



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
Silver Spring, MD 20910

Ms. Susan Childs  
Manager, Alaska Venture Support  
Integrator  
Shell Exploration and Production Company  
3601 C Street, Suite 1000  
Anchorage, Alaska 99503

**MAY - 2 2012**

Dear Ms. Childs:

Enclosed is an Incidental Harassment Authorization (IHA) issued to Shell Offshore, Inc., a legal entity of Shell Exploration and Production Company, pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*), to take, by Level B harassment only, marine mammals incidental to offshore exploration drilling in Camden Bay in the Beaufort Sea, Alaska, during the 2012 open-water season (July through October). Shell is required to comply with the conditions contained in the IHA. In addition, Shell must submit a draft report to the National Marine Fisheries Service's (NMFS) Office of Protected Resources, within 90 days after completion of the work authorized herein. Along with other mitigation measures to be incorporated, the IHA requires monitoring for the presence and behavior of marine mammals.

If you have any questions concerning the IHA or its requirements, please contact Candace Nachman, Office of Protected Resources, NMFS, at (301) 427-8429.

Sincerely,

Helen M. Golde, Acting Director  
Office of Protected Resources

Enclosure





## Incidental Harassment Authorization

Shell Offshore Inc. (Shell), 3601 C Street, Suite 1314, Anchorage, Alaska, 99503, is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107 to take, by Level B harassment only, small numbers of marine mammals incidental to conducting an offshore exploratory drilling program in the Beaufort Sea in Arctic Ocean waters under the jurisdiction of the United States, contingent upon the following conditions:

1. This Authorization is valid from July 1, 2012, through October 31, 2012.
2. This Authorization is valid only for activities associated with Shell's 2012 Camden Bay exploration drilling program.
3. (a). The incidental taking of marine mammals, by Level B harassment only, is limited to the following species: beluga whale (*Delphinapterus leucas*); bowhead whale (*Balaena mysticetus*); gray whale (*Eschrichtius robustus*); harbor porpoise (*Phocoena phocoena*); bearded seal (*Erignathus barbatus*); ringed seal (*Phoca hispida*); spotted seal (*P. largha*); and ribbon seal (*Histiophoca fasciata*). Table 1 outlines the amount of take that is authorized for each species.  
  
(b). The taking by injury (Level A harassment), serious injury, or death of any of the species listed in Condition 3(a) or the taking of any kind of any other species of marine mammal is prohibited and may result in the modification, suspension or revocation of this Authorization.
4. The authorization for taking by harassment is limited to the following acoustic sources (or sources with comparable frequency and intensity) and from the following activities:
  - (a). 8-airgun array with a total discharge volume of 760 in<sup>3</sup>;
  - (b). continuous drillship sounds during active drilling operations; and
  - (c). vessel sounds generated during active ice management or icebreaking.
5. The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS or his designee (telephone: 301-427-8401).
6. The holder of this Authorization must notify the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS or his designee (telephone: 301-427-8401) at least 48 hours prior to the start of exploration drilling activities (unless constrained by the date of issuance of this Authorization in which case notification shall be made as soon as possible).



7. General Mitigation and Monitoring Requirements: The Holder of this Authorization is required to implement the following mitigation and monitoring requirements when conducting the specified activities to achieve the least practicable impact on affected marine mammal species or stocks:

(a). All vessels shall reduce speed to at least 5 knots when within 300 yards (274 m) of whales. The reduction in speed will vary based on the situation but must be sufficient to avoid interfering with the whales. Those vessels capable of steering around such groups should do so. Vessels may not be operated in such a way as to separate members of a group of whales from other members of the group. For purposes of this Authorization, a group is defined as being three or more whales observed within a 547-yd (500-m) area and displaying behaviors of directed or coordinated activity (e.g., group feeding);

(b). Avoid multiple changes in direction and speed when within 300 yards (274 m) of whales and also operate the vessel(s) to avoid causing a whale to make multiple changes in direction;

(c). When weather conditions require, such as when visibility drops, support vessels must reduce speed and change direction, as necessary (and as operationally practicable), to avoid the likelihood of injury to whales;

(d). All vessels shall maintain cruising speed not to exceed 9 knots while transiting the Beaufort Sea in order to reduce the risk of ship-whale collisions;

(e). Check the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged;

(f). In the Beaufort Sea, vessels transiting east of Bullen Point to the Canadian border should remain at least 5 mi (8 km) offshore during transit along the coast, provided ice and sea conditions allow;

(g). In the Chukchi Sea, vessels should remain as far offshore as weather and ice conditions allow and at least 5 mi (8 km) offshore during transit;

(h). Aircraft shall not fly within 1,000 ft (305 m) of marine mammals or below 1,500 ft (457 m) altitude (except during marine mammal monitoring, takeoffs, landings, or in emergency situations) while over land or sea;

(i). Except for airplanes engaged in marine mammal monitoring, aircraft shall use a flight path that keeps the aircraft at least 5 mi (8 km) inland until the aircraft is directly south of its offshore destination, then, at that point, it shall fly directly north to its destination;

(j). Utilize two, NMFS-qualified, vessel-based Protected Species Observers (PSOs) (except during meal times and restroom breaks, when at least one PSO shall be on watch) to visually watch for and monitor marine mammals near the drillship or ice management vessels during active drilling or airgun operations (from nautical twilight-dawn to nautical twilight-dusk)

and before and during start-ups of airguns day or night. The vessels' crew shall also assist in detecting marine mammals, when practicable. PSOs shall have access to reticle binoculars (7x50 Fujinon), big-eye binoculars (25x150), and night vision devices. PSO shifts shall last no longer than 4 hours at a time and shall not be on watch more than 12 hours in a 24-hour period. PSOs shall also make observations during daytime periods when active operations are not being conducted for comparison of animal abundance and behavior, when feasible. PSOs shall also be stationed on the other support vessels and will watch for and monitor marine mammals when those vessels are engaged in active operational activities and at other times when feasible;

(k). When a mammal sighting is made, the following information about the sighting will be recorded:

(i). Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from the PSO, apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace;

(ii). Time, location, speed, activity of the vessel, sea state, ice cover, visibility, and sun glare; and

(iii). The positions of other vessel(s) in the vicinity of the PSO location.

(iv). The ship's position, speed of support vessels, and water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

(l). PSO teams shall consist of Inupiat observers and experienced field biologists. An experienced field crew leader will supervise the PSO team onboard the survey vessel. New observers shall be paired with experienced observers to avoid situations where lack of experience impairs the quality of observations;

(m). PSOs will complete a two or three-day training session on marine mammal monitoring, to be conducted shortly before the anticipated start of the 2012 open-water season. The training session(s) will be conducted by qualified marine mammalogists with extensive crew-leader experience during previous vessel-based monitoring programs. A marine mammal observers' handbook, adapted for the specifics of the planned program will be reviewed as part of the training;

(n). If there are Alaska Native PSOs, the PSO training that is conducted prior to the start of the survey activities shall be conducted with both Alaska Native PSOs and biologist PSOs being trained at the same time in the same room. There shall not be separate training courses for the different PSOs;

(o). PSOs shall be trained using visual aids (e.g., videos, photos) to help them identify the species that they are likely to encounter in the conditions under which the animals will likely be seen;

(p). Within safe limits, the PSOs should be stationed where they have the best possible viewing. Viewing may not always be best from the ship bridge, and in some cases may be best from higher positions with less visual obstructions (e.g., flying bridge);

(q). PSOs should be instructed to identify animals as unknown where appropriate rather than strive to identify a species if there is significant uncertainty;

(r). PSOs should maximize their time with eyes on the water. This may require new means of recording data (e.g., audio recorder) or the presence of a data recorder so that the observers can simply relay information to them;

(s). PSOs should plot marine mammal sightings in near real-time for their vessel into a GIS software program and relay information regarding the animal(s)' position between platforms and vessels with emphasis placed on relaying sightings with the greatest potential to involve mitigation or reconsideration of the vessel's course; and

(t). Collect all drilling mud and cuttings with adhered mud from all well sections below the 26-inch (20-inch casing) section, as well as treated sanitary waste water, domestic wastes, bilge water, and ballast water and transport them outside the Arctic for proper disposal in an Environmental Protection Agency licensed treatment/disposal site. These waste streams shall not be discharged into the ocean.

8. ZVSP Mitigation and Monitoring Measures: The Holder of this Authorization is required to implement the following mitigation and monitoring requirements when conducting the specified activities to achieve the least practicable impact on affected marine mammal species or stocks:

(a). PSOs shall conduct monitoring while the airgun array is being deployed or recovered from the water;

(b). PSOs shall visually observe the entire extent of the exclusion zone (EZ) (180 dB re 1  $\mu$ Pa [rms] for cetaceans and 190 dB re 1  $\mu$ Pa [rms] for pinnipeds) using NMFS-qualified PSOs, for at least 30 minutes (min) prior to starting the airgun array (day or night). If the PSO finds a marine mammal within the EZ, Shell must delay the seismic survey until the marine mammal(s) has left the area. If the PSO sees a marine mammal that surfaces then dives below the surface, the PSO shall continue the watch for 30 min. If the PSO sees no marine mammals during that time, they should assume that the animal has moved beyond the EZ. If for any reason the entire radius cannot be seen for the entire 30 min period (i.e., rough seas, fog, darkness), or if marine mammals are near, approaching, or in the EZ, the airguns may not be ramped-up. If one airgun is already running at a source level of at least 180 dB re 1  $\mu$ Pa (rms), the Holder of this Authorization may start the second airgun without observing the entire EZ for 30 min prior, provided no marine mammals are known to be near the EZ;

(c). Establish and monitor a 180 dB re 1  $\mu$ Pa (rms) and a 190 dB re 1  $\mu$ Pa (rms) EZ for marine mammals before the 8-airgun array (760 in<sup>3</sup>) is in operation; and a 180 dB re 1  $\mu$ Pa (rms) and a 190 dB re 1  $\mu$ Pa (rms) EZ before a single airgun (40 in<sup>3</sup>) is in operation,

respectively. For purposes of the field verification tests, described in condition 10(c)(i) below, the 180 dB radius for the 8-airgun array is predicted to be 0.77 mi (1.24 km) and the 190 dB radius for the 8-airgun array is predicted to be 0.33 mi (524 m). New radii will be used upon completion of the field verification tests described in condition 10(c)(i);

(d). Implement a “ramp-up” procedure when starting up at the beginning of seismic operations, which means start the smallest gun first and add airguns in a sequence such that the source level of the array shall increase in steps not exceeding approximately 6 dB per 5-min period. During ramp-up, the PSOs shall monitor the EZ, and if marine mammals are sighted, a power-down, or shut-down shall be implemented as though the full array were operational. Therefore, initiation of ramp-up procedures from shutdown requires that the PSOs be able to view the full EZ;

(e). Power-down or shutdown the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant EZ. A shutdown means all operating airguns are shutdown (i.e., turned off). A power-down means reducing the number of operating airguns to a single operating 40 in<sup>3</sup> airgun, which reduces the EZ to the degree that the animal(s) is no longer in or about to enter it;

(f). Following a power-down, if the marine mammal approaches the smaller designated EZ, the airguns must then be completely shutdown. Airgun activity shall not resume until the PSO has visually observed the marine mammal(s) exiting the EZ and is not likely to return, or has not been seen within the EZ for 15 min for species with shorter dive durations (small odontocetes and pinnipeds) or 30 min for species with longer dive durations (mysticetes);

(g). Following a power-down or shutdown and subsequent animal departure, airgun operations may resume following ramp-up procedures described in Condition 8(d) above;

(h). ZVSP surveys may continue into night and low-light hours if such segment(s) of the survey is initiated when the entire relevant EZs are visible and can be effectively monitored;

(i). No initiation of airgun array operations is permitted from a shutdown position at night or during low-light hours (such as in dense fog or heavy rain) when the entire relevant EZ cannot be effectively monitored by the PSO(s) on duty; and

(j). When utilizing the mitigation airgun, use a reduced duty cycle (e.g., 1 shot/min).

9. Subsistence Mitigation Measures: To ensure no unmitigable adverse impact on subsistence uses of marine mammals, the Holder of this Authorization shall:

(a). Traverse north through the Bering Strait through the Chukchi Sea along a route that lies offshore of the polynya zone. In the event the transit outside of the polynya zone results in Shell having to break ice, the drilling vessel and support vessels will enter into the polynya zone far enough so that icebreaking is not necessary. If it is necessary to move into the

polynya zone, Shell shall notify the local communities of the change in transit route through the Communication and Call Centers (Com Centers). As soon as the fleet transits past the ice, it will exit the polynya zone and continue a path in the open sea toward the Camden Bay drill sites;

(b). Implement the Communication Plan before initiating exploration drilling operations to coordinate activities with local subsistence users and Village Whaling Associations in order to minimize the risk of interfering with subsistence hunting activities;

(c). Participate in the Com Center Program. The Com Centers shall operate 24 hours/day during the 2012 bowhead whale hunt;

(d). Employ local Subsistence Advisors (SAs) from the Beaufort and Chukchi Sea villages to provide consultation and guidance regarding the whale migration and subsistence hunt;

(e). Not operate aircraft below 1,500 ft (457 m) unless engaged in marine mammal monitoring, approaching, landing or taking off, or unless engaged in providing assistance to a whaler or in poor weather (low ceilings) or any other emergency situations;

(f). Cool all drilling mud to mitigate any potential permafrost thawing or thermal dissociation of any methane hydrates encountered during exploration drilling if such materials are present at the drill site;

(g). Recycle all drilling mud to the extent practicable based on operational considerations (e.g., whether mud properties have deteriorated to the point where they cannot be used further) so that the volume of the mud disposed of at the end of the drilling season is reduced; and

(h). Suspend all drilling activities on August 25 for the Kaktovik and Nuiqsut (Cross Island) fall bowhead whale hunts. The drilling vessel and support fleet shall leave the Camden Bay project area and move to an area north of latitude 71° 25' N. and west of longitude 146° 4' W. Shell shall not return to the area to resume drilling operations until the close of the Kaktovik and Nuiqsut fall bowhead whale hunts.

#### 10. Monitoring Measures:

(a). Vessel-based Monitoring: The Holder of this Authorization shall designate biologically-trained PSOs to be aboard the drillship and all support vessels. The PSOs are required to monitor for marine mammals in order to implement the mitigation measures described in conditions 7 and 8 above;

(b). Aerial Survey Monitoring: The Holder of this Authorization must implement the aerial survey monitoring program detailed in its Marine Mammal Mitigation and Monitoring Plan (4MP). The surveys must commence 5 to 7 days before operations at the exploration well sites get underway. Surveys shall be flown daily throughout operations, weather and flight



conditions permitting and shall continue for 5 to 7 days after all activities at the site have ended; and

(c). Acoustic Monitoring:

(i). Field Source Verification: the Holder of this Authorization is required to conduct sound source verification tests for the drilling vessel, support vessels, and the airgun array. Sound source verification shall consist of distances where broadside and endfire directions at which broadband received levels reach 190, 180, 170, 160, and 120 dB re 1  $\mu$ Pa (rms) for all active acoustic sources that may be used during the activities. For the airgun array, the configurations shall include at least the full array and the operation of a single source that will be used during power downs. Tests will be conducted on a continuous (“rolling”) basis throughout the operational season and results will be provided to NMFS weekly.

(ii). Acoustic Study of Bowhead Deflections: Deploy acoustic recorders at five sites along the bowhead whale migration path in order to record vocalizations of bowhead whales as they pass through the exploration drilling area. To the extent practicable, this program must be implemented as detailed in the 4MP.

11. Reporting Requirements: The Holder of this Authorization is required to:

(a). Submit weekly reports to NMFS of the sound source verification tests for the drillship, support vessels, and the airguns. The Holder shall include drillship and vessel activity that occurred during that week in the reports. The reports should report down to the 120-dB radius in 10-dB increments;

(b). Submit daily PSO logs to NMFS;

(c). Submit a draft report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the exploration drilling program. This report must contain and summarize the following information:

(i). summaries of monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors affecting visibility and detectability of marine mammals);

(ii). analyses of the effects of various factors influencing detectability of marine mammals (e.g., sea state, number of observers, and fog/glare);

(iii). species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover;

(iv). sighting rates of marine mammals during periods with and without exploration drilling activities (and other variables that could affect detectability), such as: (A) initial sighting distances versus drilling state; (B) closest point of approach versus drilling state; (C) observed behaviors and types of movements versus drilling state; (D) numbers of sightings/individuals seen versus drilling state; (E) distribution around the survey vessel versus drilling state; and (F) estimates of take by harassment;

(v). Reported results from all hypothesis tests should include estimates of the associated statistical power when practicable;



(vi). Estimate and report uncertainty in all take estimates. Uncertainty could be expressed by the presentation of confidence limits, a minimum-maximum, posterior probability distribution, etc.; the exact approach would be selected based on the sampling method and data available;

(vii). The report should clearly compare authorized takes to the level of actual estimated takes;

(viii). Sampling of the relative near-field around operations should be corrected for effort to provide the best possible estimates of marine mammals in EZs and exposure zones; and

(ix). If, after the independent monitoring plan peer review changes are made to the monitoring program, those changes must be detailed in the report.

(d). The draft report will be subject to review and comment by NMFS. Any recommendations made by NMFS must be addressed in the final report prior to acceptance by NMFS. The draft report will be considered the final report for this activity under this Authorization if NMFS has not provided comments and recommendations within 90 days of receipt of the draft report.

(e). A draft comprehensive report describing the aerial, acoustic, and vessel-based monitoring programs will be prepared and submitted within 240 days from the date of expiration of this Authorization. The comprehensive report will describe the methods, results, conclusions and limitations of each of the individual data sets in detail. The report will also integrate (to the extent possible) the studies into a broad based assessment of all industry activities and their impacts on marine mammals in the Arctic Ocean during 2012.

(f). The draft comprehensive report will be subject to review and comment by NMFS, the AEWC, and the NSB Department of Wildlife Management. The draft comprehensive report will be accepted by NMFS as the final comprehensive report upon incorporation of comments and recommendations.

12. (a). In the unanticipated event that the drilling program operation clearly causes the take of a marine mammal in a manner prohibited by this Authorization, such as an injury (Level A harassment), serious injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), Shell shall immediately take steps to cease operations and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, or his designee by phone or email (telephone: 301-427-8401 or [Candace.Nachman@noaa.gov](mailto:Candace.Nachman@noaa.gov)), the Alaska Regional Office (telephone: 907-271-3023 or [Brad.Smith@noaa.gov](mailto:Brad.Smith@noaa.gov)), and the Alaska Regional Stranding Coordinators (telephone: 907-586-7248 or [Aleria.Jensen@noaa.gov](mailto:Aleria.Jensen@noaa.gov) or [Barbara.Mahoney@noaa.gov](mailto:Barbara.Mahoney@noaa.gov)). The report must include the following information: (i) time, date, and location (latitude/longitude) of the incident; (ii) the name and type of vessel involved; (iii) the vessel's speed during and leading up to the incident; (iv) description of the incident; (v) status of all sound source use in the 24 hours preceding the incident; (vi) water depth; (vii) environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility); (viii) description of marine mammal observations in the 24 hours preceding the incident; (ix) species identification or description of the animal(s)

involved; (x) the fate of the animal(s); (xi) and photographs or video footage of the animal (if equipment is available).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with Shell to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Shell may not resume their activities until notified by NMFS via letter, email, or telephone.

(b). In the event that Shell discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), Shell will immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, by phone or email, the Alaska Regional Office, and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators (see contact information in Condition 12(a)). The report must include the same information identified in Condition 12(a) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with Shell to determine whether modifications in the activities are appropriate.

(c). In the event that Shell discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in Condition 2 of this Authorization (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Shell shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, by phone or email and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators, within 24 hours of the discovery. Shell shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

13. In the unlikely event of an oil spill, Shell shall comply with NOAA's Marine Mammal Oil Spill Response Guidelines, to the extent practicable.

14. Activities related to the monitoring described in this Authorization do not require a separate scientific research permit issued under section 104 of the Marine Mammal Protection Act.

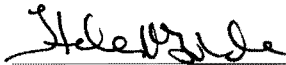
15. The Plan of Cooperation outlining the steps that will be taken to cooperate and communicate with the native communities to ensure the availability of marine mammals for subsistence uses must be implemented.

16. Shell is required to comply with the Terms and Conditions of the Incidental Take Statement (ITS) corresponding to NMFS's Biological Opinion issued to NMFS's Office of Protected Resources.

17. A copy of this Authorization and the ITS must be in the possession of all contractors and PSOs operating under the authority of this Incidental Harassment Authorization.

18. Penalties and Permit Sanctions: Any person who violates any provision of this Incidental Harassment Authorization is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the MMPA.

19. This Authorization may be modified, suspended or withdrawn if the Holder fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals, or if there is an unmitigable adverse impact on the availability of such species or stocks for subsistence uses.



\_\_\_\_\_  
Helen M. Golde  
Acting Director  
Office of Protected Resources  
National Marine Fisheries Service

**MAY - 2 2012**

\_\_\_\_\_  
Date

Attachment

## Attachment

**Table 1. Total authorized Level B take (when combining takes from drillship operations, ice management/icebreaking, and ZVSP surveys) for the *Kulluk*<sup>1</sup> and *Discoverer*.**

<b>Species</b>	<b>Total Authorized Level B Take if the <i>Kulluk</i><sup>1</sup> is Used</b>	<b>Total Authorized Level B Take if the <i>Discoverer</i><sup>2</sup> is Used</b>
Bowhead Whale	3,502	1,398
Gray Whale	15	15
Beluga Whale	65	37
Harbor Porpoise	15	15
Ringed Seal	588	320
Bearded Seal	30	17
Spotted Seal	7	7
Ribbon Seal	5	5

<sup>1</sup>This includes take from operation of the *Kulluk*, ice management/icebreaking, and the airguns

<sup>2</sup>This includes take from operation of the *Discoverer*, ice management/icebreaking, and the airguns