbean Reef and Waters of the World. Add Shedd's aquatic show to your visit for $4 per person. Or add Jellies for $3 per person. Tickets available at Shedd box office only.	Adults $28.95 Children $19.95
Aquarium Membership	Unlimited access to all exhibits	Individual $80 Family $175

In addition to the standard ticket prices, Shedd Aquarium offers a variety of "Extraordinary Experience" packages that include direct contact and interaction with belugas and other marine mammals in the collection. These packages range in cost from $200 to $350 per person.

Educational Programs

Shedd Aquarium offers several educational programs that include or involve the beluga collection. These programs, key concepts and skills, and relevant Illinois State Learning Standards are described by grade level below.

Shedd Aquarium's more than two million annual guests have many opportunities to learn about beluga whales. Shedd Aquarium incorporates beluga-specific information into a variety of educational programs. These include daily marine mammal shows, with approximately 175,000 guests annually, beluga encounters, with approximately 2000 guests annually, trainer for a day programs, with approximately 600 guests annually, and chats led by beluga trainers, with approximately 70,000 guests annually. Beluga curriculum is also incorporated into many of the aquarium's educational classes, outreach and correspondence classes and efforts, and signage and interactive displays in exhibits around the museum. Current beluga education activities and programs include:

Grades K-2 Learning Labs

Happenin' Habitats

Focus: Meet live animals, examine their homes and compare and contrast habitats in ecosystems around the world. Through investigations and problem-solving, students learn how animals use and even share these special places.

Key concepts: Habitats, adaptations, body parts, relationships

Icy Adaptations

Focus: Students investigate and explore some of the adaptations that enable beluga whales, sea otters and penguins to survive in frigid habitats

Key concepts: Adaptations, animal behavior, insulation, anatomy

Grades 3-5 Learning Labs

Whale Adventure

Focus: Students use tools and experimentation to uncover the many adaptations whales have to survive in diverse and sometimes surprising places.

Key concepts: Adaptations, food web

Target Bus Fund Program

The bus fund program at Shedd Aquarium, sponsored by Target®, offers field trip assistance to economically disadvantaged schools in the Chicago Public Schools system. Participation is limited to schools in which at least 51 percent of the student population qualifies for free or reduced-price lunches through the National School Lunch Program.

Conservation Efforts

Shedd Aquarium has been involved in a multitude of beluga-specific conservation and research projects. Below is a list of some examples of these projects.

- **Vocal Behavior of Beluga Whales** – This was a long-term project with Cherie Reicha and Peter Tyak of Woods Hole in which Shedd trained beluga whales to wear data loggers so that information could be gathered and cataloged about the meaning of various types of vocalizations. Shedd was one of several facilities participating in this research.
- **A Flipper Band for Individual Identification of Beluga Whales** – This study was in cooperation with Jack Orr of the Department of Fisheries and Oceans in Canada. Shedd trained whales to wear specially designed flipper tags so that their viability and impact on the animals could be tested before using these tags on wild belugas. This study was done along with several other aquariums.
- **Diagnostic and Metabolic Implications of Adaptive Hormonal Changes in Captive Odontocetes** – This study was led by Dr. David St. Aubin from the University of Guelph. Blood samples were taken over a multi-year period and compared and contrasted to samples taken from wild populations.
- **EKG Monitoring and Interpretation of Stranded Cetaceans** – Dr. Jon Lien of Memorial University of Newfoundland headed up this study in which EKG monitoring techniques were tested and adapted with Shedd's beluga whales. The study hand long range impacts on how EKG's were utilized with stranded and entangled cetaceans in the wild, but also improved techniques for general use in captive cetaceans.
- **Markers of Toxicity from Organohalogens in St. Lawrence Beluga Whales** – This study was spearheaded by Dr. Sylvain Deguise of the St. Lawrence National Institute of Ecotoxicology and focused on characterizing the immune system of beluga whales in an area of the St. Lawrence River that is heavily polluted. Shedd provided blood samples over a several year period to assist in this study.
- **Mimicking Capability in Beluga Whales and its Function in the Wild** – This study, overseen by Dr. Jeanette Thomas of Western Illinois University and carried out by Shedd staff recorded and documented the mimicry capability in beluga whales and utilized similar wild studies to try to better understand the capability and reasons for the beluga whales diverse vocal repertoire.
- **Rescue of a Newborn Beluga Whale in the St. Lawrence Estuary** – This article which appeared in the Canada Journal of Zoo and Wildlife Medicine was co-authored by Dr. Sylvain Deguise of the St. Lawrence Institute of Ecotoxicology and Ken Ramirez of the Shedd Aquarium and chronicled the care and medical findings in a stranded neonate beluga whale that lived for a week under human care. The findings were significant in examining the care of stranded belugas, detailing information about a wild neonate, and examining immune challenges as transferred from mother to a calf in the wild.
- **Immune Functions in Beluga Whales: Evaluation of Phagocytosis and Respiratory Burst with Peripheral Blood using Cytometry** – This was an unplanned publication coauthored by Dr. Sylvain Deguise of the St. Lawrence Institute of Ecotoxicology and Dr. Jeff Boehm of the Shedd Aquarium that resulted from the Markers of Toxicity study referenced above.

- **Genetics of Beluga Whales** – Shedd contributed to a study led by Steve Aibel of the National Aquarium in Baltimore that was a multi-facility look at beluga genetics.
- **Receiver Operating Characteristics (ROC) Curve. Analysis of Underwater Hearing Data from Three Marine Mammal Species** – This study, led by Dr. Jeanette Thomas of Western Illinois University, compared an analyzed hearing ability of three cetacean species, including beluga whales. It provided previously unavailable data on this topic.
- **Care and Treatment of an Orphaned Beluga Whale** – This article was authored by ken Ramirez of the Shedd Aquarium and documented and examined the techniques for raising and caring for a young beluga calf orphaned at five months of age.
- **The Effect of Body Size on Breath-Hold Capacity in Odontocetes: Pacific White-sided Dolphins to Killer Whales** – This study was over-seen by Dr. Terrie Williams of the University of California at Santa Cruz and included data retrieved from four beluga whales from Shedd in the study.
- C**omparison of Nursing Times and Nutritional Needs of Beluga Whale Calves** – This article and study was conducted and co-authored by Ken Ramirez of the Shedd Aquarium – it was still in press as of the start of 2012. It compares the nursing times, behavior, and health of nine beluga calves and their mothers.
- **Erysipelothrix rhusiopathiae Identification in Fish Fed to Marine Mammals** – This long term study has resulted in multiple publications on Erysipelothrix with implications for feeding and care of all cetacean species. The study was led by Dr. Jeff Boehm of the Shedd Aquarium but included collaborators from facilities world-wide.
- **Investigation of the Physiological Responses of Belugas to Stressors to Aid in Assessing the Impact of Environmental and Anthropogenic Challenges** – Aiding Tracy Romano of Mystic Aquarium in providing blood samples for this project.
- **Circulating Levels of Thyroid Hormone in Captive Beluga Whales (Delphinapterus leucas) and the Influence of Age, Sex, and Seasonality on Thyroid Hormones** – Providing Samples to Dr. Allison Tuttle of Mystic Aquarium to assist in this project.
- **Acoustic Development in Two Beluga Calves (Delphinapterus leucas) at the Shedd Aquarium** – A project overseen by Dr. Jeanette Thomas of Western Illinois University, this study examines the vocal acquisition of two different calves over a two year period.
- **The Development of Blood Biochemistry for Diving in Beluga Whales (Delphinapterus leucas): Insights into Age-class Differences in Adaptability to Long-term Changes in Arctic Sea Ice Conditions** – This project is being conducted by Dr. Shawn Norren from the University of California – it looks at blood samples in captive belugas to serve in a comparative manner with belugas in wild populations.

Chapter 3
Mystic Aquarium

General Setting

Mystic Aquarium is located in Mystic Connecticut at 55 Coogan Boulevard, adjacent to Interstate 95 immediately east of the Mystic River estuary. The Aquarium opened in 1973 and was first operated by Mystic Aquarium, Inc., a privately owned, for-profit corporation. The principal shareholder was Ohio industrialist and philanthropist Kelvin Smith who, with colleague William Kelley, developed "Instant Ocean," a product that allowed labs and aquariums to create artificial seawater. The aquarium provided a venue to advertise this product, which is used in public, private, and hobbyist aquariums worldwide. The facility has operated since 1998 as the non-profit Mystic Aquarium and Institute for Exploration.

Beluga whales first arrived at the Mystic Aquarium in 1975, with the initial collection taken from Manitoba. The aquarium was renovated and expanded in 1998. This expansion included the new Arctic Coast exhibit, one of the largest outdoor beluga whale exhibits in the nation.

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Sea Research Foundation, Inc.
APHIS license information:
APHIS Class C Exhibitor license # 16-C-0025

Beluga Facilities

The Mystic Aquarium beluga collection is housed in the Arctic Coast exhibit, a one-acre outdoor habitat featuring three interconnected pools holding approximately 750,000 gallons of water with a maximum depth of 16feet. Three 20-foot-long underwater windows, as well as above-water overlooks provide visitors with different perspectives of the belugas and their behaviors. Based on USDA requirements, Mystic Aquarium has the capacity to house 44 belugas. However, Mystic Aquarium currently only houses four beluga whales. The priorities of the beluga training program are husbandry and enrichment, research, education and conservation.

Facility Hours of Operation and Cost of Admission

Mystic Aquarium hours of operation and admission costs are detailed in Figure 2 and Table 2.

Figure 2. Mystic Aquarium 2012 Hours of Operation

Regular Hours
December - February
10:00 a.m.-4:00 p.m. daily
March
9:00 a.m.–4:00 p.m. daily
April - October
9:00 a.m. – 5:00 p.m. daily
November
9:00 a.m.–4:00 p.m. daily

Exceptions & Extended Hours:
Open every day of the year except Thanksgiving and Christmas.
Facility may be closed in the event of severe weather.
Guests already entered may visit for an additional hour after closing.
Hours are subject to change without notice.

Table 2. Mystic Aquarium Admission Prices

Ticket	Description	Price
General Admission - Adult	Age 18 +	$29.00
General Admission - Children	Age 3 - 17	$21.00
General Admission - Senior	Age 60 +	$26.00
General Admission – Young Children	Age 2 and Under	Free
Value Ticket - Adult	Admission and 4-D Theater for Age 3-17	$33.00
Value Ticket - Children	Admission and 4-D Theater for Age 3-17	$25.00
Value Ticket - Senior	Admission and 4-D Theater for Age 60+	$30.00
Value Ticket - Young	Admission and 4-D Theater for Age 2 and Under	Free
Family Membership	Family	$179.00
Grandparent Couple Membership	Grandparents	$179.00
Individual Membership	Individual	$65.00

In addition to the standard ticket prices, Mystic Aquarium offers a variety of “Encounter Programs” packages that offer direct contact and interaction with the beluga. These packages range in cost from $49 to $145 per person depending on selection and membership status.

Educational Programs

Mystic Aquarium offers three beluga interactive programs (Beluga Encounter, Whales up Close, and Train-A-Whale) to educate visitors about the natural history of beluga whales, the important research being conducted and to promote awareness of conservation efforts related to belugas in the wild. The interactive programs are designed to accommodate guests ranging in age from six to adult, and each program provides a variety of experiences. Beluga Encounter takes place in shallow water, while Whales up Close and Train-A-Whale take place on dry ground in close proximity to the whale. Through these programs, visitors have the opportunity to interact, touch and take part in interactive training sessions with a beluga whale. These beluga whale experiences are designed to inspire participants to care for and protect the belugas and our ocean planet.

Through Mystic Aquarium's Sea Research Foundation's division of Immersion Learning, a curriculum entitled: "Marine Mammals of the Arctic" focuses on key Arctic animals such as beluga whales, ice seals, narwhals, and polar bears. Students learn about the general biology and population dynamics of the animals as well as current threats and conservation efforts. Science Technology Engineering and Math (STEM) topics covered include Arctic geography, climate change, adaptations, predator-prey relationships, marine mammal husbandry, research methods, conservation and careers. Moreover, a training course for educators is given for successful implementation of the program for students in or out of school. Following completion of the Immersion program there is a goldfish training contest for students based on what they learned in the module entitled: "Beluga Basic Training" and from the "Beluga University" online game. The winner gets to join a beluga trainer at Mystic Aquarium for a day.

In addition, Mystic Aquarium leads programs for student grades preschool – 12 focused on the physical and behavioral adaptations of beluga whales. Puppets, costumes, games and exhibit visits are used to illustrate how belugas use these adaptations to survive in their aquatic environment.

Through the "Educational and Cultural Exchange Program" native Inupiat students help Mystic Aquarium scientists collect data on belugas in the field and then travel to Mystic Aquarium to participate in a week long educational and cultural exchange program focused on belugas and other aquatic animals, research, and careers. The Mashantucket Pequot Tribal Nation, a local tribe to the Aquarium participates as well with time spent at the Pequot museum and reservation. The Aquarium's "Researcher for a Day" allows opportunities for students to participate in the research by seeing how a blood sample is taken from a beluga and then spinning the blood down, processing and analyzing it themselves working side by side with Aquarium scientists.

Reaching approximately 700,000 visitors per year, Mystic Aquarium's beluga habitat portrays the Arctic coast. Through graphics, interactive videos on belugas and climate change, exhibit educator and whale trainer presentations, visitors are educated on the natural history, biology, research being done and current threats to belugas. The Aquarium's mission is to "inspire people to care for and protect our ocean planet through research, education and exploration".

Resources and Professional Development Programs

The Mystic Aquarium offers a range of professional development opportunities designed to increase educator knowledge of marine species and ecosystems. Programs focused on or involving the beluga collection are described below.

Short Courses

Ocean Locomotion *Starring Baby Beluga* (Pre-K & Kindergarten)

Children explore the ways in which different types of marine creatures move throughout their environments. The class includes observation and interaction with belugas and games and activities designed to stimulate learning.

All Sorts of Animals (Grades 1–3)

Students take part in hands-on activities designed to teach the differences between reptiles, birds, mammals, and fish. The class is intended to provide an introduction to animal classification and provide opportunities to apply knowledge gained.

Beautiful Belugas (Grades 1–3)

Introduction to the characteristics that beluga whales have adapted to survive in ocean habitats. Involves interactive activities with the beluga collection.

Beluga Echolocation (Grades 4–5)

Introduction to marine mammal echolocation using hands on activities demonstrating how beluga whales use sound to sense and interact with their environment.

Eat or Be Eaten (Grades 4–5)

Students learn about ocean food webs and predator-prey relationships.

Animal Classification (Grades 6–8)

Students learn about the scientific classification method and the key characteristics differentiating marine mammals from fish, and vertebrates from invertebrates. Class includes exercises using these taxonomic skills to classify marine invertebrates.

Marine Scientist (Grades 6–8)

Students participate in a scenario where a stranded marine mammal is brought to the Mystic Aquarium Animal Rescue Clinic. Students play the role of marine scientist by examining animal anatomy using x-rays and exploring how immune system function is affected by environmental factors. The intent of the program is to increase understanding of scientific concepts and methods through hands-on activities.

Animal Behavior (Grades 9–12)

Students are introduced to the reasons why scientists study animal behavior and the methods they use. Includes exploration of the methods used to study and train marine mammals.

Comparative Evolution (Grades 9–12)

Students explore how environmental changes drive the evolution of new species and the expansion of life into a variety of ecological niches. Students examine marine mammal skeletons to discover the structural changes these species made to adapt a fully aquatic life history. Class provides first-hand anatomical evidence supporting the theory of evolution.

Endangered Ecosystems (Grades 9–12)

Broad review of the status and threats facing a variety of marine ecosystems around the globe and the implications for plant and animal species that depend on these habitats. Includes a review of efforts attempting to address these challenges.

Researcher for a Day—Hematology (Grades 9–12)

Two-hour program exposing students to the methods used to prepare and interpret marine mammal blood samples. Introduces students to the application of immunology and hematology in the diagnosis and treatment of veterinary disorders in marine mammal species.

Seminar on Marine Mammals

A 12-week seminar delivered by visiting scientists with expertise in the natural history, evolution, anatomy, physiology, husbandry, cognition, behavior and conservation of marine mammals. The intent of the seminar is to increase educator knowledge of marine mammals.

Conservation Efforts

Mystic Aquarium has an ongoing research program focused on beluga whales. Aquarium scientists are trying to understand how climate change, oil and gas exploration and drilling, and other natural and/or anthropogenic stressors affect the health of belugas. Partnering with scientists nationwide and with the native Inupiat people, satellite transmitters are placed on wild belugas to track where they go as well as their diving profiles and blood samples and other tissues are collected and brought back to Mystic Aquarium to check immune status, disease exposure and overall health status. The Aquarium specifically studies belugas in the Chukchi Sea, Bristol Bay, AK and in 2012 will expand its research program to include animals in the eastern high Canadian Arctic. Baseline health measures at this current point in time are established for different populations of belugas and monitored with increasing environmental and anthropogenic pressures. These populations will be compared with endangered populations as feasible such as the Cook Inlet belugas.

The Aquarium also utilizes the belugas in its collection to answer questions about their biology, behavior, cognitive and auditory capabilities. For example, currently a federal funded research project focuses on the behavioral and physiological response to stressors and the ability to measure stress hormones in blood and other tissue matrices such as saliva, blow and feces. This will transition to the ability to sample free ranging cetaceans utilizing non-invasive tissue collection methods e.g. blow to assess their reproductive status or physiological state. The belugas not only support research projects of Mystic Aquarium scientists but external collaborators and scientists. For example, pioneering work on the reproductive cycle and artificial insemination methods were carried out on Mystic Aquarium belugas.

Mystic Aquarium has over a decade of experience in conducting beluga research. The Aquarium's researchers have worked on dozens of beluga-specific research projects, resulting in over 20 published research articles.

Example research projects include:

- Evaluating the use of blow for reproductive hormone and genetic analysis in belugas
- Social interaction and contact behavior in belugas
- Visual laterality in beluga whales
- Assessing fertility potential and immune function of beluga whales
- Investigation of the Physiological Responses of Belugas to Stressors to Aid in Assessing the Impact of Environmental and Anthropogenic Challenges
- Passive acoustic recordings of exhibit noise and beluga whale vocalizations
- Health Assessments of Belugas in the Chukchi Sea and Bristol Bay
- Object representation in echolocating Beluga whales
- Determining the seasonal pattern of reproduction in an adult male beluga
- Artificial insemination in a beluga whale
- Energetics and Metabolism of Beluga Whales

Examples of published articles include:

- Buck, J.D. Shepard, L.L.;Bubucis, P.M.;Spotte, S.;McClave, K.;Cook, R.A. 1989. Microbiological characteristics of white whale (*Delphinapterus leucas*) from capture through extended captivity. Canadian Journal of Fisheries and Aquatic Sciences
- Goren, A.D.;Brodie, P.F.;Spotte, S.;Ray, G.C.;Kaufman, H.W.;Gwinnett, A.J.;Sciubba, J.J.;Buck, J.D.
- 1987. Growth layer groups (GLGs) in the teeth of an adult belukha whale (Delphinapterus leucas) of known age: evidence for two annual layers. Marine Mammal Science
- Richard, P.;Heide-Jorgensen, M. P.;St. Aubin, D.J. 1998. Fall movements of belugas (*Delphinapterus leuca*s) with satellite-linked transmitters in Lancaster Sound, Jones Sound and northern Baffin Bay. Arctic.
- Reeves, R.R.; St. Aubin, D.J. 2001. Introduction to Belugas and Narwhals: Application of New Technologies to Whale Science in the Arctic. Arctic
- Romano, T.A., M.J. Keogh, C. Schlundt, D. Carder, and J. Finneran. 2004. Anthropogenic Sound and Marine Mammal Health: Measures of the Nervous and Immune Systems Before and After Intense. Canadian Journal of Fisheries and Aquatic Sciences
- T.R. Robeck, K.J. Steinman, G.A. Montano, E.Katsumata, S. Osborn, L. Dalton, J.L. Dunn, T. Schmitt, T. Reidarson, J.K. O'Brien. 2010. Deep intra-uterine atrificial inseminatios using cryopreserved spermatozoa in beluga (*Delphinapterus leucas*). Theriogenology
- Mazzaro, L.M., J.P. Richmond, J.N. Morgan, M.E. Kluever, J.L. Dunn, T.A. Romano, S.A. Zinn, and E.A. Koutsos. 2011. Evaluation of an Alternative to Feeding Whole Frozen Fish in Belugas (*Delphinapterus leucas*). Zoo Biology

General Setting, Hours of Operation, and Cost of Admissions

SeaWorld Orlando

SeaWorld Orlando is located at 7007 SeaWorld Drive in Orlando, Florida, adjacent to Interstate 4 and the Central Florida Parkway. SeaWorld Parks and Entertainment, Inc. is a publicly-owned portfolio company of the Blackstone Group. In addition to SeaWorld Orlando, SeaWorld Inc. operates marine zoological parks in San Diego, California and San Antonio, Texas.

The SeaWorld Orlando beluga collection is housed in the Wild Arctic exhibit, an indoor/outdoor habitat featuring two interconnected pools holding approximately 592,000 gallons of water. The 390,000-gallon indoor exhibit pool ranges from 9 to 24 feet in depth. The 202,000-gallon outdoor housing pool has a uniform depth of 12 feet. Based on USDA requirements, SeaWorld Orlando has the capacity to house 14 belugas. However, SeaWorld Orlando currently only houses four beluga whales.

SeaWorld Orlando hours of operation and admission costs are detailed in Figure 3 and Table 3, respectively.

Figure 3. SeaWorld Orlando 2012 Hours of Operation

Regular Hours
January
9:00 a.m.-6:00 p.m. daily
February to mid-March
9:00 a.m.–7:00 p.m. daily
May to December
Open 9:00 a.m., variable closing hours from 7:00 p.m.–10:00 p.m. daily

Exceptions & Extended Hours:
Open every day of the year.
Facility may be closed in the event of severe weather.
Holiday season closing hours vary from 10:00 p.m. to 11:00 p.m.

Table 3. SeaWorld Orlando 2012 Admission Prices

Ticket*	Description	Price
General Admission Child	Purchased online	$63.99
General Admission Adult	Purchased online	$71.99
General Admission Child	Purchased at the gate	$73.99
General Admission Adult	Purchased at the gate	$81.99

* General Admission tickets are good for a single day admission, and include a second visit for free.

APHIS License

SeaWorld of Florida
APHIS license information:
APHIS Class C Exhibitor license #58-C-0077

SeaWorld San Diego

SeaWorld San Diego is located at 500 SeaWorld Drive, San Diego, California between the southern shore of Mission Bay and the San Diego River. SeaWorld Parks and Entertainment, Inc. is a publicly-owned portfolio company of the Blackstone Group.

The SeaWorld San Diego beluga collection is housed in the Wild Arctic exhibit. Based on USDA requirements, SeaWorld San Diego has the capacity to house 14 belugas. However, the aquarium currently only houses five beluga whales.

SeaWorld San Diego hours of operation and admission costs are detailed in Figure 4 and Table 4, respectively. In addition to the standard single entry ticket prices, SeaWorld San Diego offers an annual unlimited passes for $120/year.

Figure 4. SeaWorld San Diego 2012 Hours of Operation

Regular Hours*

May

- 10:00 a.m.-6:00 p.m. Monday thru Friday
- 9:00 a.m.-10:00 p.m. Saturdays
- 10:00 a.m.-7:30 p.m. Sundays
- 9:00 a.m.-11:00 p.m. Memorial Day Weekend

June

- 10:00 a.m.-7:30 p.m. Monday thru Friday, June 1-June 15
- 9:00 a.m.-10:00 p.m. Monday thru Friday, June 18-June 29
- Weekend hours vary from 9:00 a.m. – 10:00 a.m. opening and 9:00 p.m. – 11:00 p.m. closing.

July

- 9:00 a.m.-10:00 p.m. – Monday thru Thursday
- 9:00 a.m.-11:00 p.m. Friday thru Sunday and July 4th.

Exceptions & Extended Hours:

Open every day of the year.

Holiday season closing hours vary from 10 p.m. to 11 p.m.

* Hours for August through December vary considerably depending on the day in question, and so are not portrayed in this table. Daily schedules for these months can be found online at http://seaworldparks.com/en/seaworld-sandiego/Park-Info/Park-Hours.

Table 4. SeaWorld San Diego Admission Prices

Ticket	Description	Price
2012 SeaWorld San Diego Fun Card - Adult	Admission to SeaWorld San Diego until Dec. 31, 2012. Not valid for admission on May 26 & 27, July 21 & 28, Aug. 4 & 11 & Sept. 2, 2012	$73.00
2012 SeaWorld San Diego Fun Card - Child	Admission to SeaWorld San Diego until Dec. 31, 2012. Not valid for admission on May 26 & 27, July 21 & 28, Aug. 4 & 11 & Sept. 2, 2012	$65.00
SeaWorld San Diego Single Day Admission - Adult	Admission for one day to SeaWorld San Diego.	$73.00
SeaWorld San Diego Single Day Admission - Child	Admission for one day to SeaWorld San Diego.	$65.00
SeaWorld San Diego Length of Stay Ticket - Adult	7 consecutive visits to SeaWorld San Diego	$73.00
SeaWorld San Diego Length of Stay Ticket - Child	7 consecutive visits to SeaWorld San Diego	$65.00

APHIS License

SeaWorld of California
APHIS license information:
APHIS Class C Exhibitor license #93-C-0069

SeaWorld San Antonio

SeaWorld San Antonio is located at 10500 SeaWorld Drive in San Antonio, Texas. The park is located in the western suburbs of the City between Texas Route (TR) 151 and TR 1604. The park is owned by SeaWorld Parks and Entertainment, Inc. a publicly-owned portfolio company of the Blackstone Group.

Based on USDA requirements, SeaWorld San Antonio has the capacity to house 28 belugas. However, the aquarium currently only houses eight beluga whales.

SeaWorld San Antonio hours of operation and admission costs are detailed in Figure 5 and Table 5, respectively. In addition to the standard single entry ticket prices, SeaWorld San Antonio offers an annual unlimited passes for $129/year. The facility also offers special programs providing direct interaction with the beluga whale collection, prices ranging from $99 to $159 per person.

Figure 5. SeaWorld San Antonio 2012 Hours of Operation*

Regular Hours

May

Closed Monday thru Wednesday May 1 thru May 16

10:00 a.m.-5:00 p.m. Thursdays, Monday thru Wednesday May 21-30

Weekend and holiday hours vary from 9:00 a.m. – 10:00 a.m. opening and 8:00 p.m. – 10:00 p.m. closing.

June

10:00 a.m.-6:00 p.m. Monday thru Friday, June 1 thru June 8

10:00 a.m.-9:00 p.m. Monday thru Friday, June 11 thru June 29

Weekend hours vary from 9:00 a.m. – 10:00 a.m. opening and 9:00 p.m. – 10:00 p.m. closing.

July

10:00 a.m.-9:00 p.m. Monday thru Friday

Weekend and holiday hours vary from 9:00 a.m. – 10:00 a.m. opening and 9:00 p.m. – 10:00 p.m. closing.

* Hours for August through December vary considerably depending on the day in question, and so are not portrayed in this table. Daily schedules for these months can be found online at http://seaworldparks.com/en/seaworld-sanantonio/Park-Info/Park-Hours.

Table 5. SeaWorld San Antonio Admission Prices

Ticket	Description	Price
SeaWorld San Antonio Single Day Admission - Adult	Purchased at the gate	$59.99
SeaWorld San Antonio Single Day Admission - Adult	Purchased online	$49.99
SeaWorld San Antonio Single Day Admission - Child	Purchased at the gate	49.99
SeaWorld San Antonio Single Day Admission - Child	Purchased online	$39.99
SeaWorld San Antonio 4-Pack - Adult	Purchased at the gate	$59.99
SeaWorld San Antonio 4-Pack - Adult	Purchased online	$47.50
SeaWorld San Antonio 4-Pack - Child	Purchased at the gate	$49.99
SeaWorld San Antonio 4-Pack - Child	Purchased online	$47.50
SeaWorld San Antonio Group Single Day Admission - Adult	For groups of 15 or more - Purchased at the gate	$59.99
SeaWorld San Antonio Group Single Day Admission - Adult	Purchased online	$46.99
SeaWorld San Antonio Group Single Day Admission - Child	For groups of 15 or more - Purchased at the gate	$49.99
SeaWorld San Antonio Group Single Day Admission - Child	Purchased online	$38.99

APHIS License

SeaWorld of Texas
APHIS license information:
APHIS Class C Exhibitor license #74-C-0180

Educational Programs

In addition to award-winning public displays, all SeaWorld/Busch Gardens aquaria offer an extraordinary number of in-depth programs designed for visitors wishing to learn more about animals. In 2011, approximately 530,000 children and adults participated in the parks' formal instructional programs, ranging from instructional field trips and behind-the-scenes tours to in-depth sleepovers, camps, and up-close animal interactions. These programs are developed by certified and experienced educators and reviewed by education advisory committees. These programs are designed to align with, enhance and reinforce national standards for grades preschool through college.

Teachers whose schools participate in educational programs receive a teacher's guide developed for specific grade levels. Curriculum materials enable teachers to prepare students for the special presentations and animal exhibits they'll visit at the parks. Instructional field trips generally include animal presentations and visits to animal exhibit areas. At these learning centers, specially trained educators engage and teach groups according to their grade level and are available to answer students' questions about the animals. This long-standing program provides students the opportunity to experience animals up-close while also investigating animal adaptations and behavior, natural history, ecology, geography, wildlife conservation and simple, everyday actions people of all ages can take to protect the environment.

Outreach programs are made available for those schools that cannot visit the park. Schools choose appropriate age levels and topics for the presentations. SeaWorld/Busch Gardens instructors present the assembly-style programs using multi-media presentations, videos, biological artifacts, songs, interactive activities, animal "dress up" costumes, and life-size inflatable animals such as a killer whale, beluga whale, shark, manatee, or baby gray whale. A number of these programs have been recognized by national awards from the Association of Zoos and Aquariums.

SeaWorld Facility educational programs include adventure camps, sleepovers, field trips, teacher programs and resources, scout camps, guided tours, and animal connections. Below are some examples of beluga-specific programs that each facility provides.

SeaWorld Orlando

Ocean Discovery Educational Presentations

The Ocean Discovery Field Trip Program provides students with a day full of activities designed to encourage hands-on educational experiences. This program includes age-appropriate and interactive presentation on the most popular subjects and educational activities throughout the park. The Ocean Discovery Field Trip Program provides different programs for age groups Pre-K & Kindergarten, 1st & 2nd Grade, 3rd – 5th Grade, and 6th – 8th Grade.

One Hour Courses

Whales (1st & 2nd Grade)

Students learn about killer whales, dolphins, beluga whales and more through a variety of interactions and hands-on activities. The course explores the different groups of whales and teaches students about what they have in common with them.

Animals & Habitats of Polar Regions (3rd – 5th Grade)

Students explore the unique ecosystems found at the north and south poles. They learn about polar bears, beluga whales, and penguins, and learn how they survive in some of the harshest environments on the planet.

Animal Connections

Beluga Interaction Program

Enter the water in wetsuits right alongside our graceful, highly sociable white beluga whales. Touch these gentle mammals as the animal care specialists share some techniques they use to communicate with them. Limited to only a few guests each day, this intimate, up-close encounter is a rare and wonderful opportunity to learn more about the amazing Arctic and connect with one of its most charming inhabitants.

Marine Mammal Keeper Experience

Live your dream of caring for dolphins, beluga whales and sea lions. Work side-by-side with marine mammal experts and understand what it's like to care for these amazing animals. Get an intimate look at feeding and behavior patterns and work with the animals just like the pros do.

Wild Arctic Up-Close Experience

Go behind-the-scenes at SeaWorld's Wild Arctic for a unique, interactive 60-minute program and discover all about its amazing animals. Talk to the experts who care for the animals, experience unique animal interactions and see for yourself what makes these frigid friends so fascinating.

SeaWorld San Diego

Grades 7-9 Resident Camp

Campers learn about animals and how the Aquarium cares for them as they encounter the animals up-close. They also go behind-the-scenes at the Wild Arctic exhibit to see beluga whales, polar bears, and walruses.

SeaWorld San Antonio

Animal Experiences

Beluga Interaction Program

Put on your wet suit and wade into a truly unforgettable experience as you meet the mysterious white beluga whale in a rare up-close-and-personal encounter.

Belugas Up-Close Tour

Learn all about animal training at SeaWorld with behind-the-scenes access at Beluga Stadium. Join trainers for an up-close look at and some in-depth learning about beluga whales and Pacific white-sided dolphins.

Grand Adventure Tour

An all-day hands-on experience. On this all day guided tour, you will:

- Learn the basics of animal training at SeaWorld, and use what you know to touch, feed and interact with bottlenose dolphins.
- Put on a wet suit, enter the water, and have an up close encounter with beluga whales. Meet and greet a penguin at our Penguin Encounter.
- Touch stingrays and a shark.
- Visit Rocky Point Preserve and feed sea lions.

- Go behind the scenes at SeaWorld and learn how we care for our animals.

Day Camps

Ocean Quest (ages 5-12)

Get a close-up look while exploring SeaWorld and examining the habits and habitats of sea lions, whales, penguins and more. Campers will discover how SeaWorld San Antonio trains their animals and why they aren't the only ones having fun at SeaWorld. Camp activities include educational talks by SeaWorld professionals, hands-on animal investigations, Camp SeaWorld songs and crafts.

Small Wonders (age 3-4)

Campers and their parents plunge into learning with Small Wonders. Campers get immersed into the world of playful pinnipeds, graceful belugas, and majestic killer whales. Learning activities include animal experiences, arts and crafts, SeaWorld songs, and animal dress-ups.

For Schools and Teachers

SeaWorld Up-Close (grade 3- adult)

Visit our zoological support area and Beluga Stadium to learn about animal husbandry, care, conservation, and the basics of animal training.

Conservation Efforts

Research and conservation have been an integral part of all SeaWorld/Busch Gardens aquaria from the beginning. In 1963, founders of SeaWorld organized and incorporated the Mission Bay Research Foundation, a non-profit research institute now 49 years old and now known as the Hubbs-SeaWorld Research Institute.

The Institute conducts scientific research in the areas of marine mammal conservation, mariculture, resource management and marine ecology. Although operated independently of SeaWorld/Busch Gardens, its scientists work closely with SeaWorld/Busch Gardens staff through frequent use of the park's facilities and zoological collections.

Non-harmful studies on animals, including killer whales and elephants, maintained at SeaWorld/Busch Gardens zoological collections complement research efforts conducted in the field, and vice versa. Research in both areas is necessary for a full understanding of the biology of any species. SeaWorld plays an important role in the recovery of injured or diseased marine mammals through its active participation in regional stranding programs and other federal, state, and local rescue and rehabilitation programs.

The treatment of wildlife brought to the parks for care and rehabilitation, including endangered and threatened marine mammals, is work that SeaWorld/Busch Gardens visitors may observe. In this way, SeaWorld/Busch Gardens expands not only the knowledge of the scientific community, but also the understanding and concern of the general public.

Furthermore, the compilation of basic biological and medical information gathered through participation in field work, involving beached and stranded animals, and through work conducted with marine mammals maintained at SeaWorld/Busch Gardens provides important data necessary for use in conservation efforts.

Complementing SeaWorld's work in the recovery of injured or diseased animals is the role the parks play through the provision of sanctuary for endangered or threatened species, including the Florida manatee, California sea otter, Kemp's ridley turtle, Monk seals and the green sea turtle.

SeaWorld offers a wide variety of educational and conservation programs which contribute to the understanding and shaping of positive public attitudes about marine mammals consistent with the policies of the Marine Mammal Protection Act. Furthermore, SeaWorld parks represent many years of experience in, and commitment to, the rescue and rehabilitation of distressed marine animals, including endangered and threatened species such as manatees, sea turtles, and sea birds. A critical part of the parks' environmental commitment is the SeaWorld/Busch Gardens Animal Rescue and Rehabilitation Program. Since 1965, the parks have rescued more than 20,000 animals - that averages out to about one animal rescue every day for the past 46 years. In addition, SeaWorld/Busch Gardens parks contribute to and participate in scientific research; collaborate with other zoological parks, universities, academic institutions, and state and federal agencies which are also engaged in educational and conservation endeavors throughout the U.S. and the world.

SeaWorld/Busch Gardens' successful breeding programs for marine and terrestrial mammals have received national acclaim. Many beluga whale calves currently represent the species in this successful breeding program. Other breeding programs conducted at SeaWorld/Busch Gardens have resulted in significant numbers of captive-born seals and sea lions, bottlenose dolphins, rhinoceros, killer whales, and Commerson's dolphins.