

**PANEL PEER REVIEW
OF MONITORING AND MITIGATION PROTOCOLS
IN BP'S APPLICATION FOR A LETTER OF AUTHORIZATION FOR
TAKING OF MARINE MAMMALS INCIDENTAL TO OPERATION OF OFFSHORE OIL AND
GAS FACILITIES IN THE U.S. BEAUFORT SEA**

17 June 2011

1. BACKGROUND

On 7-8 March 2011 the National Marine Fisheries Service (NMFS), working with the Bureau of Ocean, Energy Management, Regulations and Enforcement (BOEMRE), sponsored a public Arctic Open Water meeting in Anchorage, Alaska. The purpose of the meeting (the latest in a series of such meetings) was to review various oil and gas activities, including seismic surveys, site clearance/shallow hazard surveys, exploratory drilling, and operation of an artificial island that is actively producing oil, with a focus on their potential effects on marine ecosystems in the Chukchi and Beaufort seas. Much of the meeting focused on analyses of past exploration, monitoring, and research activities, as well as descriptions of proposed 2011 activities by Shell, ConocoPhillips, British Petroleum (BP), and Statoil, as well as ION a company that specializes in seismic surveys. Additionally, a presentation was also given by a National Science Foundation (NSF) researcher who intends to conduct scientific seismic surveys in the Chukchi Sea, near the Chukchi Borderlands, in 2011. Representatives from the Alaska Eskimo Whaling Commission, the Alaska Beluga Whale Committee, and the Ice Seal Committee provided information about hunting success in 2010, recent research, and concerns about impacts from offshore oil and gas activities on subsistence hunts.

At the time of the meeting, NMFS had received three applications for incidental harassment authorizations (IHAs) and one application for a Letter of Authorization (LOA) to take marine mammals incidentally under provisions of the Marine Mammal Protection Act and applicable regulations. For each of these applications, NMFS must make a determination as to whether the proposed activities will have (1) more than a negligible impact on the pertinent protected species or stock, or (2) an unmitigable adverse impact on the availability of such species or stock for subsistence hunting. NMFS also must prescribe regulations establishing permissible means of taking and other means of effecting the least practicable adverse impact, as well as monitoring and reporting requirements. The Marine Mammal Protection Act defines "take" to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal". In this instance, the Act defines "harassment" to mean "any act of pursuit, torment, or annoyance which

- (i) has the potential to injure a marine mammal or marine mammal stock in the wild [i.e., Level A harassment]; or
- (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [i.e., Level B harassment]."

NMFS requires monitoring for two purposes. The first is to detect when mitigation thresholds have been met and appropriate responses must be instigated (e.g., monitoring that may lead to a shutdown of an activity if a marine mammal enters a safety zone). The second is to allow a post-hoc analysis to estimate the number of animals that may have been taken during the course of an activity. Thus, the former type of monitoring is used to ensure the least practicable impact, whereas the latter is used to only estimate post-

hoc what the impact was based on number and types of takes. Monitoring to achieve these two purposes often requires different field techniques and/or strategies.

2. PEER-REVIEW PANEL

The regulations pertaining to issuance of incidental take authorizations also require peer review to evaluate proposed monitoring methods. Section 216.108(d) (50 CFR) states:

Where the proposed activity may affect the availability of a species or stock of a marine mammal for taking for subsistence purposes, proposed monitoring plans... must be independently peer-reviewed prior to issuance of an incidental harassment authorization.

To satisfy the peer-review requirement, NMFS convened two panels of independent experts with diverse backgrounds but all familiar with marine mammal research and conservation in the Arctic regions of Alaska. Prior to convening of the peer review panels NMFS had determined that the proposed scientific seismic survey in the Chukchi Sea, funded by NSF, would not affect the availability of marine mammals for subsistence purposes. Thus, that application was not peer-reviewed by the panel.

On 9 March 2011 one panel (IHA Panel) reviewed the two IHA applications, one from Statoil for shallow hazards and site clearance surveys in the Chukchi Sea and one from ION for a 2D seismic survey across the Beaufort Sea. On 10 March 2011, the second panel (LOA Panel) reviewed the LOA application from BP for the operation of Northstar, a production island in the central Beaufort Sea. Panel members did not strive for consensus, and different perspectives will be indicated in the remainder of this report by reference to the views of “some” and “others.” This report focuses on the review of BP’s LOA application.

The specific guidance given to the panel was as follows:

BP’s monitoring program should be designed to accomplish one or more of the following: document the effects of the activity (including acoustic) on marine mammals; document or estimate the actual level of take as a result of the activity (in this case, operation of an oil production facility); increase the knowledge of the affected species; or increase knowledge of the anticipated impacts on marine mammal populations. OPR [Office of Protected Resources] is asking you to review BP’s monitoring plan to ensure that the monitoring activities and methods described in the plan will enable BP to meet these stated goals.

- A. Are the applicant’s stated objectives the most useful for understanding impacts on marine mammals and otherwise accomplishing the goals stated in the paragraph above?**
- B. Are the applicant’s stated objectives able to be achieved based on the methods described in the plan?**
- C. Are there techniques not proposed by the applicant, or modifications to the techniques proposed by the applicant, that should be considered for inclusion in the applicant’s monitoring program to better accomplish the goals stated above?**
- D. What is the best way for an applicant to present their data and results (formatting, metrics, graphics, etc.) in the required reports that are to be submitted to NMFS?**

After discussion of the monitoring plan, the panel will submit a recommendations report to OPR utilizing the following guidance:

- Include a succinct, but explicit, numbered list(s) of the monitoring measures that the panel is recommending be modified, added, or deleted in the applicant's monitoring plan.
- Although we need concise recommendations, please include enough detail to understand what is being recommended (i.e., include methodologies where necessary).
- Include the rationale for all recommended changes in monitoring measures and clearly cross-reference the rationale to the specific measure(s) in the numbered list(s).
- Clearly indicate which measures the panel believes are needed and likely accomplishable in 2011, vs. those that will involve longer-term planning and are more appropriate for implementation in future years.

The remainder of this report reflects the views of individual panel members, which were similar in many but not all circumstances (as noted), regarding real-time monitoring for purposes of mitigation and the collection of monitoring data for purposes of informing subsequent assessment of impact.

3. COMMENTS ON SPECIFIC QUESTIONS FROM NMFS

The panel responded to NMFS's specific questions. Recommendations related to the specific questions are at the end of this section.

A. Are the applicant's stated objectives the most useful for understanding impacts on marine mammals and otherwise accomplishing the goals stated in the paragraph above?

Yes, in general the objectives are useful for monitoring substantial changes in (1) relative numbers of ringed seals near Northstar, (2) calling rates of bowheads within the study area, and (3) sounds produced at Northstar Island. Previous monitoring at Northstar has shown that bowhead calls are located farther north, away from the island, when sounds from the island are loudest. The received levels of anthropogenic sounds at the whale call locations are very low, sometimes near and even below ambient background levels. The current goals and proposed monitoring methods are useful but will not provide information related to deflection or the duration of deflection of bowheads. The question about the duration of deflection relates to how long or how far it takes deflected whales to return to their normal migratory path. There was some interest among panel members to better answer that question and the degree to which the deflection may be related to a drop in calling behavior (e.g. reduction in rate of call production) versus changes in movement patterns.

B. Are the applicant's stated objectives able to be achieved based on the methods described in the plan?

BP has three main objectives related to the monitoring of (1) seals, (2) bowheads, and (3) sounds from Northstar.

Seals: BP plans to periodically count the numbers of ringed seals hauled out on the ice near Northstar. Those counts would be conducted by non-scientific personnel stationed on the island from 15 May to 15 July. This method will be useful for a general understanding of the numbers (and variation thereof) of ringed seals that use the general area. Having Northstar personnel count seals provides some non-scientific benefits. Personnel become more observant and aware of the environment around them. Potential environmental problems could be detected first by Northstar personnel with this increased awareness.

There are some difficulties with the proposed methodology. Haul out behavior is influenced by snow melt, temperature, and other factors. Additionally, there can be a great deal of variability in ringed

seal haul out behavior within and across years. Thus, the results from Northstar monitoring may not provide much statistical power to detect changes unless changes are substantial.

Bowheads: BP intends to monitor the calling rate of bowhead whales by deploying a directional hydrophone (DASAR), and a second unit as backup, at a location (labeled as site EB or C) that has been used consistently over the years for monitoring. Bowhead calling rate, that is, the number of calls recorded per year is quite variable. Therefore, it may be hard to statistically detect changes. One of the main purposes of this objective is to trigger additional discussions about potential additional monitoring. Even though this is one of the main reasons for monitoring bowhead calling, no thresholds or trigger points have been suggested in the monitoring plan about when those discussions would occur. For example, calling rates in 2010 were substantially lower than in previous years. This could have been due to a shift in bowhead migration unrelated to Northstar activities; however, the lower rate could have triggered enhanced monitoring in 2011.

Sound levels: BP will monitor sounds produced by Northstar activities by deploying two hydrophones (one instrument is for redundancy) approximately 450m north of the Island. The near island instrument has been in a consistent spot since the onset of monitoring. The instruments are sufficient to document sounds, in the necessary frequency range, produced from activities at Northstar Island.

C. Are there techniques not proposed by the applicant, or modifications to the techniques proposed by the applicant, that should be considered for inclusion in the applicant's monitoring program to better accomplish the goals stated above?

Seals: As discussed above, detecting changes in seal numbers near Northstar may be difficult because of the variability in haul out behavior and environmental conditions. A more detailed analysis that includes environmental correlates may help in detecting changes in seal numbers if those numbers are related to island activities. Some panel members suggested that counts should begin earlier in the year to help detect when seals first haul out in the spring. The hypothesis is that seals might haul out earlier with a warming climate. Understanding if seal behavior is changing with climate change will help sort out potential impacts from various sources. Panel members also suggested that BP investigate the efficacy of conducting observations in the autumn when the ocean freezes up. Autumn observation will be limited by daylight hours, but may prove useful for a better understanding of how seals use the Northstar area at times other than the spring and early summer. A panel member also suggested that it would be helpful to try to determine whether some seals are more "resident" than others. This could be accomplished by noting seals with unique pelage patterns or perhaps with scars.

Bowheads: After monitoring has concluded for the season, BP should initiate discussions in the autumn or early winter with NMFS, BOEMRE, the Alaska Eskimo Whaling Commission, and other stakeholders. Preliminary results from the previous season should be discussed to assess whether there is a need to deploy the full acoustic array or somehow change the monitoring approach the following summer. A review of planned activities at Northstar during the subsequent year would also be helpful in discussions about potential changes to monitoring plans.

The panel discussed the difficulties of determining whether impacts from Northstar to bowheads were due to changes in calling behavior or deflection. This is an important question that remains unanswered. The question is especially relevant to the availability of bowhead whales to subsistence hunters in Barrow in the autumn, which is "downstream" of the island. The panel suggested that BP should attempt to address this question by examining their data in a different manner (as described below) or assessing the usefulness of other data sets.

BP appears to have only taken a cursory look at acoustically tracking the movement of individual vocalizing whales. Their data could be examined in greater detail for potentially tracking individual movements as a means to better understand deflection of bowheads away from the island. One panel member suggested using singing or counter calling as a method for assigning repeated calls to individuals for tracking. These movements may provide an indication of whether deflection is occurring. Modifying existing software or algorithms may be suitable for an initial look at feasibility.

The panel also discussed the usefulness of assessing changes in call types associated with various types or intensities of sounds from the island. Some panel members were skeptical about the utility of using call type as a means to better understand impacts from Northstar. One panel member suggested it would be helpful to understand the context of the various types of bowhead calls.

Other data sets or approaches that might be helpful to determining whether whales deflect or change calling behavior include: (a) Bowhead Whale Aerial Survey Program (funded by BOEMRE), (b) call locations from the more extensive Shell data set in the Beaufort Sea, and (c) satellite or acoustic tagging.

Noise Levels: The NSB SAC (SAC 2005) suggested alternative methods for summarizing sound data besides calculating an “industrial sound index” (ISI). That approach washed out larger pulses or peaks of specific sounds and frequencies and did not take into account received levels or ambient noise levels. BP appropriately modified the approach for summarizing sounds from the island in the subsequent analyses. The panel did not feel that other changes were necessary.

D. What is the best way for an applicant to present their data and results (formatting, metrics, graphics, etc.) in the required reports that are to be submitted to NMFS?

The panel was generally satisfied with the approach that BP has been using in the annual reports. For seal monitoring, the panel recommended that more specific details were needed about how the observations were conducted.

Panel recommendations based on the four specific questions from NMFS (SQR = specific questions recommendations):

SQR1. BP should attempt to assess the duration of deflection (i.e., the amount of time or distance before deflected whales returned to their normal migratory path) of bowheads away from Northstar Island, if possible. Other data sets (i.e., BWASP, Shell acoustic data) might prove useful for addressing this question.

SQR2. BP should continue to use their proposed approach for counting seals. Additional data should be collected to help interpret the counts. Those include:

- Monitoring snow thickness and progression of melt during the observation period.
- Record on-island activities and correlate them with seal numbers. (It is likely that counts of seals will be influenced mostly by onset of spring, however, numbers should also be assessed relative to island activity to investigate whether those activities impact the numbers of seals counted from the island.)

SQR3. Previously collected seal data should be analyzed for the date when seals are first seen and the peak date of haul out.

SQR4. Counts of seals hauled out on ice in the late autumn or early winter would help assess seal use of the area near Northstar at times other than the spring and early summer.

- SQR5. Counts of seals are intended as a broad measure of use of the area around the island. One component of the counts is to determine whether additional monitoring is needed, yet no specific thresholds have been identified that might trigger additional monitoring. Thresholds should be established for the initiation of discussions about additional monitoring.
- SQR6. Thresholds should also be established related to calling rates for initiation of discussions about additional monitoring of bowheads.
- SQR7. BP should incorporate environmental factors (i.e., sea ice extent, wind, etc.) in addition to anthropogenic activities, as a covariate in analyses of impacts from Northstar Island on bowheads.
- SQR8. BP should continue to deploy one hydrophone (and one back-up unit) 450m north of Northstar to monitor anthropogenic sounds from activities associated with the island.
- SQR9. BP should continue to record the amount and type of activities at the island (i.e., crew boat trips, hovercraft trips, activities on the island, etc.). If activity levels change substantially, discussions of additional monitoring might be warranted.
- SQR10. BP should continue to deploy DASARs at site EB/C to monitor calling rates of bowheads, calculate bearings to calls, and record variation in natural ambient, and other anthropogenic sound sources.
- SQR11. Determine if additional monitoring (e.g., full acoustic array) might be needed if levels and types of activities at the island increase or whether BP's lower level of monitoring (or other data sets) suggests a change in whale behavior or distribution. If any of those events occur, BP should determine through discussions with NMFS and stake holders whether the full array should be deployed or some other monitoring technique implemented.

4. OTHER COMMENTS

Results from previous monitoring: The panel discussed some of methods and results of the previous monitoring work conducted by BP at Northstar Island. In the early 2000s, BP deployed a hydrophone array north of the island to localize bowhead calls and a hydrophone about 450m north of the island to monitor anthropogenic sounds produced by activities associated with the island. Instead of using aircraft for monitoring and estimating deflection of whales, it was decided that acoustic locations would provide greater statistical power to detect impacts from sounds produced at or associated with the island (Streever et al. 2008). Those efforts provided a large amount of data and results showed that bowhead calls were found farther north, away from the island, during periods when noise from the island was at its loudest. The noisiest periods were caused by crew boats or tugs and barges that were active near the island. The industrial sound levels measured at the hydrophone 450m north of the island were low (Richardson 2010), thus the received sound levels at the whale locations farther away were even lower, at times possibly near or even below ambient. The observed results could have been caused by bowheads being deflected away from the island or due to a reduction in calling rates of the whales closest to the island and thus the noise source.

The panel discussed with BP how to sort out differences between deflection and calling rate. BP considered using active sonar but because of the limited range and other factors, the efficacy of that approach was questioned and thus, not pursued. The panel generally agreed that active sonar did not appear to be a worthwhile approach to consider. BP also tried using visual observers stationed on boats within the whale's migration corridor. Success was very limited because few whales were detected.

Some panel members suggested that using additional data sources may be a feasible method for addressing this important question.

Several panel members commented on the issue of deflection. BP's results show that whales are deflected (or that calling rates changed), but it is still unclear how long in time or space it took whales to return to their normal migration route. Other data sources might be helpful in addressing the question of the duration of deflection.

In 2004, BP requested the North Slope Borough Mayor, to convene its Science Advisory Committee (SAC) to review the monitoring plan for Northstar Island (SAC 2005). The SAC concluded that bowheads were impacted by the sound produced at the island but the deflection was modest (i.e., only a few kilometers). The SAC recommended that BP invest resources into analyzing the rich data source to better understand those impacts. Deploying the full array was not necessary every year but monitoring of calling rates and sounds produced by the island should continue. A periodic deployment of the full array was recommended. That approach has been used since 2005.

Cumulative Impacts: In 2008, BP deployed the full array north of Northstar. Because of other seismic and other oil and gas exploration activities, it was not possible to analyze the Northstar data for impacts specific from activities at the island. The louder seismic surveys swamped the relatively quiet anthropogenic sounds associated with Northstar production and would have confounded any analyses. The data were archived for possible future assessment of cumulative impacts. Data collected for Northstar monitoring in the early 2000s, when there was little additional oil and gas activity, could be compared with data collected during the 2008 and 2009, when there was considerably more activity. The increase in anthropogenic noise sources and the effect on data analyses highlights the need for a more comprehensive approach to cumulative impacts assessment.

The 2010 panel and 2011 IHA panel reports included a section regarding the need for a more robust and comprehensive means of assessing the collective or cumulative impact of many of the varied human activities that contribute noise into the Arctic environment. The essence of those observations was that for many species, sounds generated by human activities overlap those used by the marine mammals, and the potential impacts from these human activities should be determined not by each activity in isolation, but rather by the cumulative effects from the suite of human activities in relation to the biological and environmental events. The 2010 panel and 2011 IHA panel suggested, and the 2011 LOA panel reiterates that, in addition to the mitigation and monitoring of single activities, as occurs with IHA or LOA applications, NMFS should develop an overarching means of assessing and requiring steps to minimize the collective impacts of development activities on marine ecosystems, including marine acoustic habitats. This will require a fundamentally different mode of assessment than has previously been applied under federal law. The panel encourages NMFS to strongly consider how this may be accomplished within the ongoing programmatic EIS for Arctic oil and gas exploration and production. Cumulative impacts could and should be assessed in IHAs and LOAs using risk assessment methodology.

In addition to the overarching recommendation for a more holistic and biologically relevant means of assessing the overall footprint (acoustic and otherwise) of human development in the Arctic, the 2010 panel and 2011 IHA panel made a number of specific recommendations about comprehensive ecosystem assessment and cumulative impacts. The 2011 LOA panel endorses those recommendations and highlights several that are especially pertinent to BP.

- Advances in integrating data from multiple platforms through the use of standardized data formats are needed to increase the statistical power to assess potential effects. Therefore, BP should strive to work with other oil and gas operators to examine this issue and jointly propose one or several data integration methods to NMFS at the Open Water Meeting in 2012.

- Prior to the 2012 Open Water Meeting BP should strive to work with other oil and gas operators to discuss the most practical and constructive means of making their marine mammal and environmental data (e.g., aerial and vessel-based marine mammal survey data, acoustic detections of marine mammals and any responses to sound, biological and physical oceanographic data) and other information about their activities (location and movement of equipment operating in the region; type of equipment used, including characteristics of sound intensity and frequency, sound propagation in the environment at the time of the activity, and duty cycles; and timing of the activity) available to the public.
- During the 2012 Open Water Meeting, BP should strive to work with other oil and gas operators to propose an approach, method, or organization (e.g., AOOS, NSSI, NSB, NMFS, etc.) that could help accomplish this data-sharing task.

Need for additional monitoring: For the time period covered by the application for an LOA, BP stated that they are not planning on deploying the full array. They intend to continue monitoring of bowhead calls with DASARs at the offshore location and island sounds from near-island hydrophones, unless there is reason to deploy the full array. BP has stated that there is too much other industrial activity to allow monitoring impacts specific to Northstar. The panel generally agreed that the increased industrial activities in the Beaufort Sea confounded the monitoring and analyses of impacts from North Star Island.

BP's LOA application did not provide details about when additional monitoring might be needed. In addition to the thresholds for calling behavior of whales mentioned above, BP also suggested that additional monitoring might be needed if activities at the island were loud enough that whales may be impacted. BP stated that additional monitoring might be needed if sounds were capable of propagating to the migratory corridor at or above levels of about 180dB re: 1 μ Pa. The panel expressed concerns that anthropogenic sound much quieter than that have been shown to cause bowheads to deflect. Using substantially lower thresholds of sound levels to trigger this additional monitoring might be appropriate.

There are various different activities on the island that produce sounds greater than 180 dB, such as sounds transmitted from steel to gravel to water. Chances are good that those activities would not occur during the open water season but instead during the ice season. It was not clear at what point the environmental studies program at BP would know that increased activities that might generate higher levels of sound. It was hoped a notice a year in advance would be available for major changes in activities, but sometimes that type of lead time was not possible. They should engage NMFS, BOEMRE, the Alaska Eskimo Whaling Commission, and the North Slope Borough as early in the process as possible.

Monitoring other species of marine mammals: The panel asked whether existing acoustics data might be useful for monitoring other species of marine mammals? The data set is quite large and might be very useful. BP responded that there are limitations, primarily due to the frequency range of the recordings. The recorders were set up to primarily detect bowhead whales. Other species frequency ranges are considerably higher and many of those sounds were not recorded. Several panel members suggested that it would be worth taking a preliminary look at the recordings to see what data might be available including examining the previous records from manually analyzed data where other species and sounds may have been noted. Other panel members asked how easy it would be to record the higher frequencies and environmental data (i.e., water temperature, etc.).

Impacts to the bowhead harvest: The panel was pleased to see information in BP's annual report about the areas that Nuiqsut uses for hunting bowheads. One panel member suggested that it would be interesting to examine how Northstar activities have impacted the bowhead hunts in the Beaufort Sea, especially for the Nuiqsut hunt at Cross Island. Environmental conditions and industrial activity may affect success of hunt. Several panel members thought this issue was outside of the scope of this monitoring plan peer review. Other members thought it was relevant because the MMPA protects the

availability of marine mammals to subsistence hunters. Understanding how various factors (environmental and anthropogenic) may affect the success of bowhead hunts would be useful for developing appropriate mitigation measures.

Archiving data and making information available: Panel members discussed the need to archive data and make information available from the Northstar monitoring to other interested scientists. Some of the important data that might need to be archived include: island activity data, acoustic recordings, summarized acoustic data, and seal monitoring data. Data archives may be especially important for a future analysis on cumulative impacts.

Recommendations based on other comments from the peer-review panel (OCR = other comment recommendations):

- OCR1. Investigate the possibility of using existing acoustic data to monitor species other than bowhead whales. Also consider configuring hydrophones that would be deployed in the future to record at the higher frequencies and monitor other marine mammals in addition to bowheads.
- OCR2. Collect environmental information (i.e., water temperature, ice cover) that might help explain calling rates of bowhead whales.
- OCR3. Establish protocols for additional monitoring during autumn migratory seasons for bowheads when “loud” sounds are expected to be produced by Northstar activities. These protocols should be triggered when sounds might be produced and propagated to the migration corridor that are quieter than 180/190 dB (i.e., 160 or even 120 dB).
- OCR4. Develop an archive of (1) library of industrial sound sources with associated metadata, (2) raw acoustic recordings file, (3) summarized data (i.e., call counts, call types, etc.) from recordings, and (4) other monitoring data. Archived data will be especially important in the event of a large oil spill or other major impact. This archive should probably be maintained by a university or some other institution not associated with a government agency. The panel acknowledges BP’s willingness to share data.
- OCR5. Estimate whether underwater noise levels associated with the pipeline operation, including “pigging”, might be loud enough to impact bowheads.
- OCR6. Assess potential impacts to marine mammal habitat, including impacts to prey species, such as fish or krill.
- OCR7. Assess Northstar’s impacts from a cumulative perspective. Each company’s monitoring efforts, including BP’s, should fit into a larger more comprehensive monitoring program with the objective of assessing cumulative impacts. This is one of the reasons that monitoring data should be archived.
- OCR8. Develop a plan for the periodic redeployment of a full array.

5. ACKNOWLEDGMENTS

Panel members wish to acknowledge and thank Mr. Johnny Aiken of Barrow and Mr. George Noongwook of St. Lawrence Island for the information and insights they brought to the panel discussions. Panel members also wish to thank Dr. Robyn Angliss for facilitating the panel’s discussion and Ms. Sheyna Wisdom for taking minutes of the meeting.

6. REFERENCES

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PANEL MEMBERS The members of the review panel were—

Harry Brower, Jr., Alaska Eskimo Whaling Commission
Chris Clark, Ph.D., Cornell University
Jason Gedamke, Ph.D., NOAA Acoustics
Robert Suydam, Ph.D., North Slope Borough, Department of Wildlife Management