

National Marine Fisheries Service

Arctic Open Water Meeting Report

March 6-8, 2012

Anchorage, Alaska



March 2012

Introduction

This report is a detailed summary of the March 6-8, 2012, Arctic Open Water Meeting held in Anchorage, Alaska. Attendees included those from the science community, industry, native organizations, community stakeholders, and state and federal agency representatives.

Presenters provided information on their respective activities, including a summary of 2011 monitoring results and harvest updates, 2012 industry operations and monitoring plans, and environmental and marine mammal study program updates. This report provides a summary of the presentations and a detailed accounting of questions and answers after each presentation. Detailed information in regards to industry activity such as specific vessel activity, species sightings and seismic data shown in tables throughout this document cannot be verified as 100% accurate due to the speed with which presenters moved through their presentations. More accurate, detailed, statistics can be found in individual industry 90-day reports which can be viewed at <http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications>.

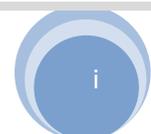
Careful attempts were made to capture identified speakers, speeches, questions, answers and comments. However, it is not a verbatim transcript, as there were instances where speakers did not identify themselves fully or began speaking without any identification. Additionally, there were occurrences where speakers identified themselves at the time of their comments, but who did not complete the conference sign-in sheet which may result in misspellings of names.

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Day One – March 6, 2012

Welcoming Remarks

Jim Lecky, Director, NMFS, Office of Protected Resources

Jim Kendall, Alaska Regional Director, Bureau of Ocean Energy Management

Mark Fesmire, PE JD, Alaska Regional Director, Bureau of Safety and Environmental Enforcement

Geoffrey Haskett, Regional Director, U.S. Fish and Wildlife Service

Jim Lecky. Welcome to all the participants and attendees. Participants from each department involved in the permitting process have joined us and each will give welcoming remarks. A number of members of Native organizations are here to join us in engaging in a dialogue. Welcome to you. We appreciate your attendance. Welcome to the facilitators. We appreciate that you are here to keep us on time and on task and adhere to the agenda during the meeting. An environmental impact statement published last December looked at options for oil and gas exploratory drilling. The public comment period closed at the end of February. We appreciate the comments received, but this meeting is not the forum to comment on those. We did get comments that span a breadth of issues and mitigation measures proposed. We will analyze and make revisions based on the comments before finalizing later in the year. We will borrow from the cumulative impact section and ensure decisions made this year are based on most current scientific information, but it will be presented through the impact statement. Lastly, thank you all for coming and spending time here.

Jim Kendall. Thank you for coming, and thank you to the NOAA staff that puts this meeting together. This is my third meeting, and I look forward to it each year. I am now permanently stationed in Anchorage. This meeting is incredibly important; the Arctic is an important place. It is important to the communities, the environment, the state and the whalers. This meeting is important to know what the plans are, what science is available and the traditional knowledge to make sure the right decisions are made. We will learn a lot. Thank you again for coming.

Mark Fesmire. I am brand new to the Open Water Meeting process. A lot of questions are raised about BOEM and BSEE. BOEM is the landlord and BSEE is the cops. Our job is to implement rules and regulations, conditions, everything BOEM and the leasing process has put on the operator. We are there to enforce it including stipulations on marine mammals and other things. We're looking forward to this summer. It will be busy and requires a lot of details. We will do everything within our power to ensure everyone is in compliance. I appreciate the invitation, and I hope I come away with a significant education and understanding about the concerns around the operations this summer.

Geoffery Haskett. It is a great honor to be here. This is my first Open Water Meeting. We value our partnerships with the organizations in the room. We have established processes engaging with community and industry to make sure subsistence is not impacted negatively. We take it very seriously. We require discussion with communities before authorizations are issued and ongoing talks to ensure species are managed effectively. With the polar bear threatened in 2008 and walrus in 2011, there is a lot of increased attention on the Endangered Species Act in Alaska. Neither listing nor designating critical habitat to harvesting for subsistence use will be effective. Common thought is that the ESA will stop people from doing things and cause problems. In 10 years and over 500 consultations under the Act, we've never stopped anything. There have been no actions stopped by the USFWS under the ESA. We hope this addresses concerns around the state, but it is important to

note. Future generations' utilizing marine mammals is an important topic to all entities, along with the declining sea ice. On behalf of the FWS, thank you, and I wish you a productive meeting.

QUESTIONS & ANSWERS:

C: Robert Suydan, NSB: I was thinking that the first Open Water Meeting was 16-17 yrs ago, and I would like to thank Jim Lecky and Jim Kendall for the improvements that have occurred in the meetings, particularly in the last five to six years. There have been valid, positive improvements. Jim Lecky, your staff (Candace, etc.), have done a good job organizing the meeting. Having BSEE and the other agencies participate is a good thing. In a month or so, Jim will be retiring. I would like to congratulate you for time served, and, although the North Slope Borough entities haven't always agreed with NMFS, your service has been appreciated. When you came to Barrow a couple of years ago, and pulled up a whale, I thought that was a good experience to share and an opportunity to see what the meetings are all about in large part.

C: Jim Lecky, NMFS: Thank you for comments on behalf of the staff and the organization of the meetings. I am happy to attend every year, and the meetings are important to making informed decisions. I did get to see some whales on the ice and how they are harvested and distributed and the excitement that occurs. I enjoyed a fantastic trip and will remember it all my life. I am leaving DC and government, but I'll be around.

Introductions and Housekeeping Items

Lisa O'Brien and Ron Felde, Facilitators

- Brief Intro of Attendees
- Review of Agenda and Meeting Objectives (Candace Nachman, Fishery Biologist, NMFS, Office of Protected Resources)
- Review of Ground Rules and Parking Lot

Lisa O'Brien, Facilitator: Our job, as facilitators, is a simple, but challenging task: to keep the meeting on track and ensure respectful dialogue. This is my fifth meeting. Last year I said you made us redundant; you were civilized and respectful. We are hoping for that same environment this year.

Candace Nachman, NMFS: Good morning and welcome. Thank you for coming. This meeting, which once consisted of 10-20 people, has grown to what you see today. The Open Water Meeting is a forum to discuss marine mammal activities. Attendees have an opportunity to hear results from previous seasons and plans proposed for upcoming meetings. Changes to the Open Water Meeting were made based on feedback received from you. Changes to the agenda format are based on suggestions from prior meetings and peer reviews. Subtopics are included on the agenda to provide more distinction. One change from last year is that the peer review met in January 2012, which allowed time for interaction between science and participants and which allows for a summary presentation of their findings and recommendations. We have also provided a map that shows where proposed activities will occur. Based on the 2011 meeting, we asked that the speakers explicitly adopt recommendations and if applicable, tell how they plan to incorporate them into 2012 activities. The 2010 and 2011 peer review suggested including a component of what to expect in the future.

2012 and 2013 plans will be presented by speakers. There will be talk about integrating data into a single system, which will take majority of the time on Thursday. Also, some topics have consistently

"landed" in the parking lot and these have been incorporated into the agenda. Speakers have been asked to leave time for questions and answers; input is important to us. The hope is that there will be productive dialogue and questions. Last, in 2009, a website was created to house information from the Open Water Meetings, and there you will find various documents, agenda, PowerPoint presentations and meeting reports. The results from the 2012 meeting will be posted in the spring. I look forward to a productive meeting. Thank you.

Ron Felde, Facilitator: Good morning and welcome. This is an important meeting, and there needs to be great dialogue so it can be productive. My experience is that the meetings are run well, and the presentations are great. One thing that helps is the ground rules, and these have helped shaped the meeting.

Ground Rules

- Honor the agenda (time, topic and process)
- Respect others, valuing professional, individual and cultural differences
- Communicate from a commitment to develop a shared understanding of the subject, the issues, concerns and ideas
- One person speaks at a time
- When you speak, be concise, allow time for all speakers
- Share knowledge
- Listen w the intent of seeking to understand the content and the underlying context that shapes people's perceptions.
- Allow presenters to present, save questions or intentions to discuss for the appropriate time on the agenda
- Be open to new possibilities
- Stay on the subject, park other issues
- No cell phones and be sensitive to the use of computers.

The parking lot is for topics that are related to the agenda but aren't on the agenda. Over the last couple of meetings, the number of parking lot issues has reduced due to the changes in the agenda and the quality of dialogue. For issues that come up, we will park semi-related issues and, if relative, allow time for discussion.

Internet access is limited. Ground rules are posted around the room, and Lisa and I are acting as the referees. Before we start the presentations, Egan Center staff will provide a safety moment.

Nicole Geils, Sales Manager, Egan Center: In the event of a fire, leave via the nearest exit and head to either corner of the building. At either side, there are exit stairwells that act as bunkers. From there, the staff will give all clear to re-enter or exit and go to the park square. If you need additional assistance, stay in the bunker, and we will assist you with your exit. Do not use elevators or escalators. There is a floor plan at the registration table.

NMFS Incidental Take Program Updates

Jolie Harrison, Incidental Take Team Supervisor, NMFS, Office of Protected Resources

Comprehensive Arctic Marine Mammal Monitoring Plan

I work in the NMFS Office of Protected Resources and lead the group that issues the incidental take authorizations for ongoing oil and gas activities in the Arctic. Today, I will briefly talk about two issues we are talking about closely at NMFS. It is good to introduce them at the beginning of the

meeting because, as we work through the oil and gas activities and the impacts of them, I think we will all think of things related to these issues: 1) Comprehensive strategy for MMPA monitoring of Arctic oil and gas activities, and 2) looking at the way we use both the Conflict Avoidance Agreement and the Plan of Cooperation processes and the impact on marine mammals.

These slides (displayed) illustrate requirements for incidental take applications that applicants have to provide a proposed monitoring plan that results in the increased knowledge of the affected species so we have a better understanding of the impact of the proposed activities on marine mammals.

To set the stage, and some have probably waded through our Environmental Impact Statement (EIS) asking for public comment and there was a discussion of this in Chapter 5 if you are interested in more detailed guidance on what we look for on monitoring, what we are thinking about today is having a more comprehensive monitoring strategy of oil and gas activities when it comes to the impact on marine mammals. What we'd like to do is develop a planning and prioritization framework for monitoring the effects of Arctic oil and gas development on marine mammals that that does a couple of things:

a) Guide and support agency decisions related to monitoring. [That is straight forward. One thing our regulations say is that an applicant can write to us and we will provide guidance on monitoring plans. We have meetings up here, but I don't think we are best prepared to do that at this point, and we are looking towards a comprehensive monitoring plan to help us do that and guide the agency on the decisions we have to make. Another thing a plan would do is allow us to think about monitoring in the context of consideration of the impacts from multiple activities that we are authorizing in a given year and also understanding impacts across multiple years (because we are issuing authorizations across multiple years), and a comprehensive plan will help us do that.]

b) Assist industry applicants (early) and provide guidance in development of monitoring plans. [There are operators that have been doing this for years and doing a good job, but there are others just getting started, and this would be really beneficial.]

A few specific goals: provide a framework that has an iterative and adaptive process for a) identifying highest priority marine mammal data needs; b) identifying effective methods for gathering this information that we identify considering past successes in monitoring and successes in other parts of the world and resource availability, assets, as well as money; c) facilitating collaborative monitoring that takes advantage of existing infrastructure; d) builds on past work; and e) encourage meta-analyses and data sharing.

Implementation of a comprehensive strategy would have two key components: 1) include soliciting stakeholder input, and 2) sharing and assimilating information including having data related to past monitoring, understanding what is ongoing currently and once determining where we want to go, having specific goals and targeted recommendations for the future. Having this data on the website for new applicants will help them understand current prioritizations.

Existing tools/future implementation to determine what is going on in the Arctic: Open Water Meeting, independent peer review, and public review and comment of a variety of MMPA and NEPA documents. Some of the things being considered for the future: potentially convening a longer-term group to help design strategy/framework and facilitation implementation. Also, developing a

webpage that focuses on what has been done in the past and assimilates monitoring results and recommendations for the future.

Plans of Cooperation and Conflict Avoidance Agreements

NMFS has responsibility to ensure that activity will not have an unmitigable adverse impact on subsistence uses of the affected marine mammals. Two processes in place to address this issue: the Conflict Avoidance Agreement (CAA) and the Plan of Cooperation (POC). Conflict Avoidance Agreements are independent agreements that have been in existence for more than 25 years between AEWC and industry that contain measures to mitigate industrial interference with bowhead hunts. The Plan of Cooperation is required by the MMPA if activities affect subsistence users of any affected species. The POC includes the actual measures the company has identified to ensure the activity doesn't interfere with the hunt; includes the indication that communities have been notified of activities; and plans for continued communication during the oil and gas activity to ensure there is a mechanism to resolve conflict. The AEWC and companies meet multiple times over the course of the year to negotiate measures to protect the bowhead whale hunt. The AEWC does a lot of legwork and gets information from the affected communities and shares it with the companies and vice versa. We have adopted in our authorizations many of the measures from the CAA. Alternatively, the POC addresses species other than bowheads, does what the regulations indicate and meets with the villages to discuss impacts on these other resources. That is what is happening now.

NMFS is already using these processes, evaluating these in the context of supporting our decision regarding impacts to subsistence uses of multiple species by these communities and ensuring unmitigable adverse impacts and making sure measures are in place to ensure there is minimal adverse impact. This means NMFS must get input from affected communities and industry regarding the feasibility of the measures we use. For example, we have received input from folks many times that they wish that representatives would be more involved in the process, be present at meetings and collect information. This is a good idea, especially to support the findings that we make. We are looking at the effectiveness of these processes to identify measures that can appropriately mitigate impacts to subsistence hunts, and we are looking at possibilities for streamlining. We hear from communities that they have a lot of pressure to attend a lot of meetings, and it takes a lot of time and money for companies to get to those places, so there may be things we can do to make that more effective. We are looking for ways to improve.

NMFS is just beginning to think about this and looking for input from everybody, the affected communities and industry. We'd like to talk more about, and hear input on, the strengths and weaknesses of the way we implement both the CAA and POC processes, as well as creative ideas for improvement. We'd like to develop an iterative, open and adaptive process building on things that worked in the past and makes future implementation easier for all. There is a lot more strategizing needed. Potential mechanisms for improvement may be increased NMFS involvement in Arctic coordination to more fully understand what is going on, and a comprehensive, one-stop-shop website that clearly identifies areas/times of concern, species/community/industry contacts, past successful measures, and meeting times; practical information that would make the process clearer and easier overall.

We talked about these things briefly in the EIS (Chapter 5). The comment period is over now, and we hope people have given us good input and feedback and ideas, but moving forward we want to learn more and are interested in what folks recommend. We are interested in making these processes as effective as possible and easier for everyone, and that is what we are aiming for.

QUESTIONS & ANSWERS

Q: Robert Suydam, NSB: You mentioned about streamlining the process because of meetings going on for both community and industry. What are some of your thoughts on how to streamline the process?

A: Jolie Harrison, NMFS: That is a good outside conversation and one where I would look for input from you guys, but at a minimum, having a group understanding of when meetings are going to occur, i.e., having them all in one week instead of spread out all season. I think those things are kind of logistical in nature and having some sort of coordinator (I would point out that the AEWC does important coordinating legwork on behalf of that resource) to help with the logistics (who that person is I don't know) would be helpful. I think there are more substantive questions, too, but certainly some sort of logistical coordination probably would help a lot. It involves understanding who the contacts are for all of the communities and the industry, and having one place to put meeting plans together or some sort of group get-together at the beginning of the season to brainstorm ways to add on to meetings instead of spreading them across months.

Q: Harry Brower, AEWC: You've heard my concerns before working with the agency in regards to the CAA and POC and how the communities voice concerns regarding the CAA process. With the POC, we don't see the organizations and communities that get together and voice concerns and how they interact with the agency and operators. I am voicing concern about how the two are used and the interaction that we get from the community. With the whaling captains and the CAA process we are able to show leadership and the needs of each of our communities. Through the POC, we don't see that structure. The community involvement and voicing concerns through the POC, how do the monitoring and mitigation need to be developed for that?

A: Jolie Harrison, NMFS: I have definitely heard your concerns, and I think one of the important parts of this exercise in looking at the CAA and POC is identifying the strengths and weaknesses of each of those processes. The obvious strength of the CAA is the back and forth and negotiating and talking about the measures that occur in the CAA process versus one meeting with a potentially unknown set of people that you don't have a good idea of where that goes. I went to Barrow a few weeks ago and had a closer look at the CAA, and I have to say that the legwork that the AEWC does is very helpful. Whether or not there will be someone there to take a role like that with other resources is unknown, which means if there is not, then NMFS and industry will have to step up and make those sort of things happen and that would probably involve some sort of education component to make sure communities understand. For example, when you guys put a new commissioner in place, I noticed that you guys put together a packet that tells about the responsibilities, about CAAs, those sort of things, and I would see us, combined with industry, step into the role and make sure that people understand what we are trying to accomplish when a meeting occurs. It is a meeting for a purpose, and one of the things I meant about potentially having a website, for example, is Earl, who works for AEWC, uses old versions of a CAA and sends them to people to comment on. Then someone has a beginning template. This is the sort of thing we are looking for. Similarly we've worked with other resources, beluga folks, etc., to identify measures. An obvious starting point is what are the measures included in the IHA before that were meant to minimize impact to subsistence users? Well, we start providing those to people and sharing them. So, I guess I'm saying we need to use the positive parts of the CAA to reach the goal of figuring out what measures do we need. Similarly, there may not be all those logistical personnel in place for other resources, but we need to figure out how to make it work with NMFS and industry if there is no other person who can help us with that. I have heard your concerns, Harry, and we are trying to work hard to figure them out.

Q: Harry Brower, AEWC: Maybe we will have another opportunity to discuss another concern in regards to what's needed regarding the monitoring and mitigation measures requirement and purpose and guidelines and there is a subparagraph about takes of small numbers of marine mammals. I'm not sure if this the right time to discuss this or maybe we might have another time to address it?

Q: Lisa O'Brien, Facilitator: Harry, I think we're confused. I think you are suggesting there is another place on the agenda to better raise your question?

A: Harry Brower, AEWC: Yes

C: Lisa O'Brien, Facilitator: Okay.

Q: Ron Felde, Facilitator: Should he ask it now or is there a better time?

A: Jolie Harrison, NMFS: Judging from the one sentence he just said, I might suggest there is a better time to discuss it.

Q: Robert Suydam, NSB: Jolie, do you know, is there a place on the agenda to discuss that or is it a parking lot issue for the small numbers issue?

A: Jolie Harrison, NMFS: I'm not sure what Harry is reading off of, but I don't recall that.

C: Lisa O'Brien, Facilitator: If you could just state what the issue is you'd like to discuss, we'll make sure there is a placeholder for it either on the agenda or we will park it and come back to it.

Q: Harry Brower, AEWC: *(unable to hear - no microphone used)*

C: Lisa O'Brien, Facilitator: Okay, he's talking about the purpose in requirements and guidelines, so he's referencing to what Candace put together--the monitoring and mitigation requirements, purpose and guidelines--his question is regarding that.

A: Jolie Harrison, NMFS: Harry, we will follow up with you and figure out exactly what it is you are asking and figure out a way to address it.

C: Harry Brower, AEWC: Thank you.

C: Robert Suydam, NSB: I'd just like to thank Jolie for NMFS' interest in being more involved in the CAA and POC processes. I think that is a real positive move forward and encourage NMFS to really take an active role in whatever it may turn out to be, whether it's the CAA, POC or a combination of both. I think that NMFS being involved is a good thing.

C: Jim Lecky, NMFS: I wanted to respond to the small number issue. The statute allows individuals, including corporations, to apply for the take of small numbers of marine mammals, and the government's obligation is to consider that application and ensure that any take it authorizes has a negligible impact on the stock involved and doesn't have an adverse impact on subsistence issues. The question is what is the small number? I don't think we have a spot on the agenda for that. NMFS struggles with this a lot. There are a couple of ways to look at it: 1) what is the effect of the take? Is it small? Or is there a portion of the population that is small? We don't really have a definition of small anywhere in our regulations. Where the take is usually by harassment, often times the portion of the population or numbers could be argued as to whether it is small or not. Typically, we look at what portion of the population is likely to be affected and what the outcome of that interaction is likely to be in terms of things we would typically look at and evaluating the effect on the population over time. So, I think this is probably a parking lot issue because we are going to talk about monitoring as we go forward. Clearly one purpose of mitigation is to minimize the number of exposures and keep the numbers as small as it can be. That is one of those terms that is a bit in the eye of the beholder.

C: Ron Felde, Facilitator: Thanks Jim. Lisa has put that in the parking lot and so we'll see if we can leave some time for that a little later. Thank you, Jolie.

C: Bill Streever, BP: I did have some comments for Jolie, but we're out of time. I definitely want to add to the parking lot that if we are going to talk about the issue of small numbers, then we also need to talk about what the definition of take is and considering that of small numbers.

Interagency Compliance Monitoring

Jana Lage, Geophysicist, BOEM

I'd like to recognize fellow members who participated in this presentation, Pete Sloan and Brad Smith. This presentation came about because we have people, i.e. stakeholders, that think that the operators are out there running willy-nilly. What I'm going to do is give a presentation about government agencies with regulatory authority, getting together, reviewing data to ensure environmental and regulatory compliance. These meetings are attended by dedicated staff and management of the regulatory agencies. I will be talking about the agencies, a bit of the leasing, exploration and development processes. When I was in Point Hope a few weeks ago this was brought up, so I thought I'd bring it out and explain a little bit about how this process flows.

In June 2010, Minerals Management Service split into the Office of Resource Revenue which deals with all the money that comes in and the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). On Oct 2, 2011, we split off and became the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety & Environmental Enforcement (BSEE). As Mark said, BOEM is the landlord. We manage exploration and development of the nation's offshore resources in a way that balances economy as well as environmental protection. BSEE works to promote safety, protect the environment and provide the environmental oversight. One thing I'd like to note about BSEE is that you have an Alaska Regional Director, which is Mark, and then there are two representatives that report directly to headquarters. One of them is an Environmental Enforcement Officer and the other is the Oil Spill Response Officer.

Looking at the NMFS organizational chart, you have the Permits Conservation and Education Division in Headquarters where the IHAs are issued, and then we have the group in Alaska that participates in these compliance meetings. With the USFWS group, we have the Polar Bear Program and the Walrus Program, and we have representatives from those groups that participate in these meetings. And then there are the regulators: myself and Pete. David Johnson is with BOEM, and his group oversees the ancillary activities. Brad Smith, Craig Perham and Chris Putnam (I know that Craig is presently up on the North Slope investigating some polar bear information so he's not available). Then we have BSEE (Randy Howell is the Acting Environmental Compliance Officer).

This is a picture of the 5-Year Plan for the OCS Leasing, Exploration and Development process (displayed). When you develop a five year plan, it goes through our headquarters group, and then after that we plan for sales in a specific region. While all of this planning is going on, we also have EIS's. They are doing the NEPA work so that it flows and can cover things for the environmental aspect of things and these colors (shown) are key to the aspects of BOEM that address these issues. At the same time this is going on, we can also have permits for seismic operations. I want to make a note that oil and gas operations are not tied to leasing, they can happen anytime. So we will conduct environmental assessments and we will give permits. Once the properties have been leased, the operators will likely apply for geological and geophysics and also do ancillary studies on specific sites.

The next stage is exploration plans. That goes through our leasing and plans organization and then, once the plan has been decided, it moves into the realm of BSEE, and they issue APDs (applications

for permit to drill) and oversee the exploration and drilling. While that is going on, you may also have some additional seismic going on, so the resource evaluation group may issue permits for that.

So then you move into development and production and like I said, this is a very broad overview. To get a picture, you've got development and production plans, and then there are more environmental NEPA reviews and EIS's. And then, the decision is made, and then there is additional drilling and final direction.

Looking at the regulatory framework, there are a lot of laws and regulations that pertain to operations offshore. Specifically for compliance, is the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA) and Code of Federal Regulations. In addition, BSEE also has to address the Oil Pollution Act. Under 30 CFR 551, BOEM issues permits for geological and geophysical activities off lease activities and authorizes ancillary activities under 30 CFR 550; BSEE issues permits to drill under 30 CFR 250. NMFS will issue IHA under the MMPA, and the FWS uses incidental take regulations to issue letters of authorization for their work. NMFS can also issue LOAs but its only after rule making. Both NMFS and USFWS issue incidental take statements under the ESA.

In the Beaufort Sea there was a lot of activity in 1980s, much of which was on ice, and there was a lot of 2D seismic. The most recent pulse of activity is primarily 3D seismic, which is to prepare for drilling. In the Chukchi Sea there really has not been as much activity. There was a lot of 2D seismic in the 1980s, but primarily 3D seismic, a little bit of shallow coring in preparation for the drilling.

To give some history of compliance meetings, since the start of oil and gas operations, MMS and other agencies have worked together; this isn't something new. In 2005, there was a Cook Inlet 3D survey in which MMS monitored and worked with NMFS to ensure that all regulations were followed. In the Chukchi, there were three IHA's issued. Again, the surveys were monitored, and we worked again with NMFS and FWS. In 2007, because there seemed to be a new pulse of energy and exploration, the MMS began meeting formally with USFWS and NMFS, and the agencies sat down at weekly meetings and used technology to do a better review. Operators out working are required to provide operational weekly reports under 30 CFR 551 for the geological and geophysical permits. The leasing and plans, under ancillary activities, are not required to provide this information, but when asked, industry has provided any information they are asked for to ensure compliance with environmental regulations. So what do we do? We enter all the operational data into an ArcGIS program, we meet weekly, and then we review and analyze data and make decisions based upon the activities and observations.

[Showed examples with slide of Statoil 2010 exploration seismic survey. Red area=full seismic array; green=mitigation gun; yellow=ramp up; purple=no seismic guns running at all; dots=all different animals seen during operation. Next slide shows a single day of seismic travel of a ship, when they get near the mitigation and line start, they ramp up and guns operating, but when animals are spotted, they ramp down to the mitigation gun level to ensure they are not ensonifying these walrus with full array and watch and ensure that the 30 minute period in which they haven't seen walrus passes before ramp up re-occurs.]

This is a way for the regulators to ensure that the operators are actually doing what they are supposed to. Another use of this data was in 2010 there was a walrus migration that occurred. On August 27, you see a couple of walrus, then on August 28th you see a ton of walrus, and there were so many walrus that they shut the guns down and they were not able to collect data. When MMS worked with FWS, they suggested moving the operations further north so that they were able to

move and collect more data while not interfering with the migration. This was useful for the FWS because they could see it was happening again and they could track and follow the walrus as they migrated to shore.

Mark Fesmire, BSEE: BSEE evolved based on the need to have a stronger enforcement and compliance group independent of the group that was making the landlord type of decisions. There is the offshore regulatory program, which is responsible for developing safety and environmental protection and regulations; reviewing permits and requests, and ensuring requests comply with all regulations including recently implemented enhanced safety requirements. We are still developing some of the safety regulations in regards to things we have learned in the past, especially in regards to the gulf, but also in respect to the things we have learned over the last several years here in Alaska. The regulations will be in place that are necessary to safely drill in the Arctic and will be in place by the time we start drilling. We also have an oil spill response division. They review industry oil spill response plans to ensure compliance and that the plans meet regulatory compliance. They develop policy and disseminate guidance and provide oversight of spill response activities. We have a representative here in Alaska who reports directly to our headquarters oil spill response group. They oversee unannounced oil spill drill programs in compliance to the oil spill response plan. They manage those exercises and work with the companies to make sure that everything in the plan is available and works correctly. They also work with other Federal agencies (USCG and EPA) to continually enhance response technologies and capabilities.

The third group is the Environmental Enforcement Division which focuses on compliance by operators utilizing environmental regulations and ensuring they adhere to stipulations of approved lease, plans and permits. They are the cops of the cops. Their job is to make sure, specifically in regards to environmental programs, that all regulations, etc., are adhered to during the oil and gas drilling and production operations. The inspection program has teams that conduct drilling and production facilities inspections. These inspections may result in issue of incidents of non-compliance and civil penalties of regulatory infractions. They also conduct accident investigations if necessary.

With respect to the planned drilling this summer, there are inspectors on all off-shore exploration drilling vessels 24/7. The director has been adamant about this, and it is not typically done in the Gulf or California, but will be done in Alaska. They will have real-time reporting capabilities to both BSEE Alaska and headquarters. Data streams from offshore operations will be monitored by BSEE onshore on a regular basis.

Jana Lage, BOEM: In summary, regulators are working together to ensure environmental and regulatory compliance during oil and gas operations. Since BOEM and BSEE so recently split, we are still trying to work together to figure out how we mesh.

QUESTIONS & ANSWERS

Q: Robert Suydam, NSB: Mark, I have a question for you. BSEE was formed basically after the tragedy and accident in the Gulf of Mexico. For Alaska, what is BSEE taking from lessons learned from the Gulf of Mexico and applying here? In particular, thinking about an accident that happened like in the Gulf of Mexico or the one that happened in the North Slope. So the first question is how are lessons learned being applied? And then, secondly, I think it's a positive move to have inspectors on the drilling operations. What is BSEE's plan on having inspectors on seismic vessels?

A: Mark Fesmire, BSEE: There has been a very, very vigorous re-write of the regulations in respect to all offshore drilling. Specifically there has been a redesign of blow-out preventers. There have

been some redesign requirements for casing programs and cementing operations, but that applies everywhere. Specifically in Alaska, because of the logistic problems in pulling capping and containment systems, we're requiring the operators to bring that equipment with them. Capping and containment equipment; they are going to be required to have clean up equipment. It is much more rigorous than what we would expect of the Gulf. Like I said, the main reason is that we don't have that capability of being able to call anybody else. If you don't have it, it's not there, so we are going to make sure they have it before they start drilling. With respect to inspectors on seismic vessels, that will probably fall to the marine mammal observers that are on there under the current plans. One of the things we are getting in the near future, as Jana mentioned, is we have hired an environmental enforcement officer for the Anchorage office, and we expect that person to be the point of contact and gather the information to ensure compliance from the observers on the vessels.

Q: Ben Greene, NSB: This question may be for Jana or Mark, but actually I think Dr. Kendall might want to speak to this. As long as we are talking coordination of federal agencies over industrial activities, there are many entities with overlapping mission statements and I didn't hear any mention of the Department of Interior's new group which is under David Hayes, the Interagency Working Group for Coordination of Domestic Energy & Production. Forgive me if I don't have that right. I'm wondering if I could have some comments on how BOEM, BSEE, and the other federal agencies are coordinating with DOI's interagency group. Thank you very much.

A: Jim Kendall, BOEM: Very simple answer: they are watching over us. We've met with them several times, they meet on a regular basis, and they get reports from us on a very regular basis. I've met with David Hayes here in Alaska at least two or three times. In terms of coordination, he has said we're here to tell you what to do, we're here to help and if there's coordination not taking place, let me know and I'll make some calls. The simple answer is, they are watching us, and we're talking. They're getting our reports, and it is a good organization. They were intended to improve the coordination and it is. It's happening on a regular basis. Mark, Geoff, any comments?

A: Mark Fesmire, BSSE: I think one of the important things to remember is while the DOI does chair the federal organization; it involves just about all the federal agencies working in Alaska. Like Jim said, I think it's working very effectively. We meet and give them essentially the same kind of update we give you all. DOI is aware of what is going on, especially in respect to the Coast Guard and other agencies, and have to know what we are doing. It's been a very effective tool for disseminating information.

A: Geoff Haskett, USFWS: The only thing I'd add to that is David Hayes is the number two top guy in our organizational structure. Our bosses, their directions are very clear: make sure the work we do is fairly seamless and make sure what we do is to protect resources we are responsible for in a responsible and respectful way. I think we are working very closely with that group.

Alaska Eskimo Whaling Commission Subsistence Harvest Updates

Harry Brower, AEWC Vice-Chairman

This meeting marks 20 years since the AEWC and the North Slope Borough Department of Wildlife Management took the initiative that led to the development of these annual peer review meetings. The reason we did that is because there was western science research being done on the offshore oil and gas operations and the impact on migrating bowhead whales and some of the research was coming out and the results weren't consistent with our own observations. So we needed to come up with a way to peer review research plans and research results that would make it possible for our hunters to be involved with the process. This way we can make sure the scientists are designing their research plans so that they are actually able to find out what the whales are doing. We had to do this same thing when the International Whaling Commission came and started quotas. The U.S.

Government was sending scientists to count whales in the spring, but they didn't know the whales can migrate under the ice. They couldn't really count them because they couldn't find them. So the North Slope Borough hired scientists to work with us, and our whalers taught them how to find the whales. After the research is done, sometimes we have to help the scientists understand what they have seen. For example, when whales deflect around an activity, the researchers try to interpret the whale's behavior in terms of noise only. Noise is a factor for whales, but their ecosystem is more complex than sound alone. Even though sound is very important to them, we have to look at what the drill noise does to the ecosystem. Whales can smell; we've always known this, but the research has only just caught up with this. If we think about the whole ecosystem, drilling puts noise, vibrations and debris into the water. The whales can hear the noise, they can feel the vibration and then can smell and taste the debris. These are some of the things we have to look at when we are trying to sign research plans and when we're interpreting results. We are very thankful that NMFS is giving us the opportunity to continue our participation in this review process so that we can make our own observations and knowledge a part of the ongoing dialogue on research in the Arctic.

Update on 2012 Open Water CAA

The AEWC is working on the CAA in collaboration with the scientists. We have been working with oil and gas operators since 1985 to find ways to balance their use of ocean with ours and with the animals who live there. What we do with the CAA can be hard for people to understand when they first come up here, and in recent years the AEWC has come under some pretty harsh criticism from a lot of people, some within our own whaling community. This is because people don't understand the CAA. They thought the CAA was stopping development, but the AEWC isn't interested in stopping development. Our job is to protect the bowhead subsistence hunt and bowhead resource. We don't mind sharing the ocean. Everything in our culture is about sharing, including the CAA. We are happy with this process; it works for us. In fact, it is so successful, others might want to think about doing something similar.

The CAA meeting was held in Barrow on Feb 16-17, 2012. Attendees included AEWC commissioners, alternate commissioners, village presidents from 11 AEWC villages and AEWC staff, the North Slope Borough's Mayor's Office, and DWM, BP, Shell, ExxonMobil, ConocoPhillips, Statoil, Pioneer, ENI, ION/GXT Technologies, and NMFS. The starting point for the 2012 CAA process was discussing the 2011 CAA w/ proposed industry changes (displayed). The starting point for the process was an executive decision by the whalers to review and decide on industry proposed changes and to discuss any changes needed by the villages, followed by a joint discussion with whalers and industry representatives for the opportunity for new concerns to be raised. In a second executive session, whalers, with a village caucus, voted on proposed changes followed by a second joint meeting by all participants.

CAA Provisions: Sect 107, Emergency assistance. This provision has become law; Sect 108, CAA process of annual peer and post-season meetings. One way to make these meetings more productive is to create a map each year of planned activity areas in relation to hunting areas.

Mitigation Provisions: The purpose of the communication centers and the communication protocols is to protect hunting areas and keep everyone safe in the water. Title III, Barge, Transit & Cable Laying Vessel Operations purpose is to manage vessel traffic to avoid conflict with whaling, to keep hunters safe on the water and to reduce the risk of ship strikes to migrating whales. Title IV - Vessel Testing & Monitoring purpose is to track industry vessels operating during migration and fall hunting, gather information on types of sound vessels put into the water to help us understand what is happening when we see changes in whale behavior and collaborate on the development of monitoring plans. Title V - Avoiding Conflict during the Open Water Season purpose is to address

potential noise and pollution related impacts to bowhead whales and subsistence hunting opportunities. Geographic and Temporal Restrictions purpose is to restrict industry operations to help keep whales available to hunters, pollution limitations help keep whales available to hunters, and help keep everyone healthy. Title VI - Late Season Seismic Operations is a special section added to address ION's proposed late season seismic shooting.

2012 CAA Changes: The definition of geophysical activities change was requested by BP. Sect 201 no longer requires Inupiat language speakers as MMOs and gives hiring preference to native residents of the 11 AEWC villages. Sect 203 expands the number of communication centers to include St. Lawrence Island. Sect 403 limits monitoring plan requirements to federal waters (for British Petroleum). Sect 503 adds the requirement that drill operations be covered by the oil spill contingency agreement and be signed by AEWC, the North Slope Borough and the ICAS (Inupiat Community of the Arctic Slope). Sect 503 changes offsite location for drilling equipment (Shell rejected). Sect 505 had the requirement that vessels leave Chukchi by October 31 deleted but it keeps the requirement that all industry vessels be south of 59 degrees, north latitude by November 15 and stay 10 miles offshore of St. Lawrence Island.

The CAA meeting also gives us a chance to hear about upcoming research initiatives; attending these meetings and helps researchers plan activities to avoid interference of hunting; and interact with EPA on ocean discharge issues.

2012 CAA Final for Signature. This has been prepared and sent to all participants. At this time, the AEWC expects all companies operating during the 2012 season to sign the CAA.

Results from 2012 hunting of all 11 whaling villages: 19 whales were landed in the spring hunt with 10 losses. In the 2011 fall hunt, there was a transfer of two, 18 landed and 3 lost. Total landed was 37, total loss 13, total strikes used 50, total strikes left 25.

QUESTIONS & ANSWERS

Q: Bill Streever, BP: You made one comment along the lines that it's more than just noise and you followed up with comments about whales can smell, etc. But on your comment about it's more than just noise, there is more and more coming out in literature about the context in which the noise occurs. I don't know if that is what you were referring to, but I thought I'd ask you to comment on that. For example, two noises at the same sound pressure level, having different affect depending on what the whale was doing in the context of noise. Was it approaching or moving away, etc.? Then I also have a question for you about a BP comment on the CAA, but go ahead and comment on the context.

A: Harry Brower, AEWC: The latter comment you just explained. There are multiple issues happening when whales deflect.

Q: Bill Streever, BP: So more than strictly the sound pressure levels? Yeah. I'm really glad to hear you say that because to people that work on this it's more and more apparent that it's not just sound pressure levels. We have been way over focused on SPLs in my view. Also, you had the comment list on the CAA. One of them was on a BP comment about monitoring only in federal waters. There must be more to it than that. I don't remember the comment from BP, but obviously we have monitoring programs in state waters, and we don't really have an issue with that so I'm not sure what that particular comment was pertaining to, but it wasn't that we don't want to monitor in state waters. That's not an issue for BP.

A: Harry Brower, AEWC: I wasn't the only person doing all the drafting of the CAA language. I've been working with Earl and sharing this information. Call Earl and communicate with him on that.

Alaska Beluga Whale Committee Subsistence Harvest Updates

Robert Suydam, North Slope Borough

Good morning. Molly hasn't shown up in the last five minutes; she would be much more entertaining than I would. Molly was intending on being here. I'm not sure why she wasn't able to be here this morning, but I'm sure she wishes she was here. Willie Goodwin also wishes he was here, and he would also be much more entertaining than I would. The presentation from the ABWC is similar to what we've talked about the last couple of years. Many of the slides will be some that many of you are familiar with, and sometimes talking about things multiple times helps us understand things a little bit better.

I want to re-emphasize what the goals of the Beluga Whale Committee are. Really it's about maintaining healthy populations of beluga whales in northern and western Alaska. The committee doesn't deal with Cook Inlet belugas, just those in the Bering, Beaufort, Chukchi seas, and really the main purpose for maintaining healthy populations is to provide for adequate subsistence hunt in villages that depend on beluga. It is an important resource for many villages nutritionally as well as culturally. So the Beluga Committee is really different from other co-management organizations that exist in Alaska. It's different because not only is it comprised of hunters of beluga whales and protects hunting privileges for Alaskan hunters; the ABWC is comprised of hunters, and regional representatives, but also includes federal, state and NSB managers and scientists. NMFS has two representatives on the Beluga Committee, the state of Alaska has two representatives, the NSB has two representatives, and these people all vote on issues that the Beluga Committee has in front of it with the exception of hunting issues. The managers and the scientists aren't involved in that. It is truly a co-management organization in the true sense of the word where folks all get together and have an equal seat at the table and an influence on what happens on the committee choices. The management plan has been accepted and adopted by tribal organizations in 1995 and accepted by tribal organizations in 1996 and 1997. Cooperative agreement for the co-management of the western and northern Alaska Beluga Whales was signed by NMFS in 1999.

When the committee was formed in late 80's and early 90's, there was very little information on belugas. There was little information on harvest and little information from science on most of the stocks, so one of the first and continuing tasks of the Beluga Committee is to try to help fill data gaps through some of the science which has occurred including genetic studies, document harvest annually, bio-sampling from animals (particularly animals that are harvested) to give us a better understanding of their health, production, diet, etc. Of course we need to understand population size and trends to make good management decisions, and, also in the last 10-12 years, we are doing a fair amount of satellite tracking. There are at least five stocks of belugas recognized in Alaska. Again, the Cook Inlet stock is not part of the Beluga Committee. The Bristol Bay stock, the Norton Sound stock, Eastern Chukchi Sea stock (which was previously a combination of what was Kasegaluk Lagoon and Kotzebue Sound), the Beaufort Sea stock which was a group of belugas that spends the summer in Canada, mostly in the Mackenzie River delta, but winter in the Bering Sea. That stock is hunted in Alaska and by Canadians and also by Russians, so some of these stocks are definitely international.

Kasegaluk Lagoon and Kotzebue Sound have been treated as one stock until recently. This slide (displayed) shows some of the genetic results of the various stocks. The height and colors of the bars represent different mitochondrial DNA, really kind of family lineages through the mother. In the middle of the slide you can see Kotzebue Sound on the bottom and see there is a lot of the

brown family from Kotzebue Sound and some other colors at the top of that bar. So when I mentioned before that we thought it was the same group of animals than what is Point Lay and the Chukchi, the Kasegaluk Lagoon bar, the third from the right, you can see there is some blue at the bottom, dark brown and a bunch of other colors at the top. If you compare those in a qualitative type, you can see they are really different. There are some common families there, but in general the make-up is different. This information has led us to believe that these are actually two different stocks of belugas and not one as we previously thought. Here in the future that may create some challenges and opportunities for management, especially since there aren't that many belugas showing up in Kotzebue Sound anymore. We don't have a clue where the Kotzebue Sound animals spend most of the summer. They show up in Kotzebue Sound, and then they kind of disappear. We don't know where they go; don't know where they spend the winter.

Harvest information is recorded each year and collected by stock. Beaufort Sea stock, primarily hunted at Little Diomedea, Point Hope, Barrow, and Kaktovik (all of those hunts are during migration) have a harvest of 48 per year on average from 2007-2011. The Beaufort Sea stock could be exposed to industrial activity especially as it is migrating back west from Canada, through the Beaufort Sea and then down south through the Chukchi Sea. The Eastern Chukchi stock (Kotzebue, Point Lay and Wainwright harvest from this stock) averaged 99 per year during 2007-2011, but if we separate Kotzebue Sound from the Chukchi Sea stock, that number would definitely go down. The stock that is harvested the most heavily in Alaska is the Eastern Bering Sea (Norton Sound, Yukon and the Kuskokwim Delta) which averaged 166.8 per year in 2007-2011. In Bristol Bay, about 20 per year, so a total of about 350 belugas are taken each year in western and northern Alaska. This is the number of animals taken each year, it doesn't include the number struck and lost. Harry just provided information on how many bowheads were landed and how many were struck and lost. Trying to get struck and lost information from 40+ villages has been a challenge, but it is a challenge the committee is trying to tackle because struck animals that aren't recovered often times die, and so the total take per year may be much larger than the 350. It is one of the data gaps the committee is working on.

Area Beluga Whale Harvests for 2011: Kotzebue, 30 whales landed; Kivalina 3; Point Hope 32; Point Lay 23; Wainwright 9; Barrow 6; and Kaktovik 0. I believe there were actually two to three taken in Kaktovik in 2011, but I need to clarify that. In general, it was a typical harvest. Point Lay would have liked to have gotten more but it was quite late. It was the 11th of July and the whole village was involved. Usually it occurs in late June or early July, around the 4th, so the 11th was a very late hunt in Point Lay.

Bio-sampling from the harvested animals is really trying to focus on health assessment. We don't have good population numbers for the Eastern Chukchi Sea stock. For the Beaufort Sea stock, the numbers are very outdated, and hopefully we'll have some updated information from that group soon. So as we think about all of the stressors the belugas are being exposed to (or bowheads, or ice seals, or walruses), there's climate change, which is a huge impact. Obviously oil and gas activities, potential shipping, all these different types of things may show up first if we can focus on the health of the animal whether that's their body condition, disease exposure, reproduction, hearing, contaminants. We're trying to get all of that information.

Concerns about industry expressed, particularly from Point Lay, is that they are concerned that industrial activity that occurs in early July. If the hunt has not happened, it could have a big impact on their hunt. That's one of the things that has been a great concern. Another thing to point out is that beluga whales may be just as sensitive to sound as we are learning about for bowheads, and we definitely need more information on that.

QUESTIONS & ANSWERS

Q: Darren Ireland, LGL: Towards one of the goals of understanding the CAA and POC overlap and how those can be better done, I'm interested to hear on how many of the beluga and bowhead hunts those time periods sort of overlap. Certainly in Point Lay, it's an individual event. At other times, I've heard or understood that the beluga hunting goes around the bowhead hunt. I guess I was looking for a better understanding of how the beluga and bowhead hunts occur in time or space.

A: Robert Suydam, NSB: I will try to tackle that and if Harry or John or Vera want to correct me, or anyone else that is here, please do. I guess the main way to answer it is that it varies village to village. Point Hope will often hunt bowheads and belugas at same time or intersperse. Some days there might be lots of belugas and not many bowheads, and they will hunt belugas. Other days they might focus on bowheads, and so there is kind of this mix in Point Hope of when beluga and bowhead hunting occurs. In Point Lay, as far as I know there is no overlap between the hunts. The bowheads are in the spring. Folks in Point Lay have gone out in the fall to look for bowhead as well, and then the beluga hunt occurs in the summer. In Barrow there really isn't too much overlap. There is some hunting in the spring time, but only if there are certain environmental conditions. The focus in the springtime in Barrow is on bowheads, and so it just varies village by village but it's probably a worthwhile thing for us to come up with a diagram or better explanation of when these things typically occur to give folks a better idea. Maybe that is something we can work on in the coming years, not only for bowheads and belugas, but for ice seal and walrus as well.

Q: Brad Smith, NMFS: Jana talked earlier about our plans for in-season management with the agencies. One of the data streams we'd like coming into that is information from the communication center so we have information from the hunters as the hunts progress on whether there is any interference or not. I was just wondering if you can explain. I'm familiar with the whaling captains associations and the villages and how the bowhead hunt is administered, but I'm less familiar with how that occurs in the beluga villages and how /if they are prepared now to communicate with the communication centers and your thoughts on how that could be relayed to the agency efforts?

A: Robert Suydam, NSB: Sure. Most of the villages that hunt belugas are an individual hunt (two or three boats working together and going out and harpooning and hunting belugas) with the exception of Point Lay and Wainwright where it is a community effort where in some cases all of the boats in the villages go out and work together to bring belugas into a lagoon and then hunt them, sometimes 20, sometimes 30, 40, 50, 60 animals at the time. Whenever those types of hunts are occurring, everyone in town knows about it, and so the communication centers are well aware when people are out hunting belugas in Point Lay and Wainwright. I think it is a situation where adaptive management could be used. Let's let the hunts in Point Lay and Wainwright happen and then once they occur, then boats can then come into the Chukchi Sea and there's less of a risk of potential interaction, negative interactions or interference. That is something we have heard routinely from Point Lay over the years: let us hunt first and then let industrial activities occur after that.

Q: Ben Greene: I understand we're over so I will cut down what was going to be two questions into one quick one. One of the more spectacular things that has occurred in Arctic with regards to situations we've seen is killer whales in the far north including some really spectacular video that I saw of a pod of killer whales preying on gray whales. Do you have any indication of any killer whale-beluga interactions that you know of?

A: Robert Suydam, NSB: Killer whales will eat belugas; they seem to like them. We don't have a really good idea of what the level of predation is annually, but killer whales will definitely take belugas, but belugas seem to be pretty well adapted for dealing with that. In Kotzebue Sound, often times if there is a killer whale in the area, the belugas will swim right up to the beach into shallow water to stay away from killer whales. It's a great opportunity for the hunters to get the belugas, but it is a great way for belugas to stay away from killer whales.

Ice Seal Committee Subsistence Harvest Updates

John Goodwin, ISC Chairman

Good morning everyone. I'm John Goodwin of Kotzebue. I chair the ice seal committee. ISC consists of five regions: YK Delta, NSB, Northwest Arctic Borough, Kotzebue, and BBNA. I'll start with the results of the 2011 harvest and plan for 2012. Most coastal villages hunt seals seasonally, and the hunting areas overlap among the coastal villages and extend 25-30 miles out. The hunters' success is important because seals migrate in packs in the arctic and use the Bering Sea and vice versa. Plans for 2012 are no different than in the past. Hunters will watch the ice, weather, timing the seal diving to determine when is the best time to hunt. They will try to get what they need for their families and members of the community who are unable to hunt for themselves. One big unknown for 2012 is how many seals will be afflicted with the symptoms of the unusual mortality event that was declared in 2011. This could have a significant impact on the number of seals available for food, hides and other needs.

Conflicts between hunters in industry in 2011 didn't seem to be a big problem, but there could be when activity starts occurring closer to shore especially during the development stage. The number of individual seal hunters and number of communities that use seals are very large compared to numbers that harvest bowhead, belugas and walrus. The harvest of seals is not very widely monitored. It should be kept in mind that the incidents of conflicts may not be conveyed to a central point like the ISC. ISC and industry should work together to help the ISC become a more effective conduit for information on seals and seal hunting. It is important that any incidents that do occur be openly discussed so they can be addressed and perhaps resolved, rather than left to create resentment in the communities. Bering Strait is important to nearly all of the marine mammals that are used for subsistence in northern Alaska. We have clear documentation from traditional knowledge and joint community agencies that most of the marine mammals migrate in strong seasonal pulses north and south through the Bering Strait. In spring and autumn, tens and even hundreds of thousands make their way through the tiny passage at the same time when more and more vessels are passing through the same tiny area to take advantage of short open water season. We must not lose sight of the importance of Bering Strait when considering the rest of Arctic open water activities. Loss of the Bering Strait could impact large and important seal population. Harvest numbers are difficult to collect, but at the ISC we do try to get numbers but they may not be accurate so I won't mention that.

QUESTIONS & ANSWERS

Q: Jim Kendall, BOEM: John, thank you for your report. You mentioned the unusual mortality event in the seals that we've seen over the summer. I wondered if you had a sense of the prevalence of how many diseased seals continued through the winter time and whether it was impacting harvest?

A: John Goodwin, ISC: At this time, we don't really have an accurate count. I can give you an idea of what happened. The six seals were exposed themselves in July in Point Barrow. That is when they first detected it and then it moved south going all the way down. They said there was even a sick seal in Chignik Bay which was real unusual. Ringed seals don't go down there. That was really

unusual for a seal to be found on the beach down there in Chignik this winter. I'm sorry I don't have the numbers.

C: Robert Suydam, NSB: I can provide some information to Jim as well. In Barrow over the winter, over 20-30 ringed seals have been harvested and many of those seals have been examined by Raphaella. Most of those seals, based on her assessment and the hunter's assessment as well, is that they were pretty healthy. They were fat and didn't have the lesions or sores that were seen earlier in the summer time. There may have been some evidence that the disease was still there, but not as active or not as an impact on the animals. So what does that mean for the UME? We're not exactly sure, but we think that it's a good sign that the seals in Barrow in the winter time have been pretty healthy.

Q: Robert Suydam, NSB: I have a quick question for John. You mentioned the harvest information on seals maybe isn't as good as it could be. What is ISC doing to change that, or are the plans in place to collect that information?

A: John Goodwin, ISC: For Manillaq, we're trying to get the funds to go house to house for harvest data. I don't know about the other different regions. We were all asked to give a report. We're just short of money, that's all it is, but we've been working on it.

A: John Goodwin, ISC: I can make one comment: from a traditional knowledge perspective, it has been passed down from our forefathers who knew about when there is an abundance of birds, fur animals and marine mammals, there is a tendency for nature to take its course by having them get sick or starvation to get the numbers down. I just wanted to mention this here. I just think and hope that this is what it is for ice seals. If it is a man-made sickness, in the future we'll be hurting, but I think this is what it is, and I'm hoping it is.

Eskimo Walrus Commission

Vera Metcalf, EWC Director

Good morning. Just a bit of background on myself: I am with the Eskimo Walrus Commission (EWC) at Kawerak in Nome. I have been in that position since 2002. I wasn't expecting to be here that long. I was born and raised in Savoonga on St. Lawrence Island. We just had some hunter meetings out there with our co-management partners, USFWS. It was a great turnout. We had over 50-60 hunters in both communities. We discussed a lot about walrus population and survey plans and hunt concerns so it was great to be home on my island. I wanted to thank AEW, NMFS and NOAA for including the EWC at the table. This is my first time at the table, but I've been to a number of Open Water Meetings for a couple of years. The EWC is comprised of 19 commissioners all the way from Barrow down to Bristol Bay, and they represent people from Bering Straits, Chukchi and Beaufort and Kotzebue, down to our region to Bristol Bay. Charlie Brower is the chair. He is Harry Brower's brother. They are a great group of people to work with. I really admire and appreciate their support in our commission work for many years. The Walrus Commission has been around since 1978, so we've dealt with a lot of issues over the years.

Some of the issues the commission works on is conservation of the species. It is a shared resource between U.S. and Russia. We try to work with industry and others like fishing to minimize disturbances. In 2008, the commission passed the resolution to minimize disturbances of walrus if they are hauled out. I think a number of you have heard about the new haul out in Point Lay, so we're thinking ahead and trying to minimize disturbances as walrus haul out in new areas. A couple of years ago we did a really cool project. We worked with native villages of Gambell and Savoonga and someone here from Anchorage who trained some of our local people to video, editing

and all that, and we produced the video "Where We Get Our Food From." It was primarily focused on the native villages of Gambell and Savoonga. The elders and commissioners were concerned that our young people were losing the traditional knowledge of hunting and the proper methods of harvesting walrus, so we produced this video in conjunction with our partner, FWS, and primarily based on the hunting practices of St. Lawrence Island. It's something that we worked on and are very proud of.

This slide shows the migratory routes and haul outs. This has changed a little bit. Point Lay is one of our newer haul outs. As you can see, there are a number of large haul outs on St. Lawrence Island. This photo shows the haul out activity on Little Diomed where thousands of walrus were trying to haul out in the fall of 2010. Imagine the number of walrus in the open water.

The Sea Ice for Walrus Outlook is another project the Commission is involved with that works with native hunters in five communities to provide sea ice and five-day weather forecasts working with NOAA and the Weather Service to provide ice conditions to our walrus hunters. Over the years with declining sea ice, our hunters on St. Lawrence Island have to go out 60-80 miles to find good ice and harvest walrus. It has become challenging, but with this year, we've had a cold winter. You can see the ice around St. Lawrence Island when flying last week. Some of the hunters have reported it's like going back 50 yrs with solid ice. I don't know if it's good ice, but it's considered quite a bit of ice. The project is worked with NOAA, National Weather Service and UAF to get better images of sea ice conditions for hunters to access. One challenge is slow internet service in communities.

This slide shows some harvest data from Gambell hunters that was shared with the sea ice observers. It is not quantitative but is showed in a line graph. We don't have all the harvest data, and were hoping one of the biologists from FWS would have the information to report, but it's a shared resource between Russia and U.S. On St. Lawrence Island, we have been working on marine mammal ordinances. In the 1930's and 1940's the island had a form of governance where the communities enacted laws to several acts, one which focused on hunting. The ordinances back then that the community brought back and reenacted focused mostly on hunting. We've revisited the ordinances that have been passed based on traditional management. As you can see, the number one law was hunting; number seven is what both communities have enacted and passed the laws to limit walrus hunting to spring back for walruses. It's something that both communities have worked hard on and are very proud of reintroducing traditional management of walrus.

We are always encouraging scientists and researchers to utilize some of our traditional knowledge experts. They have a wealth of information on sea ice conditions, migratory routes of marine mammals and highly encourage people to utilize our hunters and traditional knowledge experts in their research.

I mentioned that we have a shared resource with Russia. We just finished a three year project with funding from Beringia National Park Service research program collecting harvest information from eight communities. They meet annually and don't have a bi-lateral agreement, but it's something that we want to work with the Nanuuq commission because they have an agreement right now on polar bears.

The EWC Mission Statement is to encourage self regulation of walrus hunting and management of walrus stock by Alaska Natives who use and need walrus to survive. We hope to have a full board meeting and work closely with FWS management agency and our 19 commissioners. I don't have specific harvest information, but we are interested in getting ship transit information if the open water seasons opens. I know Shell has been out to Gambell and Savoonga and maybe Shishmaref

last year, but we've very interested in traffic information because it will impact us. The whaling season begins first out on St. Lawrence Island, and we try to have walrus and seal hunting soon after whaling season is done.

QUESTIONS & ANSWERS

C: Jim MacCracken, FWS: About tracking harvest levels for walrus, there is a requirement that tusks be tagged within 30 days after harvest, and we can use that information. There are taggers throughout Alaska that assemble that data. We also have a harvest monitoring program on St. Lawrence Island which we can use. With those two programs combined, sort of correct estimates that come in from tusk marks and what we find out on St Lawrence Island as far as the harvest and what we observe, about 80-90 percent of the harvest in U.S. waters occur from villages on St. Lawrence island. There is a 42% struck and loss factor we apply to those estimates and as you can see from the graphs Vera showed, overall harvests have been consistently declining over the last several years. This is probably due to loss of ice, poor weather during hunting season, the spring migration occurring a bit earlier and happening a lot faster than it used to in the past. The only thing that wasn't on Vera's graph was our 2011 estimate from the Russian side. We usually get that sometime in August. It takes them a while to compile those figures and get it to us so we can add it to our database.

National Science Foundation 2011 Monitoring Results for Chukchi Sea Seismic Survey

Bernard Coakley, Associate Professor, University of Alaska Fairbanks

The Chukchi Edges cruise was funded by NSF. It was a 2D multi-channel seismic reflection survey that sailed out of Dutch Harbor on September 8, 2011. Multi-channel seismic acquisition occurred from September 13, 2011, to October 5, 2011. During this time approximately 5,200 km of multi-channel seismic data collection was completed. We used the RV Marcus G. Langseth because it was available and despite the fact that it was a non-ice reinforced vessel. There was approximately 98% multi-channel seismic uptime during the cruise.

Last year I spoke about the 'windshield wiper' - how most people believe if you restore Alaska to its original position kind of pivots around the McKenzie Delta and returns back to this position adjacent to the Canadian Arctic archipelago. The only problem with that is we believe the Canadian basin to be oceanic and therefore oceanic rock is temporary at the surface of the earth, and the Chukchi Borderland is permanent and its continental; the continents are permanent, the oceans come and go. The cruise focused on the transition between the Chukchi shelf to the Chukchi borderland areas. We were looking for the structures that would accommodate the motion and also the internal deformation of the Chukchi borderland. The cruise plan was to image the southern edge of the structure, and we sailed through Popcorn and Crackjack collecting seismic data through those wells because one of the biggest issues we have in understanding the history of the arctic Ocean is we get this nice multi-channel lines, but we have no way to date the reflectors, no ways to date the acoustic images of the stratigraphy, and this deprives us of the ability to really tell the story. We can see complex history, complex structure and complex stratigraphy, but we can't relate it to other pieces of the puzzle because we can't date any of it. The idea was to sail through these two wells where we have dated horizons and basically take age control in to the Arctic Ocean by that means. We also want to test models for the opening of the Canadian Basin.

The multi channel seismic set up included 1830 cubic inches total volume over ten independent air guns and pulled a 6 km streamer with 458 channels. This is a smaller source than the oil industry

typically uses. (Displayed a model of the 10 gun set acoustics source signature.) Other acoustic sources that were continuously used during the cruise included: a Kongsberg EM 122 Swatch Bathymetric sonar (12 kHz); a Knudson 320 B/R sub bottom profiler (2.0-6.0 kHz); and two acoustic Doppler current profilers (ADCP; 75 and 150 kHz). These were run continuously from Dutch Harbor and back. Other data sets collected included gravity anomaly, magnetic anomaly and sonobuoys to get wide-angled refraction data.

The non-ice reinforced vessel was used because the cruise was originally scheduled for 2010, and we were having to do a scavenger hunt to pull together the multi-channel seismic system. We found a number of the pieces, and NSF was willing to pay to refurbish some compressors to bring on to Healy because the Healy did not have compressor capability but then, at the last minute, Scripps announced they would not allow us to use their streamers, and we were kind of stuck. This past year there was too much competition for Healy time. There were three separate successful proposals funded by different groups that all wanted Healy at the same time. The Langseth was already scheduled to work in the North Pacific, so it worked well for NSF, and there was not a lot of transit for us to swap in Dutch Harbor. The big issue was then how can we operate safely in the Arctic, especially at night, because we straddled the equinox, and a significant amount of operational time was during non daylight hours, and this presented some issues using a non-ice reinforced vessel in the vicinity of the ice edge. (Displayed AMSR-E Sea Ice Extent). We got very close to a new record for minimum ice, and this diminished ice extent really made it possible for us to do very well with the data acquisition.

Showed a single channel field record that showed a very nice stratigraphy horizontally layered. You can see an awful lot of multiples caused by reflections. Once these are processed out we will start seeing the structure of the deeper layers much more clearly. The interpreted imagery we received from the Canadian Ice Service and this made it possible for us to operate safely in the presence of the ice. The captain's confidence in the ice imagery from the Canadian Ice Service was such that he took us into 1/10 ice and sat up on the helm for the whole night sailing between floes with all the gear towed in the water.

We have 458 channels of processing, but this is a single channel record (shown). What you can see is very nice stratigraphy horizontally layered. You can see these blocks sticking up out of the basement. You can also see other features you would interpret in terms of structure, and you can see an awful lot of multiples. Multiples are where the signal goes from the guns to the bottom, to the bottom of the water, to the bottom, and back to the bottom of the water, so they are multiple images caused by reflections from the water underside and those will be eliminated in processing. We feel that once these are processed out we are going to start seeing the structure of the deeper basins much more clearly and we may even be able to see in to the Paleozoic.

One interesting thing we have seen at Northwind Ridge is an erosional surface, and we are interpreting this to show that Northwind Ridge was once above the water. It stood out above the water surface and was probably a source of sediments for the Arctic Ocean. We also collected multi beam data, and because a lot of the areas we were working in were fairly shallow, an awful lot of what we see is this continuous record of ice gouging. But, in the more northerly areas, we also find evidence of glacial activity, glaciers grounding on the Chukchi Borderland that actually molded and shaped the sea floor.

IHA was received by mail a couple days before set off for Dutch Harbor. The monitoring program included visual observations from an observation deck and a passive acoustic monitoring (PAM) system. There were five Protected Species Observers, one community observer, 7/24 PAM and

daylight visual monitoring when weather was good. The towing arrangements included a magnometer, a hydrophone array extending six kilometers behind the ship, a gun array and then the PAM array at 150 meters long.

Shut Down Radii from the 90 day report:

Table 1. Exclusion zone (EZ) radii for triggering mitigation.

Source and Volume	Array Tow Depth (m)	Water Depth (m)	Shut-down EZ for Pinnipeds, Polar Bears 190 dB (m)	Shut-down EZ for Cetaceans 180 dB (m)	Level-B Harassment Zone 160 dB (m)
Single bolt airgun (40 in ³)	6	Shallow (<100)	150	296	1,050
		Intermediate (100-1,000)	18	60	578
		Deep (>1,000)	12	40	385
1 string 10 airguns (1830 in ³)	6	Shallow (<200)	190	1,870	14,370
		Intermediate (200-1,000)	130	1,400	13,980
		Deep (>1,000)	130	425	14,070

Multi channel seismic activity included the full array being online the bulk of the time. The guns silent time was mostly during transit from Dutch Harbor and back. Some partial volume times were due partly because if one gun failed or if there was some issue with the gun array. Typically the Langseth is pulling 4 gun strings, so if we had a problem with the gun string we were towing, we'd put another out.

For source operations there were seven minutes of gun tests. There was approximately one hour and ten minutes of ramp ups over the whole cruise. We had one daytime ramp up from silence, two day time ramp ups from mitigation guns, and no night time ramp ups from mitigation gun. There were approximately 500 hours of full power survey acquisition, about 28 hours of full/partial power line changes, one hour of single airgun and a total of 531:50 hours of total acoustic source active time.

The PSO's spent about 406 hours of visual observation, 526 hours of acoustic observation and 294 hours of simultaneous visual and acoustic observation. Mammal detections included:

	Total Number of Detection Records	Total Number of Animals Recorded
Cetaceans		
Unidentifiable cetacean	4	5
Mysticetes		
Humpback whale	1	2
Common minke whale	1	1
Odontocetes		
Killer whale	1	5
Pinnipeds		
Pacific walrus	6	14
Spotted seal	3	3
Ringed seal	5	5
Bearded seal	6	7
Northern fur seal	4	9
Unidentifiable pinniped	11	12

There were runs of days where we saw nothing. We really encountered most of the mammals seen during transits. The whales we saw were before we went active, so there really wasn't an issue of takes with whales. Some of the seals we saw while we were active, and this resulted in a couple of shutdowns.

Power downs by species included five power downs for a total duration of 1 hour 32 minutes: one power down for a spotted seal, two for bearded seals, one for ringed seal and one for an unidentified pinniped.

In summary, there were not very many marine mammals encountered. There was a certain number of Level B takes authorized by the IHA. In no case did we come anywhere close to the number of takes authorized.

It was a scientifically successful cruise. There was very good monitoring thanks to the PSO's. They did an excellent job and were careful, cautious and deliberate in their observations within the restrictions of the environment. Their professionalism and intelligence was much appreciated. As a result there were minimal takes.

QUESTIONS & ANSWERS

Q: Ben Greene: Although you mentioned PAM was used 24/7, as well as the daytime visual observations, is there any correlative data between those monitoring efforts? How well did the PAM work, and did it correlate?

A: Bernard Coakley, UAF: From talking to the PSO's, I got the impression they were skeptical about its efficacy, but given that there weren't many mammals in the first place, I think it is kind of hard to judge.

Q: Robert Suydam, NSB: Were there many marine mammals heard from the towed PAM array?

A: Bernard Coakley, UAF: My understanding is there were none.

Q: Robert Suydam, NSB: Presumably that information is in the report someplace that will end up on a website?

A: Bernard Coakley, UAF: I believe that's right. If you want, I do have the 90 Day Report I can give you.

C: Candace Nachman, NMFS: It is on the website already.

C: Robert Suydam, NSB: Thanks Candace. A comment about your comment that there appeared to be very few takes. The key word is appear. You had lots of zeros in the column for animals that may have been exposed to 160 dB or louder, but we know that marine mammal observers can't see out to the 14-15 km zone far that the 160 dB includes, and so it is a presumption there is no take at those levels, it really is just an assumption. There wasn't really any monitoring out there to really be able to assess that unless I'm missing something.

C: Bernard Coakley, UAF: We had no way to see out to that horizon, but I would suggest there were minimal takes even within the visuals would suggest that we were well within the limits established by NMSF.

C: Robert Suydam, NSB: I would guess that you were probably well within the limits as well but an alternative interpretation of the data is that mammals weren't seen very often within the visual observation range because they were scared away, taken or deflected away from seismic, and so my point is that making conclusions from visual observations isn't always the best. And lastly, congratulations on getting some really cool geological data.

C: Bill Streever, BP: I'd like to respond to Ben's question because the use of passive acoustic monitoring has come up repeatedly. PAM almost never well correlates well with visual sightings. When the animals are on the surface they are often showing different calling behaviors than at depth, and the calls will carry differently on the surface than at depth. The whale that's here whose call would carry the furthest is the bowhead whale, but unfortunately it's at the same bandwidth as the propellers and the engines, so you tend not to hear it with conventional towed PAM. That's why Statoil funded some experiments a couple years ago and BP funded some experiments in Canada trying to develop a PAM system that would work better with low frequency calling. I personally think PAM works great in some settings if you understand its limitations, but in my opinion, those limitations make PAM not very effective in the Arctic for detecting bowheads. That may be confirmed by this ... you didn't see that many bowheads, you didn't hear that many bowheads?

A: Bernard Coakley, UAF: No, there were no visuals of whales north of the Bering Strait, and, as far as I knew from talking with the PSO's, they did not think they heard anything on the PAM.

Q: Bill Streever, BP: Your estimated take levels that presumably came from your application were really high, which is often what we usually see, but I'm wondering if you want to talk a bit about where those come from and if you were going to shoot in the same area would you put in lower estimates for your next authorization?

A: Bernard Coakley, UAF: This was all done out of (unable to hear) so I didn't have a direct hand in doing the take estimates. One thing that concerned me when I looked at the original take estimates is that we had zero takes for a number of species that it was thought we were very unlikely to see and that concerned me. I actually advocated for low numbers for those. I really can't speak directly to how those numbers were obtained. They do seem high to me, too.

Q: Bill Streever, BP: Does NMFS have any comment on that? Obviously, to me, as an industry representative, if I go through the trouble of putting in an IHA request I have an incentive to ask for as many as I possibly can that you'll still give me, and I would venture to guess that's probably not the best thing for the agency because then you're authorizing more than what some people might think of as a small take.

A: Jolie Harrison, NMFS: I think the standard thing NMSF typically does on research surveys is to simply multiple whatever their density estimates are in an area times the isopleth and track line that

they have. Depending on the density estimates that you're using, it can result in an over estimate, but in the interest of making sure you are assessing what the potential impacts of the take would be on the population and being able to make the findings, I think we are oftentimes erring on the side of larger estimates.

Q: David Hannay, JASCO: I'm going to go back and ask a question about the PAM. As Bill was talking about, the PAM sometimes has limited functionality due to contamination by noise from seismic air guns, vessels, etc. and the effectiveness depends on how far you can get the sensors away from those noise sources. Can you give us a brief detail about what your PAM system consisted of, how far it was towed behind the vessel, and how many channels, and how deep, for example?

A: Bernard Coakley, UAF: Honestly, other than making sure it was operational and the PSO's were happy with how it was functioning, I didn't pay much attention, but it is documented in the 90 day report.

C: Dave Hannay, JASCO: I think that's important to note when we're talking about the effectiveness of PAM. We really need to understand what type of PAM system is being used and what its limitations are for each configuration.

Q: Rafealla Stimmelmayer, NSB: You reported also on marine carcasses, and I was wondering if there is any more information on that?

A: Bernard Coakley, UAF: I believe there was just one or two, not that many, and they couldn't be identified.

C: Robert Suydam, NSB: I'd like to follow up on Bill's comment about estimation of takes and it may be a parking lot issue, and I know the peer review panels have made recommendations to NMFS on perhaps holding a workshop or figuring out some way to come up with guidance on how people should estimate takes before going in the field and then how do they calculate takes or exposures once their done.

Q: Bill Streever, BP: I want to follow up on Dave's comment saying that you should document more of what your PAM system is capable of. People really don't, and I agree with Dave that it should be done, but when people use PAM they throw it over the side, someone listens to it and says 'yeah, I can hear the boats, it must be working.' I think you guys did exactly what other people do.

A: Bernard Coakley, UAF: The physical system is documented in the 90-day report. The PSO's paid a lot of attention to it. It wasn't really ignored at all. Within the limits of its capabilities, I think it was used well but then the question of its capabilities is very important.

C: Bill Streever, BP: The reason I keep hammering on this is I know people are always reaching for a way to improve mitigation, but I fear people waste time and energy that could be better spent elsewhere on mitigation techniques that frankly just aren't going to work from base principles until the R&D work is done.

Q: Robert Suydam, NSB: You mentioned that you threw out some sonobuoys as well. Did anyone look through the recordings from the sonobuoys for marine mammal calls?

A: Bernard Coakley, UAF: No. In 2005 we did put the sonobuoys on a low power FM radio and gave receivers to the MMOs on Healy's bridge to listen directly to the channel coming off the sonobuoys. They didn't hear anything then. Whether or not that might have been more effective this time, we didn't discuss doing that for this cruise.

Q: Shane Guan, NOAA/NMFS: What is the range on the buoy?

A: Bernard Coakley, UAF: It's line of sight, so 20 kilometers.

Q: Harry Brower, AEWC: Bernie, thank you for your presentation. You said something about night vision was a problem in terms of monitoring for marine mammals. I have probably voiced a concern before regarding how we can continue permitting these types of activities when there is no ground truthing on any of the tools that are being used for verifying whether mammals are present. We need to sit down with the agency to ground truth these efforts. For example there are night vision goggles, but how effective are they and are there tools that are going to be continued to be identified and what are their limitations?

A: Bernard Coakley, UAF: During the cruise they installed a forward looking IFR camera with the idea that they might be able to use it at night, but they regarded it as experimental and did not really use it continuously.

C: Bill Streever, BP: I wanted to comment on that because this is another area I found really frustrating. It's not a criticism to you guys, it's more a criticism of all of us. We need to learn how to use the gear better. We need to better understand what it can do. Not just forward looking IFR, but other vision enhancement gear that's out there. The place to do that is not on a seismic shoot. You are intentionally trying to avoid marine mammals; you're trying to be there when there's not a lot around. What kind of way is that to test new gear? If we are going to test new gear, it needs to be on dedicated experiments, not trying to cram extra things on a seismic boat that is doing its level best to avoid marine mammals.

2011 Monitoring Results for Northstar and 2012 Operations and Monitoring Plans (Beaufort Sea)

Bill Streever, Environmental Studies Leader, BP Exploration (Alaska) Inc.

This is the 13th year of Northstar studies related to marine mammals. Northstar was built in 2001, and the first oil was extracted in October 2001. Northstar had a peak oil production of 80,000 barrels per day (bpd), compared to 2010 production of an average of 18,000 bpd and in 2011 it decreased to 13,000 bpd. Northstar is located just north of Prudhoe Bay. Cross Island is to the east about 25 miles. Activities in 2011 were typical of past years with one exception. A new personnel module was brought to the island. There were typical seal counts this year with no surprises and typical bowhead call counts and acoustics as well.

This slide provides a background of regulatory activity including IHA's and LOAs. We did request renewal of regulations for our five year letter of authorization. This is different than an IHA. In the LOA process you apply for regulations and then, if regulations are written, they apply for five years. Under those regulations you can then request year by year letters of authorization and then after five years you have to petition for a new set of regulations versus IHA's which are generally speaking one year at a time. The point is, to get an LOA you actually need to have regulations in place.

Here is a timeline of what we've done at Northstar and where we've been. In 2011 we did routine monitoring, nothing too fancy; 1 peer reviewed publication was published on call directionality; and another paper was accepted. A second, but relatively small, peer reviewed paper led by John Richardson also came out. NMFS completed a five year peer review for the Northstar project just after the Open Water Meeting last year.

2011 Northstar activities were similar to past years with one exception. Helicopter and hovercraft operations during the ice covered season and open water season was pretty normal and in range with other years. Tugs, barges and ACS boats were pretty similar to past years as well. Crew boats are a bit of a change from the way things were in the past few years. There was no crew boat from 2003 to 2009, and then we started using them again in 2010 and 2011 because of island

construction. We did some modifications to the island, including removing the drill rig, and we brought out the new personnel module so we needed some increased capacity. My hope is that they have not grown so fond of the crew boat that we'll begin to see higher numbers of crew boat usage next year but I honestly don't know and need to talk to the Northstar guys about that. The idea with the hovercraft is that it would displace the crew boat. Island enhancements included the drill rig removal in 2010, and, in 2011, other work was done around the island, including use of steam probes to thaw the gravel and then compacting the gravel, some vibratory piling, impact piling in the gravel for new module supports; seawater intake installation and the new personnel module.

Seals have been monitored at Northstar in this particular style since 2005. It is a very basic program where our guys on the island climb up to the top of the module and spend approximately 15 minutes counting seals once a day for as many days as they can during the seal basking season in the spring. It's not a huge area that they're covering. They have an inclinometer, so they kind of have an idea of where their radius is. The interesting thing about the data is that the total number of seals in 2011 was exactly the same as in 2010 (185). The total observation days were also the same (62). And the number of seals per day was the same in both cases (3). The data sheets were checked and the numbers were just coincidentally the same. All the numbers are pretty much in range with what's been seen in the past. The seal observation period is broken into four periods, and then we look at counts in each of those periods. In that respect, 2010 and 2011 numbers were not identical although the total numbers turned out to be the same. The standard monitoring was used at Northstar in 2011 utilizing one recorder 450 meters from the island telling us what kinds of sounds are coming from the island and another recorder at the location marked "C" to listen to bowheads. Location C has been maintained for the entire period that Northstar has been doing this work to give us a basis for comparison year after year.

(Presented some results from Northstar acoustics.) The near island recorder (450 meters from the island) broadband sound pressure levels from 10 to 450 Hz, relatively low frequency, from August 24 to September 29. The peaks shown are indicative of vessel traffic; the lower edges are weather-related noise. Where the black line goes up and down is by and large weather related noise. The red line (added about two years ago) instead of giving the broadband sound as measured for one minute out of every four and one half minutes, gives the lowest two second sample out of ten minutes. The reason we do this is to find out about the steady sounds out there (not vessels, air gun pulses, mystery pops, etc.) but instead is representative of weather noise, compressors, pumps, that sort of thing. Another plot was shown comparing year to year. One difference is that we have more vessel spikes or peaks this year than in past. We had a discussion about how we actually define a vessel peak, and we need to come up with a standard definition of a vessel peak, and then we actually need to count them instead of just looking at the plot and saying there's more this year than past years. It seems reasonable there would be more this year because we were using the crew boats, and the crew boats are loud under water. The one other thing to point out is the sound levels close to the island are around 130-140 even when we are in vessel peaks, so these are not tremendously loud sounds compared to seismic impulses. They are also a different quality of sound. They are continuous sounds or semi continuous sounds as opposed to impulses, but they are considerably lower sound levels. 2011 data show the maximum level in 2011 was within the range of maximum levels seen in past years. That's true for the 95% level right on down the chart. Basically we're seeing that Northstar is doing pretty much what it's done in past years in terms of its underwater acoustics footprint.

In terms of bowhead calls, 14,400 total calls were detected at C/EB (within the range of what we usually have gotten over the past few years). We've had lows as low as 331 and highs as far as

40,000. The DASAR recording season was 34 days in length with a mean of 424 calls per day. The majority of calls were more of the simple calls than complex calls, similar to 2010. (A plot summarizing the direction from which the majority of calls were coming from was shown.) In 2011 most of the calls were coming from the east. If you look at the dataset from the past you can see in past years they come from different directions, but virtually never inshore, which is to be expected, but more often than not they are coming from the east or northeast. If we didn't have the data from Shell's recorders further to the west that tells us that in fact the whales are actually going to the west and are continuing to call to the west, this would be a troubling plot because the whales are calling as they approach Northstar and then they stop. So we did some work on call directionality and published a paper that came out this year which probably explains part of what we're seeing here. I would think that we should probably do the math and ask ourselves how much can call directionality explain the results like what we see in 2011 versus how much is something else we don't understand that's going on right now. When we did the call directionality work we actually had pinger sounds in the water that we know to be omni-directional sounds, and they were not as directional as the whale calls, so it isn't simply a matter of propagation characteristics in the particular region where we're working. Something else is going on.

Q: Bob Day, ABR: Is the citation page number correct as displayed? Pages 200-2012?

A: Bill Streever, BP: Probably not. Probably 200-212, but we can PDF the link to you.

The 2011 Cross Island Hunt. These track lines displayed show the boat locations during the hunt in 2011. Three whales were landed out of the quota of four. These were unusually large animals taken early in the season. There were some vessel traffic concerns that were identified by the whalers. It was not vessel traffic associated with Northstar, just more traffic in general. There were no specific complaints about any particular vessel, just the general, and understandable, concern about increased traffic in the area.

Peer reviewers had asked that non-bowhead calls be identified. One issue with that is that our recorders were set up specifically for bowheads so they work from about 10 to 450 Hz, so the sampling rate is such that you won't hear anything calling above the 450 Hz, so that means you aren't going to hear belugas, which are mostly above that, so it isn't surprising we didn't hear any. That doesn't mean there weren't belugas there. We did hear bearded seals, and I was impressed with the number we heard, 1041. We also heard six walrus; 2,303 unspecified marine mammals; unidentified 3,459; 271 human made sounds exclusive of boats.

Q: Robert Suydam, NSB: Were the bearded seal calls typical songs, trailing songs?

A: Susanna Blackwell, Greeneridge: There are usually just little pieces of it, lasting only a few seconds. They were pretty bearded seal-like but they are not the long...

Q: Bill Streever, BP: But pretty unmistakable?

A: Susanna Blackwell, Greeneridge: Yeah.

C: Robert Suydam, NSB: Thank you for that. Conventional wisdom is that bearded seals are mostly singing their cool songs in the springtime and not at other times of the year.

This was something the peer reviewers asked us to do. I thought it was interesting. Definitely, if you wanted to look at animals other than bowheads you would not do it with this bandwidth. It's just not the right bandwidth, but we can still do it. It doesn't really take an awful lot of effort when we're processing the recordings to do it.

Q: Robert Suydam, NSB: Is this just all from 2011? Is there any anticipation about looking at old data?

A: Bill Streever, BP: If there was good justification for the expense we'd consider it, but we'd want to know why people wanted that before we spent the money. It's a substantial amount of work. You'd have to listen manually and go back and listen to all those old recordings. That's not to say we wouldn't do it, but I would want to know why people wanted to do that before we invested in it, not because I think there's anything to hide, but I don't think it will be very interesting partly because these aren't the right recorders to do that with and maybe not the right location.

Our plans for 2012 include hopefully receiving the LOA for Northstar, possibly with additional requirements, and we kind of assume the peer review comments will be included in the LOA. We will also have:

- ongoing monitoring
- the 2012 hunt
- publication of our first Northstar deflection paper
- possibly submit seal paper
- possibly submit second deflection paper
- cumulative effects work (unrelated to Northstar; BP is supporting a series of workshops on cumulative effects trying to develop a method to get at the issue of cumulative effects)

Q: Harry Brower, AEWG: I'm trying to understand a bit more about the deflection papers. I've voiced this concern in the past about how BP identified its objectives to address the deflection in regards to whales. When you are saying that, submit the seal paper or the second deflection paper. It has a question mark. I'm trying to understand what you're indicating. Is it that researchers are losing interest on it?

A: Bill Streever, BP: They are losing youth. With the seal paper, we've had a draft paper that we've kicked around among six or seven co-authors. It just never becomes the priority because there is always one more NMFS requirement that takes up our time, and they just don't get finished. As long as we have all these new requirements coming in, we didn't have time to really understand what we've already done. I think it was in 2004 I made that argument to the Science Advisory Committee that works with NMFS and NSB, and I made that argument to them so that we could ramp down so we could work on some of those results and that's when we did our first major revision to the data analysis and that's where we really started to clearly see this deflection effect year after year. We wrote one paper on that that's been published, and we have another paper that is largely based on the first paper, and I guess I could say it shouldn't be that hard to do but everybody is getting older, some are trying to retire or are ramping down, and people don't have the time.

The monitoring plan for 2012 includes one location to record Northstar, one location to count calls, and two redundant locations at Sector C with three recorders.

In summary, we have had 13 years of Northstar. We have ongoing reservoir depletion. We have had typical activities plus some island enhancement and have seen typical sound levels; typical seal counts; typical bowhead counts; and a successful hunt.

QUESTIONS & ANSWERS

Q: Robert Suydam, NSB: How long does BP expect to continue pulling oil out of Northstar? 10 or 15 years?

A: Bill Streever, BP: I can give Bill Streever's opinion. I don't know if there is a consolidated BP view. In my opinion, ten years is believable if the price of oil remains high; 15 years I'd be pretty skeptical. I'd also say that if we started talking about demobilization in five years I'd not be surprised. It's going to depend on the price of oil and on the technology.

Q: Robert Suydam, NSB: You mentioned the increased use of crew boats in 2011. What do you anticipate being the activities in 2012? Will you go back to using the hovercraft more or will crew boats stay about the same or what?

A: Bill Streever, BP: I need to talk to Northstar management about that. The crew boat was brought back for the island construction and demobilizing the rig, but the problem is people are going to get used to it, and my fear is they like the crew boat and are going to try to keep it out there. So, I need to talk to those guys and let them know it is an issue for underwater sounds and see what kind of influence we have. I can't answer you because I can't pull the plug on the crew boat myself, but I can try to exert influence.

Q: Robert Suydam, NSB: When was full array out last?

A: Bill Streever, BP: Full array was out last in 2010 Susanna?

A: Susanna Blackwell, Greeneridge: I think it was 2009.

A: Bill Streever, BP: We did it two years in a row. That was a while ago.

Q: Robert Suydam, NSB: Any thoughts about trying to put that out again in the near future?

A: Bill Streever, BP: My feeling on that is if we had a good reason to do it and some good questions to ask, I'd be open to it. But barring that, if all we're doing is monitoring, and we're seeing years like we saw this year, where there's no news, I'd say wouldn't everyone be better off if we tried to learn something new about bowheads. Generally speaking, BP would not want to do work that is totally unrelated to Northstar, with Northstar money. It might make more sense to do something unrelated to Northstar or less directly related to Northstar than it would be to put the full array back out. I'd also say there is still a lot of learning to be had from the existing dataset. I would like to see us continue to whittle away at that stuff.

Q: Brad Smith, NMFS: That new piece where you looked at two second low sound levels, did that correlate with certain island activities? And I wasn't clear whether that was from the 450 meter hydrophone?

A: Bill Streever, BP: The one I showed here was. We do it both offshore and at the 450 meter distance. We do it at both of those.

Q: Brad Smith, NMFS: So did that approximate ambient, or are you picking up a lot of on island noise? Is that what defines that baseline?

A: Bill Streever, BP: Ambient is a funny word in this case because Northstar is now part of the ambient noise. That line on the near island recorder, that low line, that two second interval and the other line as well, are both elevated by things like compressors and pumps working on the island. They are both elevated a few dB.

Q: Brad Smith, NMFS: You didn't pick up any transients or any way to further reduce the noise that is obvious? It's just basically the hum of the island?

A: Bill Streever, BP: It's the hum of the island. When you're talking about a few dB, those are almost not meaningful numbers. I did notice, for example, on one of the tables in there we report dB to the tenth. One tenth of a dB doesn't really mean anything. When you say can you reduce a sound by 2 or 3 dB, I don't think you can consistently measure the difference and make a meaningful difference.

C: Susanna Blackwell, Greeneridge: It's half the power of 3 dB.

A: Bill Streever, BP: Yeah, but could you consistently measure the difference?

C: Bill Streever, BP: I would like to add one more thing. I come to these meetings, and I see a lot of the same faces, but what I find is people are all over the map in terms of their understanding. I think the one thing we can think about collectively is trying to sponsor some training courses to get people closer to be on the same page in terms of dB, calibration, etc.

C: Lisa O'Brien, Facilitator: I agree. I sometimes wonder if you all have the same definitions.

C: Dave Hannay, JASCO: As far as the acoustic monitoring, what we are looking at is a lot of variability. These two to three dB changes are really tough to identify when you are seeing weather differences of at least 15 dB. We really need to look at these statistically; we don't expect to see a transition immediately. It is very difficult to extract these small changes.

C: Bill Streever, BP: There is variability in measurement, no matter how good we make the hydrophones, there's always going to be problems, but there's also variability in propagation and variability in the background noise. I would also add the variability seen in the lowest two second sample is mostly weather.

Statoil 2011 Monitoring Results for Chukchi Sea Marine Survey Program

Shallow Hazard and Geotechnical Program Operations

Roy Wollvik, Principal Engineer, Statoil

I've been with Statoil for five years working mainly with seabed mapping and marine operations particularly in the Arctic. I was offshore in the Chukchi Sea last year on the geotechnical vessel. Last year in the open water meetings Statoil presented the 2011 operation, and I will present some of the results of what we did.

We had two simultaneous operations. The vessels used were the Duke for site survey on shallow seismic and Fugro Synergy was our geotechnical vessel for drilling and taking samples of the seabed. The operation area was in the Chukchi Sea, and we mobilized from Dutch Harbor and had a four and one-half day transit to the site area about 100 miles off of Wainwright. Being in such a remote area takes a lot of planning because of the distance and lack of infrastructure. We had a hospital on the Synergy in case of emergencies. We didn't plan to do any trips to shore during the operations except we had a small crew change with the Duke.

The Duke was used for site survey work. The Duke is a rather small vessel built in the 1980's in Norway. It is ice strengthened, and there is space for 50 people. We had 39 aboard on this trip, including four MMOs and two from JASCO. The vessel has an 11 1/2 knot cruising speed. It was mobilized August 1 and demobilized on September 25. There was a small crew change during that time.

The scope of work for the site survey was to investigate a few drilling well locations to make sure there were no shallow gas hazards and such. To do this we used shallow seismic and subbottom profilers, multibeam echo sounders and side scan sonar for mapping the sea bed. There were two planned survey areas: the west area 11 x 4.3 miles and the east area was 9.7 x 4.1 miles. The sound sources used were: 10 cubic inch mini airgun for the UHRS streamer; 40 cu in airgun for HRS streamer, SBP 300 sub bottom profiler; side scan sonar, EA 500 single beam echo sounder; EM 2040 multibeam echo sounder, USBL subsea positioning system for positioning SSS towfish. A sound source verification test was performed on both vessels.

The side scan is using a towfish towing behind the vessel. It sends sounds out to both sides, and the reflection gives us a black and white image of the seabed. The darker spots are sand ripples on the seabed, and the lighter ones are harder soil. We don't go in to the seabed on this; we just get a picture of it. The multibeam gives us a nice image of the seabed, and the main difference is with the multibeam we get the position and depth of all the data so we can use it to create a 3D model. We had two types of shallow seismic: the HRS and the UHRS. The HRS used a 600 meter long streamer towed behind the vessel. We also had the subbottom profiler. It is a single beam powerful echo sounder and goes a bit into the soil and gives us a more detailed image of the top five to eight meters of the seabed. These data will be nice to have when we start drilling. When we start coring and sampling we can compare it to these data.

To summarize the site survey work with the Duke: 1,600 line miles of survey were completed during the 55 days spent in the field (including transit), all necessary data were collected, all regulatory requirements were complied with, and there were no breakdowns or other incidents.

The Fugro Synergy was built in 2008 in Norway. It is ice strengthened. It is 340 feet in length with space for 70 people. Its cruising speed is 15 knots. The Synergy was mobilized August 31 in Dutch Harbor and demobilized on September 30. Four days were spent in transit to the site.

The purpose of the soil investigation was to document soil conditions and collect quality soil data and basically to see if the seabed in these locations are solid enough to place a platform there. There were five locations, three on the eastern side and two on the western side, with three boreholes at each location. One 50 meter hole was drilled and three 30 meter holes. Push sampling and cone penetration testing (CPT). A sound source verification test was conducted on this vessel in cooperation with the Duke and the JASCO personnel on board. Temperature measurements were in the scope but it was not a high priority task, but we brought equipment to perform temperature testing in the bore hole.

Push sampling is done by lowering the drill pipe to the seabed, and a small tube is pushed one meter down into the seabed and get a sample. Then we drill another meter down and take a new sample. In between they are using this CPT which is a three meter long pole pushed down to the sea bed and is used to measure resistance when pushed in to the seabed.

1,460 total feet were cored from all five locations. 30 days were spent in the field, including transit. Detailed knowledge of soil conditions was obtained with geotechnical testing in combination with geophysical subbottom profiles. No unexpected soil conditions were encountered. All regulatory requirements were complied with.

During the 49,000 man hours on the two vessels there were no accidents or issues. The work was conducted in a manner designed to avoid conflict. We followed the communication center protocols and were in daily contact with Wainwright. There were community meetings held October and November with some more to come in a few weeks time. The 90 day report was issued in January. We had three port calls to Wainwright and one to Nome for medical, personal emergency or safety (equipment repair) reasons. There were five MMOs onboard the Duke and four on the Fugro Synergy.

QUESTIONS & ANSWERS

Q: George Edwardson, Inupiat Community of the Arctic Slope: Was the intensity of air guns you were using the same strength as last year, or did you change?

A: Roy Wollvik, Statoil: Darren will cover that in his presentation.

A: Darren Ireland, LGL: It was a much, much smaller array than used in past years. This was a shallow hazards site survey so the air guns, the number of guns, the total volume, was all substantially lower than a 3D or 2D type seismic survey where they are looking much deeper in to the earth.

Marine Mammal Monitoring Program and Results

Darren Ireland, Marine Biologist, LGL

(Displayed a video of the vessel transit and marine mammals sighted.) The video gives you a bit of a feel for how the vessel moves and goes about conducting the survey on the site.

The Duke left Dutch Harbor August 1 and entered the Chukchi Sea on August 5. Site survey work began on August 7, and there was one trip to Wainwright on August 28. The site survey was completed on September 20, and the Duke departed the Chukchi Sea on September 21, returning to Dutch Harbor on September 25.

The monitoring program objectives were to measure the sounds at the start of season when survey equipment began to be used; to visually monitor the area with MMOs for occurrence and behavior of marine mammals near seismic survey operations; to implement appropriate mitigation measures; to collect data on the distribution and relative abundance of marine mammals in the area; and to use observations to estimate exposures of animals to seismic sound.

2011 peer review panel recommendations were implemented as previously planned in 2011, including:

- train all observers together at the same time
- use visual aids during training
- pair experienced observers and new observers together during training and in the field
- document visibility conditions during observation periods
- maximize time spent monitoring areas within the safety radii
- conduct observations from the best possible vantage point (typically the bridge)
- alternate visual scans with high power binoculars and low power binoculars
- record survey activity status and environmental conditions every 30 minutes or whenever a parameter changes

The changes that were made to the 2011 monitoring program based on peer review panel recommendations included:

- additional emphasis was made during MMO training to record sightings as "unidentified" if they are not certain of the species
- recording pertinent biological information for unidentified sightings
- using an electronic database to record survey activity, environmental and sighting data in real time. This allows for real time geographic display of data.
- Observers specifically conducted more nighttime watch efforts using night vision devices, and the findings are summarized in 90 day report.

JASCO performed the sound source measurements work using two different types of hydrophones, OBH and AMAR. Both are dropped over the side of the vessel, are stationary, and float just off the bottom. The work was done on the Duke on August 8th. (Displayed sound source measurements from the Duke.) The primary reason these are done is to create and measure the distances to the critical threshold radii that MMOs are going to use to power down or shut down operations.

Full Air Gun Array Sound Level Distances (meters)			
Received Level dB (rms)	Pre-Season Modeled Radii	Field Season Measured Radii	Final Measured Radii
≥190	50	37	37
≥180	190	130	130
≥160	2,250	1,500	1,500
≥120	39,000	30,000	30,000

Mitigation Air Gun			
Received Level dB (rms)	Pre-Season Modeled Radii	Field Season Measured Radii	Final Measured Radii
≥190	10	15	15
≥180	45	59	59
≥160	715	840	840
≥120	24,000	29,000	29,000

Displayed the sound source measurements from the Duke on the various sound sources used including the 40 in air gun array, 10 in air gun array, single beam echo sounder, subbottom profiler, side scan sonar, multibeam sonar, SonarDyne position system, SonarDyne beacon and the Duke transiting at 4.5 knots. The data are pretty valuable and there is starting to be more than a few years worth of data available to understand just what kind of sounds really are coming from these instruments being used on survey sites.

The same thing was done for the Synergy. We dropped the hydrophones over, had the vessel run a transit just to get the vessel sounds itself and then had the vessel go on station right nearby those hydrophones to record the sounds of the vessel as it was in dynamic positioning and doing the coring operation. The dynamic positioning is when the vessel of this size doesn't drop anchor to hold in place but uses thrusters on the bow and in the stern and it is able to, with GPS's on either side and a computer system, maintain its position within a few meters. Those thrusters can be relatively noisy at times. There is potential for those sound levels to be consistently above a disturbance threshold for continuous (non impulse) sound levels of 120 dB. Our pre-season estimates from measurements of a different vessel in the Chukchi Sea in dynamic position in previous years was about 7.5 kilometers to the 120 distance. This year's measurements were 2.3 kilometers to that distance. Notice the zeros on the chart at the critical safety threshold distances. The sound levels from the vessel when it was in dynamic positioning or coring were not above these threshold levels.

Coring Sound Level Distances (meters) - Dynamic Positioning Only			
Received Level dB (rms)	Pre-Season Modeled Radii	Field Season Measured Radii	Final Measured Radii
≥190	0	0	0
≥180	0	0	0
≥160	0	0	0
≥120	7,500	2,300	2,300

Coring Sound Level Distances (meters) - Dynamic Positioning & Coring			
Received Level dB (rms)	Pre-Season Modeled Radii	Field Season Measured Radii	Final Measured Radii
≥190	0	0	0
≥180	0	0	0
≥160	0	2	2
≥120	7,500	1,800	1,800

Interestingly, when the boat was in dynamic positioning, the measurements were lower when in dynamic positions and coring equipment was in use, the measurements during that time were lower than when in dynamic positioning alone. The coring operation doesn't really make a whole lot of extra sound above that produced by the dynamic positioning. The fact that the numbers were lower was probably a product of the timing of the measurements, and the boat may have been working a little harder against the wind or current to stay in position.

Displayed the sound source measurements from the Synergy including from the single beam echo sounder 18 kHz and 200 kHz, the HiPAP positioning system at 22/23 kHz and 21/21.5 kHz, the Synergy in DP w/o Coring, the Synergy in DP with Coring and the Synergy transiting at 4.5 knots.

Marine mammal visual monitoring included the use of five MMOs on the Duke and four on the Synergy. At least one MMO is required to be on duty on the source vessel during all daylight seismic operations. We had at least one MMO on watch 100% of the daylight seismic, 100% of nighttime seismic, during 94% of all operations and during 20% of operations in darkness. Two MMOs are required to be on duty 30 minutes before and during all full ramp ups and as much as possible during other survey operations. We had at least two MMOs on watch during 100% of ramp ups, 88% of daylight seismic and 55% of nighttime seismic.

Cetacean sightings included eight total gray whales and eight total unidentified mysticete whales. (A map was displayed of cetacean sightings relative to airguns during survey periods including mitigation air gun use, full array and non-seismic.)

Pinniped sightings (followed by the number of individuals) included: 59 (61) bearded seals, 20 (20) ringed seals, one (1) spotted seal, 17 (17) unidentified pinnipeds, 24 (24) unidentified seals and 81 (147) pacific walrus. (A map was displayed of seal sightings and one of walrus sightings relative to airguns during mitigation airgun use, full array and non-seismic.)

The number of marine mammals observed within the safety radii were:

Cetaceans ≥ 180	Seals ≥ 190	Pacific Walrus ≥ 180
0	0	2

Mitigation measures implemented on the Duke included: 08/15 shut down for unidentified pinniped carcass; 08/17 power down for pacific walrus; 08/17 power down for pacific walrus; 08/19 power down for pacific walrus.

Mitigation measures implemented on the Synergy included: 09/10 moon pool monitoring for pacific walrus, 09/11 moon pool monitoring for pacific walrus, 09/16 speed reduction for gray whale, and 09/22 speed reduction for pacific walrus.

The number of marine mammals observed within the disturbance radii were:

Cetaceans ≥ 160	Seals ≥ 160	Pacific Walrus ≥ 160
0	71	60

A couple of methods are used to calculate what might have been there that we didn't actually see. Traditionally that's done by calculating densities. Calculating densities helps to correct for those animals that were likely there but that weren't seen. We used the MMO data that were collected during seismic periods, during active operations, and during non seismic periods. (The estimated numbers of marine mammals potentially exposed to seismic sounds (≥ 160 dB) and coring sounds

(≥ 120 dB) based on densities calculated during seismic and non-seismic periods was displayed.) During seismic there were very few animals observed. Non seismic sightings include those observed during transit to and from Wainwright. For cetaceans, somewhere between zero and 18 animals was the estimate of animals exposed to the disturbance thresholds. The requested take was in the 44-88 range. (Displayed seal densities and requested take numbers.) Essentially the number used to estimate potential impacts at the start of the season are substantially higher than are higher than what our actual estimates come out to based on the data we collected during the season.

We had our observers use night vision devices and infrared cameras and take some notes on how well they did or didn't work. These are the military type units with two eye pieces. They can be held like binoculars or they can be worn on the head. The typical observation sessions lasted five to ten minutes, after which eye fatigue diminished the quality of observations. They were found most useful during the twilight periods when there was still a small amount of natural light available. Nights with no fog, no ambient light, or heavy seas made observation nearly impossible. Vessel deck lights and/or internal bridge lights had limited usefulness from inside the bridge. The effective range was estimated between 10-500 meters, depending on ambient light and vessel lighting conditions. Jellyfish and seabirds are sighted when conditions are good. Two Pacific walrus were sighted, in both cases first with the unaided eye and also detected with the night vision device. The Northern Lights were found to be distracting. The device is a light intensifier.

In 2010 Statoil used an infrared camera system. It had similar environmental limitations (fog, high seas). The infrared system generated less observer fatigue. This unit collects the data and sends it to the bridge or wherever you have your observer station and there is a series of two or three computer screens that are showing you the images its collecting. It collects images 360 degrees, five frames per second in every direction. It has a much wider field of view. It is still in the testing and development phase and is not commercially available.

The peer review panel asked for Statoil to look at the 2010 data and the correlation between visual and acoustic detections in the same time and location. As Bill Streever mentioned earlier, lining these two things up is incredibly difficult. It is made more difficult by the fact that this was not a towed PAM system. These acoustic detections are coming from the bottom mounted recorders, so the only time you can get overlap of a call that you then detected the animal when it surfaced is when the boat was right near the recorders and that doesn't happen often. It does, however, allow you to see if you are picking up the same kind of trends. (Slide displayed representing visual observations of bowhead whales, the dates observed and the acoustic detections and dates detected.) We did not see a lot of overlap with this data, but the number of observations was limited, and it was during a time when we did not expect to see a lot of bowheads in the Chukchi Sea. (Similar slide displayed representing visual and acoustic data for bearded seals and Pacific walrus.) With Pacific walrus, the trends line up a little more than on the bowheads and bearded seals.

QUESTIONS & ANSWERS

Q: George Edwardson, Inupiat Community of the Arctic Slope: Did you do any purse seining to see what kind of fish were in the waters?

A: Darren Ireland, LGL: No, we did not do any fisheries or purse seining as part of this project.

C: George Edwardson, Inupiat Community of the Arctic Slope: I had a MMO that was on a ship doing that and every place they set their purse seines in the water nothing but salmon fingerlings would come out of the purse seines up to 130 miles offshore. Every time they would cast it you

would see the salmon fingerlings in there. When you look at the seals and the walrus you will know what they're eating.

Q: Bob Day, ABR: In the map that showed the sightings, the 160 dB non-seismic period was larger than it was for the mitigation airgun. I would assume that your non-seismic period would ... yeah, on the right, your 160 dB radius is bigger than the one on the left, and I would think it would be the opposite.

A: Darren Ireland, LGL: It is simply on there for reference, a distance reference to the sightings. There is no actual 160 dB distance from the airgun when the airguns aren't operating. You are right. That line doesn't actually exist, there aren't shut down criteria in place there. It's really just for reference in comparing to the two slides next to it.

Q: Jolie Harrison, NMFS: Relationally all the sightings on those are in the top hemisphere. I'm just wondering if that's north or in front of vessel?

A: Darren Ireland, LGL: In front of vessel.

Q: (Unidentified Speaker): If you look at the walrus part, I was wondering if there would be any way to determine if some of walrus were females with calves?

A: Darren Ireland, LGL: Some of the observers did record that, but I don't have that in my head. We do have that data.

Q: Christina Anderson, HDR: What is moon pool monitoring?

A: Darren Ireland, LGL: Moon pool is a hole in the boat. When you have a vessel where you are sending a drill pipe down to the sea bed, usually it's not down on the side of the boat, it's done through the middle of the boat, and that's called the moon pool. There is the potential for the animal in the water to come up in the middle of the moon pool and therefore be in close proximity to the equipment in the water, and so there is monitoring making sure the animal isn't there if you're taking gear in and out of the water in the moon pool.

Q: Robert Suydam, NSB: You were talking about real time maps and recording data so the observers have a record of where the animals were. Was that information relayed back and forth between the two vessels or is it just on a single vessel, and if it's just on a single vessel are there ways to transmit data back and forth so sightings from both vessels are on the screen at once?

A: Darren Ireland, LGL: In this case it was just on a single vessel. There was not a real time link between the two vessels. There is some work being done on real time work between vessels, but I'm not sure if it is a WiFi system or what they're using. Our system doesn't currently have that ability. I do know that in other operations in the past the MMOs would get on the radio and communicate positions and plotted on a map manually.

Q: Robert Suydam, NSB: It seems like it would be worthwhile to investigate ways to electronically send those sightings back and forth so a MMO isn't spending a lot of time transcribing data and manually putting things on maps.

Q: Robert Suydam, NSB: I was impressed with how many fewer seal sightings there were on Synergy versus the Duke. Can you comment on why that is? Also, have you plotted sightability curves?

A: Darren Ireland, LGL: Yes on the sightability curves. The sightability curves we actually use aggregated the sightings in the comprehensive report. All those curves are in an appendix to 90 day report. I'm not entirely sure why the difference in sightings on the two vessels. Part of it could be the vessel itself being stationary, not transiting through and not as likely to encounter patches of seals. I think a lot of the time on the boats the sightings will come in patches. The Synergy, being

stationary, might be less likely to encounter those higher density patches of animals. That would be my guess and honestly just a guess.

Q: George Edwardson, Inupiat Community of the Arctic Slope: On the walrus sightings, I grew up out there on the ocean and when I get over 100, 120 miles offshore, the big animals become the bearded seals and polar bears with heads so wide my arm can't reach across it. Those kinds of animals are out there beyond the 100 miles. I see the difference in your walrus and seal sightings with your machines. You are not looking at each walrus as a walrus or are you depending on your machine to see the size?

A: Darren Ireland, LGL: I think the reference that I was making here was not to an individual walrus or seal sighting. When I was looking at these it was more that seal sightings were clustered closer to the boat because overall the seals are smaller than the walrus, and so you usually don't detect them as far away. With the walrus being a larger animal and sometimes having more of their head out of the water, they are easier to detect and therefore are detected when further away from the boat.

Q: George Edwardson, Inupiat Community of the Arctic Slope: So you did identify walrus as walrus and not these giant bearded seals that live out there naturally?

A: Darren Ireland, LGL: That's correct. And, you can talk to some of the observers here to get their sense, but I think the observers come back and tell us they feel pretty confident between their sightings of bearded seals versus walrus, largely because the tusks are usually pretty evident to them.

Q: George Edwardson, Inupiat Community of the Arctic Slope: I just had to make sure you were looking at the tusk because if they don't have them you are probably looking at an 18-20 foot long bearded seal that do live out there. And, on the fish, salmon we've run in to, we've seen schools under 12" salmon and aerial photos done by the Naval Arctic Research Lab that shows one school eight miles wide and 28 miles long, juvenile salmon, in the ocean in your area. You have not run in to those have you?

A: Darren Ireland, LGL: Not that we've seen reported from the observers.

Q: Robert Suydam, NSB: I am interested in the comparisons between seismic to non-seismic, and I was surprised you include transit in the non-seismic times. It seems like there may be some habitat issues closer to Wainwright that we'd expect to see more gray whales than offshore. It just doesn't seem a fair comparison when habitat isn't controlled for or expectations of sightings are not controlled for. In this case the difference between seismic and non-seismic may have been a lot smaller if the transit sightings were not included. Can you talk more about the reasoning behind including the transit information?

A: Darren Ireland, LGL: I readily acknowledge that issue in the data. There are two ways we can look at the densities and take estimates. The seismic versus non-seismic comparison could be limited to just the survey area and try to get a little closer to apples to apples. The reason I think it might also be worthwhile including the additional information essentially to get a higher estimate is to include all those data knowingly they're from a different area but you're likely going to include more sightings and therefore come up with a higher density than maybe you were actually seeing in the survey area but I'm looking at the multiplication of the non-seismic density times the survey area to try to come up with a high, and in this case probably knowingly higher than really was out there, comparison to come up with a high value for the take estimate.

C: Robert Suydam, NSB: As a follow up to that, also making sure the non-seismic is not truly a baseline. Just because the boat is there and the boat has the sounds from the vessel has the potential to impact especially cetaceans, and so even these comparisons, seismic and non seismic, are still biased low potentially for cetaceans because non seismic still has the influence of the boats in them.

A: Darren Ireland, LGL: Vessels, as far as impacting the ability to observe animals or their reaction to it and therefore not being detected is certainly part of it.

C: Robert Suydam, NSB: I wanted to thank you for trying to look at the 2010 acoustic and visual data and putting it together. The peer review panel was very interested in that. It is a good start, and I hope we can continue that. I think the preliminary results shows the importance of having both acoustic and visual monitoring at the same time and that they pick up different aspects of the population, and sometimes visual sampling is a much better way to go and sometimes acoustic sampling is a much better way to go. Thanks for making that combination.

Report from 2012 Peer Review Panel

Robert Suydam, Wildlife Biologist, North Slope Borough Department of Wildlife Management

The monitoring requirements of the MMPA are to increase understanding of:

- marine mammals in the project area
- potential exposure and response of marine mammals to potential stressor(s)
- impacts of stressors to 1) fitness or survival of an individual or 2) species/population/stock
- increase understanding of the effectiveness of mitigation and monitoring
- better understanding compliance with the incidental take authorization
- increase in the probability of detecting marine mammals through improved technology or methodology

NMFS asked the peer review panel some specific questions:

1. Will the stated objectives effectively further the understanding of the impacts of activities on marine mammals?
2. Are the stated objectives achievable based on the methods described?
3. Are there technical modifications to the proposed monitoring techniques that should be considered?
4. Are there techniques not proposed that should be considered?
5. What is the best way to present data and results?

The 2012 panel members included Harry Brower, John Burns, Doug Nowacek, Tim Ragen, Brandon Southall, Robert Suydam, and Facilitator Robyn Angliss. This is the third peer review panel that has been convened by NMFS. Recommendations are coming out, and it keeps improving every year.

The 2012 panel reviewed three IHA applications: BP Simpson Lagoon Seismic Survey, Shell Drilling - Beaufort Sea (Camden Bay), and Shell Drilling - Chukchi Sea. Some recommendations are also included from the ION Beaufort seismic survey (reviewed in 2011).

BP Seismic Survey

The project is an ocean bottom cable survey near Simpson Lagoon, mostly inshore or near shore between Barrier Islands and the Midland but also some seismic offshore. The objectives of the project were to: implement mitigation measures, record data to estimate the number of animals potentially affected, compare the distance and distribution and behavior and movements of marine mammals with and without seismic. When we talk about the recommendations, BP knew that their monitoring program wasn't a major scientific effort and that they probably wouldn't be able to do everything they wanted to do.

For the first question, are the objectives appropriate, BP had as its first objective as mitigation and so that objective isn't really going to help with understanding the impacts from BP's operation. The panel thought the objective was appropriate because mitigation has to occur, but it's not helping us really understand the impacts. The next objective that some information should come out of the monitoring that will be helpful for understanding takes and estimating takes but there are limitations with MMOs and BP is only going to have MMOs on the source vessels and not all the associated support vessels. Only a limited amount of information will be available but some will help in the minimum estimation of takes or exposures. Objectives C and D are appropriate, but there are limitations in the seismic versus non seismic.

The second question, are the objectives achievable with the proposed methods. For the first two objectives the panel felt there were limitations because there was only going to be one MMO and only on the source vessel. These are small boats in shallow water, and so there is not a lot of space to have multiple MMOs on board. With only one MMO you will only be able to see in front of the vessel, and there will be limitations in their ability to implement mitigation measures or to collect data that will be useful for estimating takes. Also, the takes are only about the seismic vessel and not any associated vessels. The panel also said that for objectives C and D comparing behavior and movement and distribution of whales in seismic versus non seismic time that some information will become available, but BP plans to have two or three seismic source vessels operating in the same area at the same time. They will alternate shots of the air guns, but we think it unlikely that there's going to be much time at all during the summer when there's going to be no seismic at all. The panel believes that BP will have a difficult time having data that are really baseline for comparison with seismic data or times when the air guns are operating. The panel also thought there could potentially be conflicting tasks for the MMOs. Some spent a lot of time looking in the far field but they're not really looking near the ship to implement mitigation measures. Sometimes MMOs may spend a lot of time monitoring the behavior of an animal instead of observing as much of the area as possible.

On the third question as relates to monitoring, some of the improvements, because there is only one MMO, are perhaps there are ways to use crew members as observers at times when the crew members don't have other tasks. We also think that enhanced training may be needed. There needs to be specific guidelines as to where observers look and for how long. There should not be a large amount of time documenting behaviors. Instead, MMOs should record specific behaviors when they initially see them but not spend a lot of time/effort on what the animal is actually doing. And finally, the MMO needs to be trained to record animals on land as well. There could be seals or walrus hauled out on the islands and making sure that information is included is important. With only one MMO doing the observation and recording the data, the more time spent writing information on a data sheet or recording data in a computer, the less time they are spending looking on the water. The analysis of seismic versus non-seismic could be very challenging because there may not be much time with non seismic. Estimating take could be difficult when it is dark or in inclement weather.

In regards to Question 4 on other techniques, the panel thought that aerial surveys would improve the monitoring, but they may not be needed. BP's planned activities would be before August 25, and, after the 25th, they would move in to the Barrier Islands and would not shoot any seismic offshore, and that's consistent with the Conflict Avoidance Agreement with the AEWC, and, after August 25 there are likely more cetaceans in the area than before that so aerial surveys are probably not needed. BP could perhaps enhance their acoustic monitoring technique by using a dipping hydrophone to measure the sound that's bleeding out from the lagoon into the ocean. The panel also thought BP should consider using bottom mounted hydrophones to collect information as well.

Shell will also have instruments out there in the general area and encourage BP and Shell to discuss data sharing to enhance BP's monitoring efforts. The panel felt there is a need to improve observational aids, whether it's night vision or infrared devices or other techniques.

Shell Drilling (Camden Bay)

In general, Shell's approach to their monitoring program was really a three pronged approach: vessel-based, aerial survey and acoustics. The panel thought the objectives in all three of those areas were appropriate. There are some limitations because of the MMO limitations discussed earlier. The panel did struggle with the objective of the monitoring helping to ensure that the disturbance to subsistence is minimized. We couldn't connect the dots between the monitoring and how disturbance to subsistence will be monitored. That objective needs to be modified or reworked.

The panel thought that in general the objectives are achievable with proposed methods for the vessel-based and aerial-based. Some of the things that are important are that the MMOs need to have the authority to implement mitigation, there needs to be efforts to identify species but not over effort, having the best observation spot for MMOs, and sampling of the near-field along with the far field and that observations need to be done carefully to avoid biases. The panel was excited about the new aerial survey technique proposed. For the Beaufort Sea they will have an airplane with an observer, still cameras and high definition video. The comparisons from these, along with the observers, are very positive. Using still cameras and high definition video for monitoring is still an untested system and being able to make comparisons between observers and cameras is very appropriate. Shell's approach, using help from LGL and whomever else provided the power analysis of survey lines is a good modification from previous monitoring plans. The proposed modifications for the DASAR arrays are reasonable, but the panel was a little concerned about sound source verification, the sound source characteristics and having a line of bottom mounted instruments may not capture directionality of the sound fields coming from the vessels, etc., and there may need to be some modifications

On Questions 3, improvements to monitoring, the panel thought time spent watching the water is more important than recording data and finding a method so observers spend most of the time watching the water is important. Sharing information back and forth between vessels is going to be very important for the drilling operations. Visibility issues remain and improvement there will help with monitoring. Improving the independence of the MMO program is important. There were some questions about cow/calf pairs on the aerial surveys in Camden Bay and the possibility of using BWASP data to circle and count for cow/calf pairs and maybe the Shell surveys shouldn't do that. In large part that may depend on what might be in an IHA and whether there are mitigation measures dependent on the number of cow/calf pairs. There was a little concern about the sampling approach to aerial surveys. Surveys were going to start at the west and move to the east trying to avoid counting a whale twice. Some members thought it might be worthwhile to randomize the starting line and not always go from west to east. The still camera photography should be consistent across seasons will help with comparisons. The sampling scheme for acoustics has been improved. The panel thought there needed to be improved propagation models for ZVSP and ice management.

For Question 4, the panel did not come up with too many other techniques that could be used other than the integration of visual and acoustic data as much as possible and the request that Shell provide some of the acoustic data from the DASAR area to BP for better understanding of the potential impacts from seismic shoots in Simpson Lagoon.

Shell Drilling - Chukchi Sea

The recommendations were very similar between Shell's drilling in Camden Bay and Chukchi Sea for Question 1 on the appropriateness of objectives with two exceptions: the aerial surveys in Chukchi Sea are mostly coastal surveys, and we thought the surveys were helpful for looking at impacts in the coastal areas only and that is a good objective to have. Photography is a good addition but not a replacement for observers.

Question 2 on whether the objectives are achievable with proposed methods was the same for vessels as mentioned for the Beaufort. For the aerial coastal surveys the panel thought the surveys should be flown earlier in the season to help detect beluga whales. Sound source verification recommendations were the same as for the Beaufort Sea. There was some discussion about adjusting the hydrophones away from the drilling operations because of masking. There is still a need to have instruments near the drilling operations so that acoustic localizations can be obtained.

Question 3 on improvements to monitoring were again similar as to that in the Beaufort Sea. We look forward to some of the coastal surveys in the Chukchi Sea area analyzed relative to the activity that's occurring offshore and is the offshore activity influencing distribution of animals near shore.

Question 4 regarding other techniques was again similar. The panel really agrees with the photographic comparison with the observers and that the data from the Beaufort Sea will be helping in informing the data that come from the cameras in the Chukchi Sea.

ION's Beaufort Sea Seismic

The 2011 panel looked at the old plan and in talking to ION the plan has changed considerably from 2011 so the comments here are relative to the plan from last year. Shooting later in the fall was a trade off so that in order to avoid subsistence hunts they will be working more in darkness and inclement weather and ice. The panel for 2011 really thought it would be hard to achieve any of the objectives related to monitoring. We really struggled with the proposal. The 2012 plan has some improvements including acoustics and additional vessels that will be helpful. One of the things the panel noticed was that in the fall and early winter, there isn't a lot known about marine mammal distribution and relative abundance. It is dark and difficult to make observations. There have been over-wintering equipment out in the last couple of years but, it is hard to understand what the impacts might be when we don't have a lot of baseline information about what marine mammals are doing in the Beaufort Sea in October, November and December. The panel last year believed that acoustic recorders should be incorporated, possibly aerial surveys at least in October when there is still some light, and that the timing of the survey might be appropriate to help avoid disturbance to bowhead hunting or migration.

The 2010 and 2011 reports include some general recommendations as well:

- acoustic monitoring and assessment of impacts
- aerial surveys
- MMOs
- near versus far field monitoring
- improving peer review process
- baseline
- cumulative impacts
- take estimation

- reporting

QUESTIONS & ANSWERS

Q: Lois Epstein, The Wilderness Society: Did you look into infrared versus visual spectrum of photography?

A: Robert Suydam, NSB: The panel reviewed plans that Shell put together for their monitoring approach. So we looked at it just from the visual spectrum and not the infrared and in part that's because some of the IR work that's been done on bowheads really doesn't pick up much of a signal. The skin temperature of bowheads is about the same as the water. Some of the older work done in IR didn't really seem positive for bowheads. Trying to do the comparison with the observer in the plane with the cameras and doing a visual to visual comparison we thought was appropriate.

C: George Edwardson, Inupiat Community of the Arctic Slope: When you talk about baseline information and all you have is observation done from a boat doing seismic and a boat not doing seismic, but when I'm out in the ocean in an open boat and stick my paddle in the water, I can hear a boat coming 30-40 miles away before I see it. This is normal in the Arctic Ocean. If you are going to do a baseline study that noise cannot be there because if it is, you won't see the animals. This is aimed at the federal government that has to do the baseline. You have to go out there without noise to observe the ecosystem. If you are using a boat with a diesel engine, I will hear you 30-40 miles away before I see you.

A: Robert Suydam, NSB: Thank you for the comment. I don't like to use the word baseline very much, but you are right that there are increasing amounts of activity out there and being able to observe when there aren't boats and understand how things are without people around is important for comparison. A benefit of using acoustic monitoring is we can get data when there isn't boat around or seismic air guns operating. We need to take those things into consideration when takes are estimated, when potential impacts are estimated.

Q: Earl Kingik: The Chukchi and the Beaufort are very important to my way of life. Who selected the two people from the Arctic to be on the panel?

A: Robert Suydam, NSB: The NMFS asked people to serve on the panel, and they requested nominations from oil companies, NSB, AEW, the Beluga Committee, etc. They received recommendations for who should serve on the panel and then they asked those people if they would serve. All the co-management organizations had the opportunity.

Q: Earl Kingik: Who is the sponsor to let these MOUs sign?

A: Robert Suydam, NSB: I work for the North Slope Borough and that's who paid for my trip and time down here and the time I spent on the panel as well. All the panel members were volunteers. None of us got paid an honorarium. Our travel was paid by NMFS but all of us volunteer our time.

C: Candace Nachman, NMFS: The two panel report recommendations on the two Shell programs went up on the Open Water Meeting website on Friday, and the BP report will be up shortly.

Day Two - March 7, 2012

BP 2012 Beaufort Sea Seismic Survey Operations and Monitoring Plans

Bill Streever, Environmental Studies Leader, BP Exploration (Alaska) Inc.

Before I start on the seismic thing, I wanted to follow-up on some discussion we had yesterday. I made these slides specifically for Brad. Brad, you asked about a 3 dB decrease in sound on Northstar, and I got into a discussion on whether or not we could detect it, and I pretty quickly said you can't detect a 3 dB sound change. I want to go back and explain what I meant about that a little bit. So the first thing that Susanna pointed out is a 3 dB change is doubling of sound, she called it sound power, which is the same as sound intensity or power per area. So a 3 dB increase in sound intensity is a doubling of 3 dB increase of half of sound. We generally don't talk about intensity in these meetings; we talk about sound pressure levels. So for sound pressure levels, 6 dB increase is a doubling of the sound pressure level, 6 dB decrease is a halving of the sound pressure level. For a perspective, for humans--now we're talking about air sound which is a different unit than underwater sounds - different reference pressure, it's a totally different unit. But for humans, we can detect a 1 dB change in sound levels. So if I played you a sound and then I increased it by 1 dB, at least some of you in the room would recognize that I increased it by 1 dB, okay? So there are some bullet point reminders. So what level can we detect? And I think you have to think about what can we detect in the laboratory. Certainly in the laboratory we can detect very fine levels changes in sound levels. The next question you have to ask is, and this is where I was coming from when I said it would be tough but not impossible to detect a 3 dB increase or decrease at Northstar, what level of difference can we detect in the field across time in the field? One way to look at this is in the field, we could go out to this location where we actually have three recorders that are calibrated and we could easily look at that data (and I'm going to do it because I'm personally curious). We're going to look at that data; these recorders are within about 100 meters of each other. We can't put them right on top of each other because we have tag lines on them for recovery, but they are sitting on the sea bed very close to each other. We could ask ourselves how close are those readings from those different recorders which would give us some idea of detectability or precision at slightly different distances offshore. That would be part of the question. Then the other part of the question is this graph, and you see this tremendous variability across time which has to do in part from changes in sound levels because boats are coming and going, equipment is being turned on and off. It has a lot to do with weather, and those are the big humps up and down, but it all has to do with changes in propagation characteristics in the water column itself. The new currents come in, water temperature changes, salinity changes, so propagation characteristics change. So you could look at this and you could say, okay, if I decrease levels of sound at Northstar in a seismic shoot or something like that, what level of difference could I really detect? And I think quickly we look at this and you see what Dave was getting at which was you would need to apply a statistical method sample across time so you would sample across time in a 30 or 60 or instantaneous time difference then you'd do the same thing after you decreased the sound and see if there is a statistical difference. There's all kinds of problems and challenges with that, one being when you sample across time and your first time window is a set of calm days and your second is a set of very rough days, then really what you'd need to do is increase and decrease by 3 dB across the period sampling on and off to see if you get a difference. So anyway, I just wanted to follow-up on that, partly as a thought exercise, partly because I knew you guys were just waking up and going what the heck? But you have to think these things through, and I spoke pretty quickly saying we can't detect a 3 dB difference and that led to a longer discussion.

Q: Brad Smith, NMFS: What I was asking is whether, from that sampling that you are doing over the two second interval detecting that lower range, you determined any culprits? Any particular noise, realizing that the majority of the noise probably has to do with shipping, whether you found any one source (generator, etc) that was a dominate remainder of the noise that was coming from the island? I realize it might not have a lot of application in open water with all the variables and contributions of wind and weather and such, but it might have application during the winter.

A: Bill Streever, BP: Okay and actually, that question is easy to answer. We did that years ago. We actually have main pieces of gear on the island; I can't recall off the top of my head which pieces of gear, other than obviously the compressors, were the biggest contributors of sound. They have characteristic frequencies, so they are pretty easy to identify. In addition, MMS--when they were still MMS--wanted a study I believe out of their D.C. office and sent a crew out of noise control engineering out to the island and measured individual pieces of machinery and tried to do something similar to what you are suggesting. I didn't think you were suggesting we should look too closely at 3 dB, but I thought it would be an interesting exercise to walk through that, first for myself because I had to think about it myself a bit and then with the group here; help people get their mind around how some of this underwater structure. Even what we talked about had to be pretty simple, because I understood it and it's pretty easy to get into a lot of stuff is a lot more complicated.

So, to continue with the agenda, I'm going to talk about the seismic operation. The seismic program project is to provide imagery and support of improved reservoir management. BP is not looking out here because we're trying to find new oil, this is for reservoirs that are already producing, and we're trying to maximize production of an existing reservoir. This reservoir is being produced from onshore; the production is for onshore. We have a reasonable idea of what the reservoir looks like in some ways, but we need better resolution data and new data to better understand the reservoir changing over time. The location is just north of Nome Point for those of you familiar with the North Slope. This slide (displayed) shows a red line and purple line. The red line encompasses our activity level. That will be the area where we have vessels running around and people out there working. The purple line encompasses a subset of that area because when you shoot seismic and acquire seismic data, you have to have activity outside of the area that you are fully imaging. The area that says full survey is the area we want to get a really clear image of for our purposes of producing oil. In order to do that, we'd like to be outside the Barrier Islands with seismic source vessels July 1 - August 25; inside/outside the Barrier Island from the first dates we can get there in July until October. We are going to have an operation that is inside and outside the Barrier islands until August 25. The whales start to show up around then, so we will quit active work on the inside. We intend it this way so we can acquire all of our data in one season with minimum impact to the bowhead migration.

The air gun operations will occur inside and outside the Barrier islands. There will be three source vessels, but don't think of this the same way as you think of an offshore shoot. BP has lots of offshore, deep water shoots all over the world, except in Alaska. We haven't done one in Alaska in some time. This is a different ball game. This is something we've done similarly at Liberty back in 2008, so these are smaller source vessels and smaller gun arrays. At Liberty, we used two source boats; here we want to use three source boats. We'll have ocean bottom sensors, so instead of a towed array or a streamer array behind boat, we'll have ocean bottom sensors where the receivers are placed on the sea bed. We'll have geophones, and we'll operate close to shore. It's an offshore seismic shoot, but some of the data we're acquiring will be via geophone, and its back on land fairly close to the coast. It is in accordance with the CAA. We're looking at approximately 220 people--we don't know exactly how many yet--involved in the operation. Larry Wyman is the seismic acquisition manager in charge of the project. We will be installing receivers in shallow water. We probably

won't be having people wade around in the water this time. We will probably use John boats and an ARKTOS vehicle, a type of amphibious vehicle. We'll be using helicopters and autonomous nodes on shore without cables, so we don't have problems with caribou being held up in the cables.

There will be two main source vessels, one mini-source vessel, a recorder barge and a tug (similar to what we used at Liberty), five to six cable boats, two crew vessels, possibly two to three shallow water vessels and a HSSE vessel. We're still working on details on the vessel changes, so this is an approximation to give you an idea of what we have in mind. The two main source vessels are being worked in France and built for Arctic conditions. It's not a terribly large vessel--these are offshore vessels--and the floating pontoon thing is the rack for the air guns which will hang off the rack in the middle that will be behind the vessel and be supplied by pressurized air from the vessel for the air guns to fire. The mini source vessel will also have a rack behind vessel to tow its air gun array. The cable boats that will be laying cable for the receivers are being fabricated in France with Arctic conditions as well. The recorder boat has a tug that sits to the left in a keyhole tied to the barge so it is kind of permanently attached.

On the two offshore boats, there are two sub arrays each 8 x 40; so eight guns, each gun 40 cubic inches; eight identical guns, which is advantageous when you are doing these because that means you have lots of spare parts. Total source 640. Sound level - 223 dB re 1 uPA (rms). On the inshore, there are two main source vessels that work in deep water with identical gun arrays each, two sub arrays, 8 x 40 each. On the shallow water boat, one array with 8 x 40 or 320 cubic inch source level. Those are the source levels which are relatively small compared to what you would see in a deep water shoot.

The source boats will travel perpendicular to shore (N-S) and receiver lines will be parallel to shore (E-W). This slide (displayed) shows the islands and where BP will be until August 25; then inside Barrier Island after August 25. After August 25th, all three boats will be operating inside the Barrier Islands. The green on this slide (displayed) indicates water too shallow for the large source vessels and mini-source vessel with 320 gun array will be used. The blue indicates where a larger source or mini source vessel could be used. There is a possibility of some 640 cubic inch work inside the Barrier Islands and possibly some work with 320 cubic inches outside the islands.

The intention is to shoot every four to five seconds outside Barrier Islands with both boats operating. Inside, with all three boats operating, the duty cycle is about one every four seconds. We've seen some concerns stated, I believe it was in the draft EIS, about limiting the number of source vessels to two vessels or something like that. We provided feedback because for these inshore shoots it often makes sense to have multiple source boats. It doesn't necessarily increase the number of shots per second. Once you get up to one shot every four seconds, that is as close as you can get. You won't get the data if you are any closer together than that. Doesn't matter if we had six or ten boats, we'd be limited to shooting once every four seconds.

Modeling:

- Outside the barrier islands with the 640 array: 190/180 dB to .012/.95 km; 160 dB to 5.5 km and 120 dB to 44 km. This won't occur after August 25. This sound isopleth model is interesting, especially for seals; by and large bowheads won't be swimming through this level as main migration comes after this piece of work is finished.
- Inside the barrier island; 640 inch array--190/80 db to .31/.75 km and 160 db to 1.8 km and 120 dB to 6.4 km. Because the water is more shallow, the isopleth changes. Also, the sound leaks out in the barrier islands through shallow water via a channel.

- Inside the barrier island w/ 320 cubic inch array. 190/180 dB to .16/.48 km, 160 dB to 1.5 km and 120 dB to 5.7 km. Again you can see the leakage through the channel. We intend to measure again as well to verify findings at Liberty as requested by the peer review committee.

Potential animals exposed greater than 160 dB.

- Requested authorization for bowheads is 93. Do not expect many bowheads traveling through the area therefore estimate is certainly high. We don't have good numbers for whales traveling in the Barrier islands and don't have good numbers for whales in the shallow water, but guess most hunters would tell us if we look back at this plot it would be pretty unlikely in a one-month time that you would see 93 bowheads swimming in the 160 area. We based our estimates on the available literature.
- Belugas: 8 (50*). The 50 is added because they occasionally appear in big groups.
- Ring seal: 567
- Bearded seals: 44
- Spotted seals: 24** (Average was multiplied by a 3-4 or 6 factor in case more spotted are observed than literature indicates.)
- Ribbon seals: 3
- Also requested authorization of 3 gray and killer whales and harbor porpoise and 1 minke and humpback

Standard mitigation practices are expected. Shutdown radii is the normal 180/190; ramp up in good visibility only after >10 minutes shutdown. If we shut down for any reason for 10 minutes or longer, we have to ramp up only in good visibility. That ramp up would be over 15/20 minutes. We would turn on one gun, then double the number of guns every five minutes; one MMO on duty during daylight on each source boat with maximum four hour shifts. Some may ask why you are proposing a single MMO when it is the standard to have two or three MMOs? Remember these are very small boats, so we don't have the space to have two or three. What we've done in the past with Liberty is since the MMO can't possibly work on his own because these boats are shoulder-to-shoulder with gear and people, so the people around him that may be driving the boat or doing other things are also helping the MMO spot marine mammals; on visual monitoring vessel outside Barrier islands, MMO's are to look for cow/calf pairs.

This slide (displayed) was borrowed from Robert (Suydam) showing questions on the BP seismic program, which were built around the Review Panel feedback:

Question 1: Objectives

- Objective A: When BP looks at their mitigation, it is primarily for mitigation versus when the Review Panel looked at this it was mainly in response to develop a better understanding of the whales. The panel states the mitigation will not help with understanding impacts as an objective for mitigation; BP response is why would it? Mitigation is not designed to provide more information. Most of the energy put into the exercise is indeed for mitigation.
- Objective B: Should provide some information but limitations of MMOs and only on source vessels. Robert, could you help me out on that one? I couldn't really understand it when I reviewed your packet.

C: Robert Suydam, NSB: And I don't think you have the report yet either. Basically, for Objective B, which was to estimate takes, is that the MMOs will provide some information that will be useful for estimating takes, but there are limitations because of only one MMO per source vessel and none on

any other vessels. Some information will be provided on understanding impacts, but there will be limitations in the information.

C: Bill Streever, BP: That's right. I would add to that--there's a few things there. I always say we don't estimate take. That's up to NMFS. We can estimate exposure and can give them information about behavioral changes, but I'm not going to pretend that we can estimate takes. But also any program with MMOs, if an animal is moving to avoid your vessel is a take--I don't know if it is, but if it is--you would never see that with MMOs. So no MMO program could clearly document takes. That is why we do these estimates based on the densities observed in the absence of seismic.

- Objectives C and D: Further understanding, but limitations because of seismic versus non-seismic. I suspect what you were getting at is with three vessels operating, the only time all three vessels will shut down is when weather is so bad that none can shoot. It is possible that other problems could occur where all three will shutdown, but unlikely.

Question 2: Are objectives achievable with proposed methods?

- Objectives A & B limited because of one MMO and MMOs only on source vessels
- Objectives C & D: By the review panel's estimation, we were able to obtain some info regarding impacts from seismic.

C: Bill Streever, BP: Conflicting tasks from MMOs - there you must mean they are there for mitigation so it is a bit of a conflict with just doing research work. Is that what you meant?

C: Robert Suydam, NSB: That's part of it, but in past there is some guidance to MMOs that they need to collect more behavior information. And so in collecting behavioral information, they may be watching one patch of water instead of the entire area or one MMO is recording data as well as trying to do observations so those are some additional limitations on MMOs and their ability to observe the area.

C: Bill Streever, BP: Okay. I would agree with that, but I guess it is somewhat mitigated because there will be other crew on board that will be watching. Not dedicated MMOs, but other crew.

Question 3: Improvements to monitoring:

- I guess you guys are suggesting what we routinely do. I don't know if we presented that to you in Seattle or not, but basically everybody on the boat would be watching for marine mammals.
- Training: Scanning behaviors for marine mammals on land? I guess what you mean there is the MMOs have the appropriate training that describes different behaviors?

C: Robert Suydam, NSB: The training for MMOs and crew members working as observers need to not look at one patch of water, not just use binoculars to look at far field, but need to scan the near and far field in a described, consistent manner. The panel doesn't feel the MMO should focus on focal follows of one animal to document behavior. They need to record behavior in somewhat of a simple manner, but shouldn't focus on one animal necessarily. They need to keep scanning. Then, because the shoot is in shallow water and the Barrier islands are nearby, that documenting the animals hauled out on land may provide some interesting insights on how marine mammals are responding to seismic like if they are hauling out on land at certain times or others. There may be some insights there that are worthwhile. MMOs need to record that information as well.

C: Bill Streever, BP: Okay. Susanna will be training MMOs for us, so we'll obviously see this again and adapt our training around that, but I venture to guess we already covered that in our standard training. One thing we haven't done in the past that I know of is we haven't provided MMO training for crew members, but we could easily provide some sort of a MMO-light training for the crew members. It wouldn't be the full MMO training that takes several days, but a MMO-light training.

C: Robert Suydam, NSB: I think the panel members felt it would be beneficial to have similar type training for crew members, but again that was just our recommendation and understand there may be some limitations or something like that.

Q: Bill Streever, BP: So the MMOs and crew members have the same training?

A: Robert Suydam, NSB: Some of the panel members thought it would be worthwhile especially if some of the crew members are serving as individuals that implement mitigation measures.

C: Bill Streever, BP: Okay.

- Recording data? I guess there you must be thinking of an electronic recording for standard entries and what did you say?

C: Robert Suydam, NSB: Or tape recorder so that if a MMO is recording data, they are obviously not looking at the ocean and so figuring out a way to record data in a simple, quick fashion so most time is spent looking at water.

C: Bill Streever, BP: I like the idea of a tape recorder. I can't recall if we've done that, but it seems like a workable thing.

- Analysis of seismic versus non, estimating takes. My feeling on this, and I've shared it with Robert and others, is that seismic operations are not research operations. They aren't marine mammal research operations, they are seismic operations. Yes, we do analyze different kinds of data, and we write reports with beautiful color graphics, but my feeling is we don't learn very much. We can do the analyses--we will do the analyses to the extent possible-- but as you pointed out earlier, they are seismic versus non-seismic. And even in other cases of seismic versus non-seismic, it's awkward for lots of different reasons. And estimating takes, since we don't have clear definition of take, we can estimate exposure, etc., based on the animals we do see.

Question 4: Other techniques

- Aerial surveys would improve (I guess that means would improve our understanding to mitigate, I'm not so sure about that), but probably not needed. BP agrees that aerial is not needed.
- Acoustic monitoring (dipping hydrophone/bottom-mounted hydrophones). So we have this boat that we will be able to use periodically during the operation to do different things. You're suggesting, and I think we might have offered this up, that BP will use the hydrophone, which is basically a real-time hydrophone that you lower over the side of the vessel to see what you can hear, to check our sound isopleths that were muddled in the offshore area. I think you are also suggesting here, that was suggested in our discussion in Seattle, bottom-mounted hydrophones, i.e., DASARs, or something equivalent, presumably outside the Barrier islands to see how the sound is channeling through the islands?

Robert Suydam, NSB: You will definitely get more detail for all of these things in the report, but the bottom hydrophone is for looking at propagation of seismic sounds from inside the Barrier islands to outside, but also using the bottom hydrophone monitor for marine mammal calls as well.

Bill Streever, BP: So you monitor retrospectively, not in real time information.

- Observational aids for darkness and inclement weather. Do you guys have suggestions for that or just talking scopes?

QUESTIONS & ANSWERS:

Q: George Edwardson, Inupiat Community of the Arctic Slope: Before you start anything, do you set a baseline to listen to eco-system before you start any kind of work? Give yourself a baseline to know natural sound level and then after that, once you have your baseline then you can start to see how much you are putting into the area? Do you do that?

A: Bill Streever, BP: Yes, we would do that if we have bottom-mounted recorders. We'd have what some people might call a baseline from before we begin shooting and then after. We'd all have a visible baseline before we shoot, clearing the area, ensuring no animals in area before we start our ramp up procedure.

Q: George Edwardson, Inupiat Community of the Arctic Slope: When you do the baseline, you turn off all machines so you only listen to environment? Then from there you could work your way up.

A: Bill Streever, BP: Except obviously in the Prudhoe Bay area. It's not possible to turn off all the machinery. There are sounds that are coming from onshore, there are sounds that are coming from boats, that have nothing to do with us.

C: George Edwardson, Inupiat Community of the Arctic Slope: I mean within the area where you are working. That background noise is background noise. I'm talking about where you are and what you're doing. That's what I'm talking about. Not shut off Prudhoe Bay.

A: Bill Streever, BP: We would have ambient sounds; yeah, that would happen as long as we put recorders out before we start operations, which we would do. We would have those data. We already have them for Northstar of course, which isn't too far away, but it is somewhat different out at Northstar.

Q: Leo Matumeak, Nanuq: From past experiences with MMOs and crew members, if you are talking about crew members trained as MMOs, I see there will be a problem with that because a crew member, his first job is to get the job done and get production. When you have an actual MMO on board, that's his job, and he's going to stop the job if there is an impact to any marine mammals in area. How will you train that?

A: Bill Streever, BP: I probably screwed up the explanation. We will have MMOs. They will be on every source vessel at all times of operations when there is visibility or daylight. We will have MMOs onboard the vessel. In fact, during shift changes of work, there will probably be two MMOs onboard, with one on duty. Those are dedicated MMOs. In addition to those MMOs, there will be crew members keeping an eye out and assisting the MMOs by saying, hey did you see that one? But it will definitely be the trained, dedicated MMOs that are calling the shutdowns. Also, and this might have been lost in the review panel too, we have a relatively smaller boat out there with one MMO on duty, another MMO on board to swap out duty times, but there's really not a lot to do on these boats. By and large, what often happens is both MMOs are hanging out, on duty during the whole period although officially one is on duty and is scanning, concentrating and the other maybe having a cup of coffee and also scanning. But these are professional, dedicated MMOs; we are not suggesting it would only be crew members who were secondarily acting as MMOs.

C: John Goodwin, ISC: I was a MMO on a tugboat, and we took a barge from Dutch Harbor to Prudhoe Bay and back and on the tugboat, like he mentioned, it's hard to have two MMOs on a boat because of space available. So they had one two tugboats, just one MMO, but what happened there the crew knew what the MMO had to do so they learned the system. I showed them our system from MMO training, and they would just get GPS course and time and when he was on break, the crew was really helpful.

C: Bill Streever, BP: Thanks for that, and actually that's a good hint for us because we were talking a moment ago about how to train MMOs versus non-MMOs crew members, but give them some training. Part of it would be training, but part of it would also be on-going coaching from MMOs

while on the boat. Which is kind of what you did--you coached the tug crew to be MMOs when you were on rest period. That seems good in two ways because 1) it improves training and 2) integrates the crew and gets them working together more effectively. These are small boats where we ask people to work together and eat together and share sleeping quarters for weeks and weeks, so it is good if they work together and get to know each other.

C: Robert Suydam, NSB: With the two MMOs on board and one being on duty all the time and sometimes the other one that is off is actually observing too, it is probably worthwhile to make sure that is recorded when it's happening versus when it's not happening. I could easily see an MMO that's off duty taking a nap some times, not other times, and recording how much observation effort is going on is important.

A: Bill Streever, BP: So Susannah, could you do that? Yeah, okay. Thanks. We always do that.

Q: Robert Suydam, NSB: Okay, good. And then, I think we talked about it in Seattle, but having MMOs on cable boats seems like it would provide an opportunity to make observations in the more far field, away from the seismic source vessels. Has BP considered that? Is there any option of having MMOs on cable boats to make observations at greater distances from the source vessel?

A: Bill Streever, BP: My recollection is that we talked about it and pretty quickly dismissed it because there's just no space on the cable boats. Is that right, Larry? Yeah, there's just not enough space. We're not trying to snow anybody. I'll invite you guys out; you can see for yourself how crowded the boats are and what might or might not work. It's really just not a workable situation. We will have the HSSE boat out that will go out for what you are calling--I would hesitate to use the word "far field", because that would confuse with acoustic near and far field-- but some distance out, the HSSE boat will be able to make observations.

ION Geophysical Corporation 2012 Operations and Monitoring Plans for Beaufort Sea In-ice Seismic Survey

2012 Operations

Ed Nelson, Geophysical Project Manager

I'd like to thank everyone for inviting us to present our operations plan and monitoring and mitigation plan. We have been working in the Arctic since 2006 in-ice program. We shot a total 42,832 kilometers of in ice seismic survey in northeast Greenland, the Canadian Beaufort and some in the Chukchi. We've been at this now for five years, and we have a very good safety record; almost 1,000,000 man hours in the five years (not including the 2011 statistics).

We have four sister companies (ISS, GX technology, MISD and Orca, and Concept Systems). Each one contributes personnel and technology to our safety and success in the in-ice program that we conduct in the Arctic.

This video (displayed) shows the icebreaker leading the way with the seismic recording vessel approximately 1/2 mile behind the icebreaker. We are looking at dense ice coverage. This picture (displayed) shows the ice conditions expected in the Alaskan Beaufort, similar to what has been seen in Greenland.

The vessels being used will be the Geo Arctic, the icebreaker Vladimir Ignatyuk, a Class A icebreaker, and a medium class support vessel called the Polar Prince. There will be three vessels in the project area. We propose to record 7,177 kilometers with a planned acquisition timeline of October to mid-December 2012. We do not intend to start any of our projects until well after the Kaktovik and Nuiqsut whale hunts. We will start on the east at the Canadian-U.S. border and work west, and our

project will avoid both the whale hunts and whale migration. We will tow a 9,000 meter streamer with a group interval of 25 meters. The source array will be 4,450 cubic inch. We will record 18 seconds of seismic data at a time, and the shot point interval is 50 meters. During our in-ice operation, continuous forward motion is required with no backing and ramming of the ice. We anticipate 10/10th ice and probably 9/10th ice both less than two feet thick.

Stakeholder outreach was started in 2010. We met with the North Slope Wildlife Department, presented to the North Slope Borough planning commission, attended both the AEW 2010 captains' mini-convention and the 2010 NMFS Open Water Meeting. We also visited leadership in impacted villages including Barrow, Nuiqsut and Kaktovik and held public meetings in the communities. We also attend the AEW quarterly meetings. In 2011, we did much of the same. In 2012, we plan on doing the same, but also meeting with the Barrow Captain's Whaling Association and the Wainwright Whaling Captain's Association. ION has signed a CAA with the AEW.

QUESTIONS & ANSWERS

Q: Robert Suydam, NSB: Can you tell us a little about plans you have for doing seismic surveys in Canada in 2012?

A: Ed Nelson, ION: Yes. We are going to be doing some seismic in 2012 in Canada. It is going to probably be up around Bathin Island. It's going to be further up in the Canadian High Arctic.

C: Robert Suydam, NSB: I was thinking about Beaufort Sea more so than farther in the east.

A: Ed Nelson, ION: Right now we don't have any plans for the Canadian Beaufort Sea. We do have plans for the Canadian High Arctic.

Q: George Edwardson, Inupiat Community of the Arctic Slope: Once you start your seismic, is it continuous, intense seismic all the way across? Is that what I am seeing?

A: Ed Nelson, ION: Yes, we are going to do seismic all the way across. How far we get depends on ice conditions and weather. If we can make it as far as Nuiqsut, we will be doing good. Then we'd have to come back next year. Its 7,100 kilometers; a lot of work to try to do in four to six weeks.

A: George Edwardson, Inupiat Community of the Arctic Slope: Yes, never mind the ecosystem; you are just going to do the mad sweep.

Q: Chris Clark, Cornell: Could you tell us what is the energy is per pulse and what the total number of pulses would be and what your total energy would be if you completed this entire survey?

A: Ed Nelson, ION: We'll be shooting 43 impulses per linear mile. I can get the bar meters and pulse to you by the end of the presentation.

Q: Chris Clark, Cornell: I just have to multiple 43 x 7,177 miles?

A: Ed Nelson, ION: Okay, yeah. Its kilometers.

Q: Chris Clark, Cornell: It's kilometers? Okay

A: Ed Nelson, ION: It would be like 4,500 linear miles.

C: Chris Clark, Cornell: So you're talking like 20,000 shots? Alright, I am just trying to get a sense of the total energy that you would be putting into ocean over that time.

Q: Todd Sformo, NSB: At the last meeting in Barrow, you mentioned the North Slope Borough and Barrow search and rescue for some of your operations. You also mentioned Coast Guard. Have you had further discussions with the Coast Guard for emergencies?

A: Ed Nelson, ION: No, we have not. That's our next move. We're planning sometime this month to go back up to Barrow and talk to Oliver Levitt and the people at North Slope Borough and present to them our ERP plan and meet with Anchorage Coast Guard. During the winter, they move assets

down towards Bristol Bay, but told them they could get response from people at the army base in Fairbanks. Right now that is being worked on.

Monitoring & Mitigation Plans

Darren Ireland, Marine Biologist, LGL

I think we've had some good discussion already in this meeting about some of the topics I'll cover here, and we've already looked at some of the monitoring programs that have been done last year and proposed again this year, so some of this is going to look pretty familiar.

Certainly with MMOs on the vessels, their primary role when on the boats is looking for those safety zones while the air guns are operating so implementing mitigation measures--power downs or shutdowns--for mammals with the critical radii is their primary responsibility and role of the mitigation program. Documenting those animals, documenting what the visibility is like while conducting their operations, are all standard parts of the MMOs' duties while they are on watch. There's been interesting discussion, and I'd like to, at some point, chat with folks and get a better understanding where the behavioral concerns are as far as recording behavioral reactions. There has been a lot of discussion about having MMOs not spending too much time recording behavior, and I think that's been the routine the last few years. Certainly all the monitoring programs I've been involved in, focal follows and the real detail, behavioral-type data involved with recording service intervals or dive intervals, detail stuff is not really part of the programs I've been involved with at all. There may be concerns there, and it would be interesting to see where it's coming from and whether or not it is legitimate or misplaced because I definitely agree with folks that we want to protect these animals, and the primary way to do that is to shut down or power down if they are within those safety zones. We're keeping an eye on those and not worrying too much about individual behaviors. During non-seismic, or elsewhere where vessels are operating away from seismic, some of the information can be used as baseline type data. Again there's been some discussion about what baseline means to different people here, and one of the biggest challenges with this project (and an understood trade off that ION is making here) is there isn't a lot of data on marine mammals out there this time of year. There are data that suggest that a lot of the animals are out of the area. There's also acoustics data from over winter recorders that suggest that some animals are still present. So lower numbers, harder to see because of darkness and ice conditions, but still some animals around. So this is sort of a known trade off for when this operation is going to take place. But, having acoustic and visual monitoring go on during the operation will start to give a little bit of insight on what kinds of animals may be present during this time period.

The primary mitigation measure, in our view, is the timing of survey. It is being done late in season after the primary bowhead migration occurs, starting in October. Actually, the whale migration continues reasonably solidly through the middle of October in the Eastern Beaufort Sea. Most of the migration is up on the shelf in the shallow waters. The operational plan, given that ice conditions will allow, would be to start the survey area in the northeast deep water, offshore areas those first weeks to allow most of the bowhead migration to continue on further west and into the Chukchi Sea. ION has agreed not to start their surveys until after the subsistence hunts in Kaktovik and Cross Island are complete. The operation's end date will depend partially on ice and weather conditions in the survey area, but also down in the Bering Strait in order to get the vessels back out of the operation area.

There will be three observers on the ice breaker that will be operating ahead of source vessel and two observers on the source vessel. The major operational program change for ION this year compared to what many of you have seen in previous years, is that a third vessel will be

accompanying the other two vessels this year. The third vessel will be there as a safety outlet, will help refuel if necessary, and serve as a basis for additional monitoring that was discussed with the peer review panel over the past couple of years. The MMOs will be following the standard work routine that we've seen; on duty during all daylight seismic operations. In October it is a reasonable amount of time, but by late November and into December, when we'll be looking at twilight periods, there's really just a few hours of twilight during the day when you have enough visibility to see very well. The MMOs will be on duty on most non-seismic during the usual 30 minutes prior to ramp-ups. Mostly what they would be focused on during pre-ramp up is looking for animals in the 180 dB and 190 dB safety zones. I understand there is a lot of darkness during this operation. If the operations are shut down at night for any reason, we understand the limitations and have talked about them here. The night vision devices typically aren't going to allow an MMO to truly see and clear a full 180-190 dB distance, so if operations shut down at night they will not likely be able to ramp back up until the daylight period the next day. There will be a lot of operational downtime if shutdown occurs at night.

Some of the sound source modeling (and Chris, your question talked about source level of the array and so on) and some modeling has been done. We don't have the source level value in this presentation, I don't think, but we can certainly share that. As far as the distances to some of the critical thresholds, the 180/190/160 dB distances have been modeled at five different locations across the Beaufort and five different water depths as well. This graph displays brownish-orange lines showing the shallower water zones where 180/190 distances would be (600 meters for the 190, 2.8 km for the 180). When we get out to the deeper water, they shrink up a little bit. About two-thirds of the survey activity is in the deeper waters with the other one-third in the shallower water.

During daylight activities MMOs will continually monitor safety zones, power down if they see animals within the appropriate safety zone; and, if the animal is right near the vessel or near the single mitigation air gun, completely shut down if necessary. Any additional mitigation measures will also be implemented by the MMOs. That is their primary role on the boat. The ice breaker up front will have binoculars for use during daylight periods. Also, the forward looking infrared camera will be deployed on the icebreaker and also on the support vessel for further testing and evaluation. With the MMOs on board, daylight periods will be covered by visual observation. At night, we'd like to use both forward looking infrared camera and night vision devices at the same time for side-by-side comparisons with those instruments to try to get a better idea on how useful the tools really are during darkness or poor visibility.

The typical sound source measurements that are part of most operations are planned. These would occur at the start of the operation in the eastern Beaufort. The seismic streamer recorders have been talked about before. When this has been a two vessel operation in the past, there was a lot of interest from the peer review panel, NMFS and others to try to get some more acoustic data. It was a real challenge though, because the two boats are tied so closely together. The icebreaker can't depart from the seismic source boat. They have to stay together so the ice breaker can clear a path. They are really kind of one boat in that operation and doing additional acoustic monitoring is very difficult. Towing a PAM from the ice breaker isn't an option; you are just going to have sounds right between the two boats. Tossing sonobuoys over the side are likely to get hit by the seismic vessel as it follows behind the ice breaker. So options were limited. One possibility was to record sounds with what the seismic industry calls noise records, but the air guns aren't fired at one or two intervals when they normally would be fired, but the streamer data is recorded still so you get a little bit of a background, a baseline noise level. Using those noise records and the operational position of the ice breaker to determine what kind of sounds are being produced by the icebreaker and the vessels operating in ice is one technique that has been talked in the past for collecting more acoustic

data. The other thing that is moving forward this year is that Shell has put out over-winter acoustic recorders in the Beaufort and last year, if this operation had gone forward, ION was planning to participate and cooperate in that program. Since they weren't operating, I don't believe they did this past year, but they are interested in working with Shell again this coming year. There is also some potential acoustic monitoring from the support vessel.

Typical types of data would be collected at the start of operations and used to revise safety radii for the MMOs. ION would be coordinating with Shell to help implement the over winter acoustic recorder program. These are bottom recorders out for the duration of winter to record both seismic activity and the vessels as they move through the ice, as well as biological sounds either during that time or after the vessels have left so a good over-winter record of sounds in the Beaufort can be had.

Having another support vessel in the operation opens some avenues for collecting additional acoustic data. This vessel would allow for real-time data collection on the acoustics involved in the seismic operation and the ice breaking. A couple of different methods have been talked about with the peer review panel. One method discussed was throwing sonobuoys out behind the vessel. These are instruments that float in the water; they drop a hydrophone down into the water and broadcast the data through VHF radio to the vessel. It's real-time data and can be recorded on the vessel and analyzed to provide information. The nice thing is the boat that dropped it can get away from the recorders, and you are not contaminating the noise on the sonobuoys with your own boat. You can get away and not have the self-noise issue you often have with the towed acoustic system. They don't operate forever (i.e. battery life); and, if the operation moves far enough away, they won't provide much data because it is a line of sight communication between the buoy and your vessel in order to collect that data over the radio stream. And the sonobuoy units, after their life, they scuttle and go to the bottom of the sea.

The towed passive system was discussed some yesterday, and I think a lot of folks understand the limitations with towed systems. Unless you get that streamer a long ways behind the vessel, you will have a lot of self-noise contamination issues. In this case the Polar Prince, the vessel that would be used to do this type of work, does not have what ION calls a [inaudible word] that helps get the air guns and cables below the ice levels and protect them from damage. This vessel does not have that type of structure, and, therefore, a towed PAM system would be very vulnerable to ice closing in right behind the vessel or even going underneath the vessel. It wouldn't be long before that towed system would be lost, so it is deemed as unlikely to be successful at all. Primary efforts are to try to make the sonobuoy approach happen. The biggest limitation is that sonobuoys are a military export controlled equipment, and these would be going to a foreign flagged vessel. There are hurdles there that we need to overcome to logistically make this happen, but it is our intended methodology.

This slide (displayed) are numbers of animals that if you look at what we have available for density numbers for these species and multiply it by the area exposed to a given sound level (160dB rms in this case), these are the numbers we come up with. As I mentioned earlier, data on animal presence at this time of year is few and far between if not nonexistent, so we had to get creative on where these data come from. The BWASP aerial survey program was used in the case of beluga whales and bowhead whales. The data come from early October. These data are based on October densities, but also applied into November and December when we expect fewer animals to be around. The ringed seal numbers are based on densities from spring on-ice surveys. That time period, for ringed seals, is when they are at their highest levels. Typically they are grouped together on shore or ice, pupping and breeding, so those numbers are based on pretty high densities compared to what we

think we are actually going to see or that would actually be present out there even if we didn't see them.

I mentioned that the support vessel, Polar Prince, may do a run for fuel in the middle of the operation over to Tuk. If that occurs, and if it is moving through ice, the ice breaking activities that would occur would be outside the site where seismic sound and activity is going on, so that would be some additional noise input to the overall program. NMFS requested that we look at impacts of ice breaking sounds from that run to get fuel. That's what these take estimates and take requests are getting at (displayed).

As required by the permit, the 90-day technical report would talk about the amount of quantifying monitoring efforts that occurred, summarizing what sightings were actually made, documenting what measures occurred (power downs, shutdown and even changes in direction of the vessel), analyze what influences the detectability of marine mammals, the estimated number of animals exposed, and repeating essentially the type of method used to estimate the takes to compare side by side using the data that were actually collected during operations to come up with those density efforts, and analyzing the effects of seismic operations to the extent that we can comparing seismic and non-seismic data to see what that tells us about animal occurrence during those different operational times.

QUESTIONS & ANSWERS

Q: George Edwardson, Inupiat Community of the Arctic Slope: Have you thought of putting out smaller boats in front of the direction of your seismic boats, about 20-30 miles in front? That way you can catch the ecosystem before disturbing it with your heavy diesel engines.

A: Darren Ireland, LGL: There have been some seismic operations in the past that have vessels in front of the boat like you mention. They haven't been as far out as 20-30 miles. To look at that distance...

C: George Edwardson, Inupiat Community of the Arctic Slope: If you would want to take a look at it before they get disturbed by the heavy diesels and your motors, then that is about how far out you would have to be. So if you would take a look, you would satisfy me.

C: Darren Ireland, LGL: In this case, with the ice conditions around and such we could probably use a relative lighter, small boat to do that, but it's likely to get stuck in the ice. But in open water conditions, yeah.

C: George Edwardson, Inupiat Community of the Arctic Slope: You get those boys from Barrow, they have no ice problems.

C: Darren Ireland, LGL: Very good.

Q: Robert Suydam, NSB: Thanks Darren, for the information, and thanks to ION for some vast improvements in the monitoring plan in 2012 over what was planned for 2010 and 2011. A few different questions; you mentioned and Ed mentioned that one reason for doing surveys late in the season was to avoid whale migration and whales as much as possible, and I'm glad that you mentioned that there really isn't a lot of information on what is out there and if marine mammals are there in late October, November and December. This may be a comment more than a question in that in 2011, the bowhead migration was really late in the Beaufort Sea. There were some whales off of Barrow in early October, but the bulk of whales didn't show up till mid-late October and were around until late October. If the delay in the migration continues in the future because of ice changes or whatever is causing it, your take estimate for bowheads may be dramatically low. If you start in early October in the eastern U.S. Beaufort, you may encounter a large percentage of the population of bowhead early on in the survey. Who knows what is going to happen after that, so

one thing to consider for NMFS as well as ION, is the max number of bowheads that may be exposed to seismic sound may be dramatically larger than what is on the screen. So then one question here about MMOs. You mentioned there was going to be three on the ice breaker, three on the support vessel, and then two on source vessel. I assume these aren't three on duty at the same time, but there are three MMOs that rotate on. Why only two on the source vessel?

A: Darren Ireland, LGL: The theory is to try to put the most eyes on the front leading icebreaker and treating these as two vessels operating at the same time. There would be an MMO on duty on the icebreaker communicating also with the MMO on the source vessel. Our expectation is that most of sightings, although not all, will be first detected by the icebreaker out in front. That is where we would like to put most of the effort, and so we do have fewer on source boat itself. One will always be on duty and able to shutdown and power down and monitor the area immediately around air guns there.

C: Robert Suydam, NSB: It seems like potentially 12 hour duty a day may be normal aboard ships, but on MMO duty you can get pretty tired after a few hours. Given MMOs on source vessels are really there to implement mitigation measures, only having two MMOs on board that are probably trying to get information from the more distant vessels, and somehow write it down or put it on a system to visualize where marine mammals are, it seems like with just two MMOs this would create some real difficulties to be able to implement mitigation measures.

C: Darren Ireland, LGL: For clarity, the MMOs on source vessels wouldn't be on duty during all darkness periods, so I guess their watch schedules would not necessarily cover 24 hours period of that time. I guess the 12 hour per MMO is less than that.

C: Robert Suydam, NSB: So to maybe follow-up on that one, at one point you talked about having lights on source vessel that are looking out around the source vessel so you can at least observe some safety radii around source vessel. If this occurs and you are going to do all you can to try to reduce potential for physical damage, the Level A takes, you would need MMOs on duty in darkness when lights are on. It seems like using lights to help observe the safety radii would be an appropriate approach.

C: George Edwardson, Inupiat Community of the Arctic Slope: I'm glad to see you are waiting for the whales to migrate past before you do your seismic. Here's a problem you are going to have. When villages quit whaling, the main body of migration, the mothers and newborns, haven't started coming by. We hunt the young ones that are up ahead of the main pack in front. Those are the ones we hunt from all our villages. The ones that are bringing the newborn babies are almost a month behind. When you do your seismic right after we quit whaling, you take the main herd and chase them out into the open waters and endanger the newborns. That has to be put into your considerations. We do not hunt when mothers and the babies come through. We leave that alone. That's why our whales reproduce and multiply as we continue harvesting them because we do not disturb mom and her baby.

Q: Darren Ireland, LGL: If we operate further offshore away from where that main migration is going through the Beaufort Sea, do you think that would help alleviate that problem of potentially scaring mothers and calves offshore?

A: George Edwardson, Inupiat Community of the Arctic Slope: I don't know, I can't answer. You would have to ask the commission that because that's their job to monitor that. I'm just observing, and I hear your intention of not bothering the whales and that is the best news I can hear. When you do it unknowingly, and you chase them out into the high seas, it works backwards. You could do the same thing by crowding them in too.

C: Darren Ireland, LGL: Understood. Yeah. Okay.

Q: Ben Greene: Thank you very much. I appreciate your presentation. I don't specifically have questions for ION, although I will however offer a brief comment. I'm greatly encouraged to see

companies willing to think outside the box in terms of trying to design processes for seismic acquisition that occur beyond the window of the primary migratory pathway mammals. I think it is very good trying to acquire the scientific data we need and trying to minimize our environmental impact to the marine mammals. That's really good, however it is a very intriguing proposal and really my question is not so much for ION, it's for NMFS. NMFS is responsible for the implementation of the MMPA and adjudication of the permit application and to me, to my small brain, I had difficulty connecting the dots in terms of how will NMFS adjudicate this permit application according to the tenets of NEPA? I know that all of the NEPA documents that are typically used to rest upon are a whole slew of EIS's, prior permit decisions, etc., all that have occurred during the open water season. So there is a huge body of materials that NMFS can use to rest its permitting decision for an average IHA during open water season. This is not that. This is an IHA application that is occurring, if I heard correctly, in 2012 through October--I think you mentioned November. I think you could do a word search of all the EIS' that NMFS uses for the word November, and I'm not sure it would come up. Certainly December would not. I am wondering whether we could hear briefly from NMFS in terms of adjudication of this? Thank you. I'll stop there.

A: Jolie Harrison, NMFS: Lots of times, when we don't have other documents that we can use or adopt or we think fully cover things, we do write NEPA documents and do NEPA analysis for specific actions; and we actually do this quite frequently. For example, we are writing an EA to cover the two Shell drilling activities. There are a couple of things that could happen: The EIS we are working on includes sections to address the use of ice breakers in the arctic so that's one possibility. We obviously need to have a NEPA document that covers that, so we will be dealing with writing one. I guess that's the answer.

C: Chris Clark, Cornell: I appreciate the situation you are in and the situation that the seismic exploration companies are in to try to collect data. This is more directed not at ION and the efforts by industry to collect data, but really addresses NMFS or the agencies. Jolie, you are looking at me and probably know exactly what I'm going to say. First off, here's the prelude. We all know these marine animals, especially bowhead, are totally dependent on listening to sound and producing sound to maintain their social system. Their social network depends on a quiet ocean to communicate, especially during migrations between mothers and calves. The specifications we are using for estimating takes are essentially biologically irrelevant. So we are starting off with a process which is fundamentally flawed. 160 dB are a mess; some of you may or may not know about the arguments that are going on about what kind of decibel level you are going to use. To estimate takes, to be blunt, it is a biological travesty and let me say why. Why are we living under the pretense that 160 dB is some magic number for estimating something that we are calling impacts? I'm not aiming it at you. You are just doing your job. Maybe we are all just doing our jobs. Anyway, anybody that knows about the acoustic footprint from an air gun array operation knows that 160 dB isopleth around this thing doesn't contain the impact zone. So some of you may know there is a paradigm shift going on where we are looking more at cumulative impacts and effects, and we're looking at something that has not been mentioned here, the impact from reverberation. When an air gun array goes off, sets off explosion in shallow water, the energy doesn't all go into the substrate and bounce back, it goes into the horizontal field. And those numbers are emerging. For example the work that Susanna and Greeneridge Sciences have been doing is revealing enormous footprints. Cumulative exposure ... you guys know about cumulative exposure. What about the whale that is swimming through the field and receiving 1,000 shots and they are all at 155 dB? That whale is not a take, right? But every nine seconds, or 12 seconds, or 14 seconds or 18 seconds it is exposed to 155 decibels SEL. How do we deal with that? What I am trying to do is bring onto the table and pull back a bit of a curtain because the process by which your activities are being evaluated; you're doing the best you can, you're under certain conditions. We are caught in a cul-de-sac. The process we are in isn't going to define the biological consequences of these activities.

I'm not saying whether they are good or bad, I'm just saying from a biological point of view of the whales and the seals, they are not describing and actually coming up with a reasonable metric for defining what the biological and ecological impact is. Thanks very much.

C: Darren Ireland, LGL: Chris, I appreciate you not targeting me individually per se, and I think Chris brings up a pertinent point and it is a troubling one. I think one thing that I hope people have realized over the last couple of days is that this is an incredibly complex system and problem we are dealing with. My only dart back at Chris in a sense is that I didn't hear a solution. I know you are working on it. I think all of us are thinking about it and trying to come up with a solution to better analyze the overall impacts and where that threshold is. I think a lot of us that look at data understand that at times 120 dB might matter to a bowhead whale. At times, 170 dB might matter to the bowhead whale depending on what it is doing and where it is. How sound is active to it ... is the sound moving towards the whale? Is it moving away? All these things play into how animals react. They all play into how we react to each other and to our environment around us. It is a complex behavioral system in which they operate and a complex sound system. Chris' point is right on. That picking a single, individual threshold and saying if an animal is inside this boundary it counts. If it is outside, it doesn't count. There are time limits inside the boundary when it shouldn't count. It's times when it's outside the boundary when it probably should count. And then we take it to the next level of understanding what the biological significance to those animals are of being in or outside the threshold, and it grows to another whole level of complexity. It is a very interesting question. I think the solution is where we are struggling to the degree you already acknowledged that we are kind of stuck inside a rubric at this point as far as the regulatory framework and limited understanding of the system right now. But where we go from here is a larger discussion. I think we have some time tomorrow where we will be talking about the data that have been collected here in the Arctic over the last few years and what it is starting to tell us and then finding a way to pull it all together and really understand the impacts and the overall meaning impacts on the animals is a huge challenge.

C: Jim Lecky, NMFS: I just wanted to respond because I think that comment was mostly directed at NMFS. The process requires two things, and I think your comments merged those, so I wanted to maybe disarticulate those a bit. One is that we have to enumerate the take, and we need a mechanism for doing that, so we look at the kinds of take that occurs. Take is a term that is a combination of several other terms-- killing, harming, harassing are part of the definition of take. What we are talking about here is harassments. NMFS doesn't have a definition of harassment. FWS defines harassment as an activity that may wind up being harmful --it's not directly correct, but something akin to that, so we are not looking at every single response the animal undertakes. We are trying to find out which are biological responses that are meaningful. In order to enumerate a take for purposes of evaluating requirements under the ESA and the MMPA, we are still using 160 dB. We know there are all kinds of problems, most of which Darren just articulated, but that isn't the sole analysis we go through in deciding and evaluating negligible impact requirements. In addition to trying to enumerate what is expected to happen, we also conduct an analysis through NEPA for the most part and our own analysis under the MMPA, to evaluate the negligible impact statement. There we do consider the debate that is going on in the scientific community about appropriate levels, cumulative effects and how many activities are likely to be ongoing. That's actually the reason we initiated the EIS that just went through the public comment period, to try and deal with that issue. So actually there are two problems here: one is enumerating the take and one is analyzing the expected effects. I do think we look broader than the 160 in analyzing the effect on the animals. Finally, I would note that there isn't agreement in the scientific community on what an appropriate level is or how to do that. We are currently struggling with that to come up with revised criteria for enumerating take and hopefully in the not too distant future we have better metrics, but right now we are stuck with the state of the science.

Q: Harry Brower, AEWC: Trying to understand such important issues in a short period of time is somewhat difficult. Thank you to Ed and Darren for indicating that you signed the CAA with AEWC. That is very much appreciated. Our goal is to work with each operator having activity in open water in the oncoming year. That is going to be a good message to share with our whaling captains as well. They are the ones that push me, Johnny and others from the AEWC to get the operators to sign the CAA so there is a means to communicate, in looking back into the language of the CAA, to minimize impacts. It's difficult when we are dealing with multiple resources. I'm trying to stay focused on the bowhead whale, but it is hard when there are all these other resources in the Arctic. I'm trying to voice concerns as to how do we best approach this, and what are the lessons learned from your previous operations like in the higher Arctic, the Canadian Arctic or the Greenland Arctic. Did you come back and look at what were the lessons learned from those operations and how to make improvements to your monitoring from what occurred in the past? I'm not sure if you've done that or not, but is that something that you are looking to do? At a later time? I'm trying to understand how this works in the dark season after a hunt. You say you are going to start further east after the hunts, but how far west are you going to go as far as conducting your activities within your plots or your post activity areas? If I could understand that a bit more, that would be helpful. The animals still have a presence. They are not all moved out yet. Barrow is still hunting, other villages may have taken their quotas, but the presence of animals is still in the water and still moving.

A: Darren Ireland, LGL: The line ION proposes as far as the western boundary of where they would work essentially until Barrow is done with their hunt with bowheads is the red line (slide displayed). I think the CAA and the Barrow blackout zone is even further to the west even than this line, so we're trying to take a cautionary approach certainly to the bowhead hunt and protecting the subsistence activities. I think you are right about the other animals and other subsistence activities that are occurring, i.e., seal hunting that starts up I believe after the bowhead hunt is complete. Our understanding is that they are more near shore activities, and this operation hopefully will not be that close to shore. The boats can't get that close to shore especially if fast ice is forming. Our anticipation is that we won't be interfering with these activities, but if there is more information we need to know about on other subsistence uses that might be going on after the bowhead hunt and more in conjunction with the timing of the survey, please let us know and help us avoid that.

C: Harry Brower, AEWC: Our observations as hunters, I can share with you that having gone eastward from Barrow and hunting up into the cape, there are seals there and polar bears. Belugas and other whale species are moving westward. They are hanging around near shore and the Barrier islands and remain throughout the winter as well. Not knowing how much further close - I can't tell the distances just looking at the map how close to shore you will be getting. Those were the other resources I was referring to outside of the bowhead whale. As a hunter, I have made these observations.

Q: Robyn Angliss, NMFS: This is a follow-up to something Robert said earlier and Harry brought up. I understand there is variation expected in the bowhead whale migration. It seems like we should plan for there to be some variation. Is there some kind of feedback mechanism where the information from ION is being fed to that group of managers in Anchorage so that near real-time decisions and advice back to the operator can be made if something unexpected that comes up?

A: Darren Ireland, LGL: I guess something that is never described very well in these presentations is the typical daily reporting procedures that go on during the season and Jana hit upon it yesterday. This is great actually because I was talking to Jana about it this morning; about needing to emphasize this as a potential tool and for operators to get more lead time on it. That is to understand what information, and what format and frequency, the agencies need. In the last couple of years we fed the information directly to BOEM, and it gets passed on; usually Shane has been copied on emails, and so it can work. Just who is involved varies sometimes a little bit by operator. It is a daily report of vessel activity, all the sightings that occurred, and mitigation operations (power

downs/shutdowns). That type of information is normally transmitted daily to the agencies and can be used to help agencies and operators work together. Say we are encountering a situation here that we didn't expect--a lot more animals, a lot more bowheads--we can adjust the operations as needed. It is very important. I think it is very difficult for operations; and, as someone who gets involved in seeing these data come in daily and trying to produce reports and get them out to the agencies, that is a whole stream of data that needs pre-planning to be able to make it efficient and get agencies to get the information needed in a useful format. All these things are technological hurdles that are tough to accomplish shortly before the season goes out. As much lead time as we can have, and like literally this month would be great, to understand what type of data and format that agencies need to help monitor operations this year would be helpful.

C: Robyn Angliss, NMFS: I know commercial fishery observers report back to the agency in real-time in a standard program I think all the observers use, and it might be good to move to something like that because it might really streamline data analysis on the manager end when you are starting to look at numbers.

C: Jana Lage, BOEM: By regulation the operators are required to provide weekly reports, however as I stated in my presentation, they have been giving data daily on a voluntary basis. They are communicating with us as the regulators.

Robert Suydam, NSB: Chris talked about using the dB level and the thin line in the sand that isn't constant but that is what being used as regulation, and that the biological consequences don't have a lot of meaning. I would like to support Chris' encouragement for the agency to really take a look at things in a different way. Jolie, Candace, we've talked about this in the past, and I was really hopeful that it would have actually been dealt with in the EIS and that another way of looking at things instead of specific levels, SPL, would have been used, and unfortunately that didn't happen in this EIS. But I encourage the agency to continue to work with people like Chris and Brandon and others who have been thinking about this and have expertise in using different techniques, different approaches to assess what anthropogenic sounds might do to marine mammals whether that's cumulative SEL or whether it's something else; we definitely need a new system. Jim mentioned that there isn't agreement among scientists on this issue. Well that's always the case. Scientists never agree on anything, but some good progress can be made to look at things and use a different approach. Because we're stuck in the current system, I've always struggled with using 160 dB for impulsive sounds as the level in the Arctic because using the simple system that is in place, I think there are data--the best available data, the best available science--that suggests bowheads and probably belugas, are responding to impulsive sounds at much lower levels than 160 dB. So I continue to encourage the agency to think about the Arctic as being a little different and that 160 dB for impulsive sounds may not be the right line in the sand. It may need to be lower, but also recognizing responses of marine mammals can be contextual: are they feeding? Are they migrating? Are they traveling? I also wanted to make a comment on the acoustic monitoring program that is planned for ION's project. Ed, you mentioned that it is unlikely that ION will do all the lines this year, and previously you mentioned to me that it may actually take up to three years to get the survey completed. Because there are few data on marine mammals at this time of the year and because the project may occur over two or three years, because there is not a lot of information on propagation of seismic sound under ice in the Beaufort (maybe there is in other places that I'm not aware of), there really needs to be a strong acoustic program this year in both the western and eastern Beaufort; the western Beaufort to help gather information about what's going on over there for marine mammals. There are people that have over-wintering instruments west of Cape Halkett, and so it may be relatively inexpensive to get some of those data or support a project continuing on for another couple of years, so collecting over winter, late fall, early winter in the western Beaufort would be worthwhile. Darren, you also showed a slide where Shell has their over-wintering instruments, and I noticed that there are a lot of seismic lines farther offshore than where those

instruments are, and I would recommend that ION consider trying to get additional instruments out there this year for what is happening. Most of the lines are farther offshore than where the instruments are and trying to get some additional instruments, especially out in deeper water, would be worthwhile. Finally, a recommendation to NMFS, this monitoring plan is much, much different than what ION proposed in 2010 and 2011, and you decided to not have the peer review panel review it this year because they reviewed it in previous years. But because the monitoring plan is so different, I would suggest a peer review by email to get feedback from people like Chris or Brandon. Additional comments would be useful on this monitoring plan.

C: Jolie Harrison, NMFS: Can I respond to that? I just wanted to let Robert know we never precluded that option. I think our thoughts when we decided to convene the panel and our understanding of what the monitoring plan would be, led us to think we may not have to do this, but we were always considering if it changed enough - we just received that application - then we have that option to look at it with extra people.

Q: Chris Winter, Crag Law Center: I just have two really quick questions. Thanks for the presentation. It is outside the box as Ben suggested, and I think that is a really interesting project. My two questions are first, is the project designed to collect seismic data that hasn't been collected before, or is it that previous data are proprietary and ION doesn't have access to the seismic data? My second question is, given the darkness and ice cover and the possibility that animals will be hauled out on ice at this time, has ION ruled out the possibility of Level A take as a result of the project and thought about where five year regulations may be an appropriate course?

A: Darren Ireland, LGL: Correct me if I am wrong about whether data exists. I think seismic data has been collected in that area back in the 1980's, early 1990's, I'm not sure, so there are some historic data available. My understanding, you know technology is improving, that kind of thing, that the data are not as useful as companies would like or need them to be. The short answer is no. Not in the timeframe those data are useful. Long answer, I think far enough in the past, there has been some seismic out there. The second part of the question, I'm not sure how much that goes to me versus NMFS. At four knots, the typical survey speed, five mph, for animals that are hauled out, I fully expect seals to be able to move if they are hauled out. So the likelihood of a seal or a polar bear or walrus or anything else being crushed by the ice breaker, I see that as an extremely...

C: Chris Winter, Crag Law Center: I was talking about entering the water in the 180/190 dB.

A: Jolie Harrison, NMFS: Thanks for that question Chris. We actually are considering the possibility of animals being exposed to levels that could potentially be exposed to what we consider an injury, and so the plan would be to authorize some Level A takes. And as a general procedural thing, we can do that under an IHA. You just have to do a rulemaking if there is a potential for mortality.

C: Chris Clark, Cornell: This is just a point of information. In a collaboration that Cornell has with folks at National Marine Mammal Lab, we are going to be deploying an auto-detection buoy in the Chukchi this summer. That will be reporting via satellite and be online and automatically detecting for bowhead and fin whales. I think these are the primary species, although others will show up. Just to let you know. So you might actually be able to listen this summer and see if whether some of those seismic impulses are showing over in the Chukchi.

Q: Darren Ireland, LGL: When will the recorder be removed? What time of year?

A: Chris Clark, Cornell: That's a dynamic answer but it probably would not extend or overlap over the period when you will be operating.

Q: Lisa O'Brien, Facilitator: Where?

A: Chris Clark, Cornell: It will be in that cluster of sites where Shell, Statoil, ConocoPhillips are. I could show you exactly where it is on a chart, but it's over in Chukchi Sea.

Shell 2012 Beaufort and Chukchi Seas Exploratory Drilling Programs & Monitoring Plans

Michael Macrander, Science Team Lead, Shell Alaska Venture

We have several hours of presentations to go here. Let me start by introducing some of the experts who are participating. We are trying something different this year. In years past, I've given the whole presentation then moved to a format where each person presenting each portion. To be as streamline and efficient as possible, I will be giving the Shell presentation in total, but I have my lifelines here to help me when I falter. Each team member introduced themselves:

- Bill Koski, aerial survey program and implementation of digital photograph/video monitoring systems in aircraft
- Dave Hannay, acoustic programs primary in Chukchi for monitoring and sound source verification on specific activities--vessels, drill rig operations
- Craig Reiser, MMO program and coordinator of Alaska native hires and professionals biologists from recruiting to training for both vessel and aerial programs
- Dale Funk, general biological support
- Susanna Blackwell, Greeneridge, DASAR-based acoustic monitoring in Beaufort
- Pauline Ruddy, team lead, regulatory affairs for the Alaska Venture
- Susan Childs

I will be talking about our proposed operations for 2012, marine mammal monitoring program overview, details of select aspects of monitoring program, and peer review questions. After each segment, a question and answer/discussion opportunity will be provided.

Proposed Operations for 2012

Shell's hope and intent is to drill wells at the Burger prospect in the Chukchi and at Torpedo and Sivulliq prospects in the offshore of the Camden Bay area of the Beaufort. The hope for 2012 is to drill up to three wells in the Chukchi beginning in July and going through the end of October; and, in the Beaufort, up to two wells beginning in July and going through the end of October. While conducting activities, we will continue to do a full suite of science programs in support of our short-term aspirations and long-term goals. Shell will participate in the joint industry program, Chukchi Sea Environmental Studies program. There will be the marine mammal monitoring program, an ice and metocean observing system where ice, weather and metocean data will be recorded, an on-shore and near shore studies program and a drilling monitoring program.

Vessels

There are two areas of drilling close to the Burger prospect in the Chukchi Sea. The air permits are accompanied with 25 mile zones around where Shell will drill, which they refer to as exclusion zones. The reason for this is the air emissions within the zones have to be carefully controlled and monitored, and there are a limited number of vessels that can monitor within the 25 mile zone. Note that there will be some vessels that can operate within that zone and others that will be required to stay outside the zone.

Vessels participating in drilling at Burger (Chukchi) are the Discover (drill rig), which will be supported by a primary ice management vessel, anchor handler, secondary ice management vessel, and a landing craft based out Wainwright. Only the Discover, Nordica, and Tor Viking are allowed in the 25 mile exclusion zone. The second group of vessels in support of the Beaufort program is the drill rig Kulluk, ice management vessel Fennica, and secondary ice management and anchor handling

vessel Aiviq. This is a brand-new, built for purpose, ice management vessel. The Arctic Seal landing craft will be available for shuttling equipment and personnel in/out of Deadhorse. Two additional vessels that will come and go periodically during the season are the Harvey Explorer and Harvey Spirit. They will be shuffling supplies etc. from Dutch Harbor to the Beaufort leases.

In the Chukchi Sea, there will be a dedicated spill response capacity that includes a built for purpose, ice capable vessel, the Nanuq, which will be located within the 25 mi exclusion zone, but per the response plan it must be one hour within the rig. Additionally, the Klamath tug and barge will be offshore close to Wainwright to respond as well. In the Beaufort, the dedicated, within-one-hour capacity will be provided by the Endeavor barge and the Point Class tug as well.

In addition to these spill response vessels, there are two additional vessels: the Infinity, a fully ice capable tanker, which will be available and can take on recovered oil in the event of a spill and also serve as a fuel source. It will be positioned somewhere between the Chukchi and Beaufort, and Shell will work with local stakeholders to determine the least invasive area. The Arctic Challenger and Tug is a containment system, being built-for-purpose, which will have on-board the same equipment as that which resolved the Gulf of Mexico incident in 2010. Shell committed to local stakeholders that in the Beaufort, we won't discharge the drill mud and cuttings and other waste streams. They will be collected and removed for disposal, which necessitates two additional vessels in theatre to do this.

Mitigation Comments

There have been a number of mitigation measures that over the last four years Shell has committed to and is implementing in 2012. As per regulations, we participate in plan of cooperation meetings with villages. We have agreed and will be signing the CAA that will agree to a shutdown and removal of the rig out beyond the shelf break by midnight, August 25, in the Beaufort. Drilling operations will cease by August 25 and the rig removed from the migration area and not return until Kaktovik and Nuiqust hunts are completed. In Beaufort, once we get below the 20" casing, all mud and cuttings will be captured on-board the rig and transferred to another vessel for removal and disposal outside the Arctic. The waste streams will include treated sanitation gray water, ballast and bilge waters and will not be discharged into the Beaufort Sea.

There is a communication plan, which includes multiple communication methods with local stakeholders and partners to get input and monitoring how things are going during the season. We meet regularly with AEWC and other co-management organizations such as the Nanuq, Beluga, and Ice Seal Commissions, and have stated clearly that we will not transit without communication with stakeholders. Shell will hire subsistence advisors in most of the coastal villages, and MMOs will be on all vessels, not just the source vessel. This is one of the things we agreed to do and said we would do, and now we heard yesterday that we are being told to, but a capping stack and Arctic Containment system will be constructed and will be part of our response equipment.

Real Time Ice and Weather Forecasting

In terms of supporting activities and being able to work safely in the Arctic, current ice and weather forecasting doesn't provide the kind of resolution Shell feels is needed. Shell acquires its own satellite imagery and process in-house by ice forecast and ice analysis personnel who have worked world-wide. The same goes for weather, so Shell issues its own ice and weather forecasts daily during operations. Crew changes, to greatest extent possible, will be done by helicopter primarily from Barrow and Deadhorse. Consultation on all routes that will be flown will occur, before the season and on-going during the season. Full oil spill response (OSR) capabilities for each sea will have a rig in each sea at ready capability to drill a relief well should it be necessary.

In regards to mitigation programs, we have several. One of the programs is the subsistence advisor program in Barrow, Kaktovik, Nuisqut, Wainwright, Point Hope, Point Lay, Kivalina, Kotzebue, St. Lawrence Island, Wales, and Diomedede. Each will have an advisor that is a local hire who's role is to be Shell's "eyes and ears" to understand what type of subsistence activity is occurring, where the activity is occurring, and provide Shell with information to figure out if there are times and places where it should adjust activities. Additionally, in most communities, there will also be community liaison officers who, again local hires, will serve as avenues of communication into and from the community to Shell.

Plan of Cooperation Meetings

In 2011, Shell visited all the affected communities and informed them of the projected activities for 2012. They took feedback from them. We will revisit the communities again in 2012, starting later in March, to continue communications.

QUESTIONS & ANSWERS

Q: Raphaela Stimmelmayer, NSB: Do you have an estimate on the number of helicopter transfers to the sites? What are we looking at?

A: Pauline Ruddy, Shell: Daily helicopter flights, sometimes twice a day.

Q: Raphaela Stimmelmayer, NSB: Okay, can you sum that up for me what that boils down to? That's several hundred, right for that time period?

A: Pauline Ruddy, Shell: I don't think it adds up to several hundred. Our drilling season is only going to be from early July to late October and we will be running crew changes on 21 or 28 day rotation.

C: Michael Macrander, Shell: It's important to remember that there, given the weather patterns, etc., there are a lot of days where helicopters won't be able to fly. So, when we have a good weather window, one to two helicopter trips a day on them, but there may be days, weeks at a time, when we aren't able to do that.

Q: Robert Suydam, NSB: So, for the Beaufort Sea, you move the drill rig and the vessels out of Camden Bay by midnight on August 25. Where are they moving to, and has there been consideration for potential impacts to belugas if you are moving them out near the shelf break?

A: Michael Macrander, Shell: There is a designated location in the CAA and it is north...

A: Susan Childs, Shell: It is 72 miles northwest of Cross Island.

Q: Robert Suydam, NSB: Do you know what the water depth is? Is it at a shelf break? It's near the shelf break, huh?

A: Susan Childs, Shell: It's pretty deep. It's deep enough that we won't be able to anchor.

C: Robert Suydam, NSB: Okay. The shelf break is important for belugas, and moving the boats to the shelf break, that may complicate things a bit.

C: Susan Childs, Shell: Okay. Noted.

Q: Vera Metcalf, EWC: I am glad to hear you will be communicating with the communities before you transit. Regarding the discussion about hiring subsistence advisors, I assume there are qualifications on hiring from the communities. You list the St. Lawrence Island, Diomedede; we'd be interested in assisting with those because those are the people we work closely with walrus. I'm glad to see that.

A: Michael Macrander, Shell: We are seeking input from the co-management organizations on who would be good in those roles, but generally speaking, we are looking for people who are well established in the hunting communities and plugged in. We've had a good exercise the last couple of years in Wainwright because we've done our onshore program out of that, and during the

activities we have a daily conference call with subsistence advisors in Wainwright, Point Hope, Point Lay and Barrow and get input. For the onshore program, it has literally been days where we've said we aren't going to take our helicopter out there because we know people are hunting, etc.

Q: Leandra De Sousa, NSB: How fast can the drilling rig move? If there was an accident in one spot, how many knots per hour can that go in optimal conditions?

A: Michael Macrander, Shell: I believe those vessels are capable of about 10 knots, something like that. We figure within 48-72 hours they could be over from Chukchi Sea to the....is that right? Yeah.

Q: Leandra De Sousa, NSB: What is the cut off weather-wise to halt operations? What's the weather state when you say, okay, we can't move the rig in these conditions?

A: Michael Macrander, Shell: Can't move the rig?

Q: Leandra De Sousa, NSB: Yes, like you have a storm or something. What is the cut off to say we can't move it until conditions get better? You just talked about helicopters for example.

A: Michael Macrander, Shell: The rig movements would not be constrained by fog, etc. They are fully ice capable, fully ocean going capable vessels. It would take a pretty significant storm for them to stand down, and there would be limited timeframes where they would be stood down.

Q: Todd Sformo, NSB: You mentioned the Arctic Challenger and the capping system that is being built. Will there be time for systems to be tested before actual use?

A: Michael Macrander, Shell: That's part of the requirement for it.

Q: Todd Sformo, NSB: The second question is if you want to operate until the end of October and Alaska Clean Seas (ACS) is the primary response organization...

A: Michael Macrander, Shell: For the near shore.

Q: Todd Sformo, NSB: For the near shore. So they won't be available then. They tend to shut down mid-October, so you will be on your own then?

A: Michael Macrander, Shell: With all these other assets, yes. The whole, and I don't want to go too far into the spill response because this is for marine mammal monitoring, so I don't want to get too far down that path, Shell's approach to spill response in the Arctic is to be on-scene with the fully capable resources we need to contain that spill as close to the source as possible and to cap and stop a spill as quickly as possible. There are constraints built in, but all components of the spill response fleet are able to operate in ice conditions.

C: Pauline Ruddy, Shell: Michael, may I add to that? We have a contract with ACS that is through our drilling operations.

Q: Raphaela Stimmelmayer, NSB: Have you identified safe harbors in the areas where your drilling operations are since we do get bad weather up there?

A: Michael Macrander, Shell: The vast majority of these vessels are not likely to seek safe harbor because they are fully ocean capable. Similar to in the Gulf of Mexico, the larger vessels, the Coast Guard vessels, don't seek safe harbor close to shore, they go out to sea. That is where they want to be and that's the case with these. So, for safe harbor, if they saw a really big blow coming in, they wouldn't be looking to find places close to shore with the exception of the smaller vessels, which will go to home base.

Q: Robert Suydam, NSB: I'd like to echo Vera's comment about Shell communicating first with the communities before transiting. I'd like to ask a hypothetical question--I kind of feel like a broken record--that Point Lay is always saying we don't want any assets out in the Chukchi Sea offshore of Point Lay until the beluga hunt is done. What if Point Lay's hunt is late and you communicated with them and they say they don't want you guys out in the Chukchi north of Point Hope until the beluga hunt is done? If that didn't occur until the 11, 12, or 15 of July, would Shell wait before moving their assets north?

A: Michael Macrander, Shell: I will answer that the way we've answered that many times before. We will have a conversation with community and make every effort to discuss that at the time the hypothetical situation becomes real. The last thing we, Shell, want to do is interfere with a local hunt. Part of the discussion is we'd like to have is, is there some ways we mitigate it. Can we transit further offshore? Or any number of options in a jointly discussed, adaptive management approach.

Q: George Edwardson, Inupiat Community of the Arctic Slope: The closest relief well rig is how many hours away?

A: Michael Macrander, Shell: The closest relief well rig that we will have will be within minutes because the rig that has the well control problem would be pulled off and it will be capable. It will have extra drill pipe, it will have additional blow-out preventer stacks, it will have everything that it needs to be able to drill its own relief well. That's absolutely the first and most likely scenario.

Q: George Edwardson, Inupiat Community of the Arctic Slope: You will have your relief driller rig there on both locations?

A: Michael Macrander, Shell: Again, the primary relief well drilling vessel is the vessel itself. Then the second one is ...*(both talking at the same time)*

Q: George Edwardson, Inupiat Community of the Arctic Slope: What if you have trouble with that rig? Let's say a fire, or what happened down in New Mexico? What if you run into that situation? What's the nearest boat available to help you?

A: Michael Macrander, Shell: The nearest? The nearest boat that is available to help us--remember there's the barge that has the capping stack and that sort of thing that actually stopped the well in the Gulf of Mexico, is about 1/2 way between the two theaters.

Q: George Edwardson, Inupiat Community of the Arctic Slope: Eight to ten hours away?

A: Michael Macrander, Shell: Eight to ten hours away. The other vessel is 48-72 hours away.

Q: George Edwardson, Inupiat Community of the Arctic Slope: You are not set up like Canada? You have a relief drill rigger there with each hole you make. You're not set up?

A: Michael Macrander, Shell: No.

Proposed Monitoring Programs Overviews

Shell has a pretty aggressive science program in place that we operate. When talking with outside groups and communities, they are unfamiliar with this component and ask why does Shell do a large amount of science? I get asked that question internally, 'Michael, why do you want all these millions of dollars for your budget?' So I have made the case as to why it is legitimate, as to why we need to do this, and you will hear me use this analogy that we look at our program as legs of a stool. There is no one support for anything we do, that there are multiple legs and avenues of information. The three legs, the three business drivers, the three reasons we do science, is that some of it is regulatory driven. Permit conditions; -we get the permit, and we don't have a choice. We design those monitoring programs to be as robust and accurate as they can be. What we are here to talk about, the marine mammal monitoring, one aspect of that is a condition of incidental harassment authorization, and we take that very seriously. For our air permit, there are monitoring requirements, and we will have reporting requirements to the agencies. Baseline studies, we refer to this more as ecological characterization. It's important for a number of reasons. It's important for us to demonstrate to ourselves and external stakeholders, that we understand the system we are trying to operate in, both physically and biologically. Physically the ice, the weather; biologically, the animals that exist there, the currents, etc., and how it all fits together so we are able to accurately project in the future what the ramifications of our actions will be. Another reason why we invest a lot in understanding the baseline conditions out there is because that is where we are going to be operating. We need to understand how much force do ice flows put on structures out there, and how are we going to operate safely and responsibly out there. We need to understand that. The third component is how do we design capacities? How do we design and build a structure that will

be able to eventually withstand ice forces year round? How do we collect the many, many kinds of data we want and need to collect in a manner that exposes as few people as possible to flying offshore in dangerous conditions away from a place where they can land and potentially have a capacity that can be operating 24-hours/day and is much less intrusive? A Twin Otter taking off and landing and flying around is pretty loud; one of these things are pretty darn quiet. We are constantly looking at technologies that can lower our footprint, operate more safely and be environmentally aware.

A point to make is that Shell isn't alone in this. A major factor or portion of the science program is invested through collaboration. We have a very productive partnership with ConocoPhillips and Statoil; others, with GXT and ION, Pioneer and ENI from time to time, have participated. We work with universities across the country, especially UAF, and different agencies to determine how to share resources. If a vessel is going out there, can we put additional investigators on them and perhaps increase the scope of science? On a whole, about 60% of the funding that we spend on science annually is leveraged. It doesn't make sense for each company to have independent science programs when we can get a larger, more comprehensive program if we join resources. It is important to understand that the work the oil companies are doing; what Chris said earlier about understanding the implications of sound levels, this is one of the major sources of information that is helping us to understand this ecosystem and what we are doing. It is something we take very seriously. In 2010, Shell signed the NSB Science Agreement to fund baseline studies program with \$5 million over five years. It is a collaborative program with the North Slope Borough that is beginning to make progress in terms of locally directed priorities for people in the communities. In 2011, Shell, ConocoPhillips and Statoil signed an agreement to share scientific studies and data available for review and use by others through NOAA. We hope that this will advance the understanding of the Arctic as a whole. The data will be available for other scientists to build on and analyze in ways we wouldn't simply because it may not be something Shell is particularly interested in, but we're hopeful this huge volume of data will advance the understanding of the Arctic.

I wanted to mention this because it one of the legs of support for our science program, and there is a nexus between this program and our marine monitoring program. Since 2008, Shell, ConocoPhillips and Statoil have been collaborating in the Chukchi environmental studies program. The program is operated by Olgoonik Fairweather operating in the Klondike prospect from 2008-2010. In 2010, we added the Statoil prospect and in 2011 kept some of the focus on them, but also extended the area. We are looking at physical oceanography, benthos, plankton, acoustics, fish, marine mammals and marine birds in an interdisciplinary and coordinated manner.

MMOs

Three components of the program for getting information are: 1) MMOs or PSOs, 2) aerial program, and 3) acoustic monitoring program. MMOs will be on every vessel along with integrated biologist/local knowledge staff. The aerial component in the Beaufort and Chukchi has occurred when appropriate since 2006. The acoustics component has occurred since 2006 in Chukchi and 2007 in Beaufort. Since 2007, in the Chukchi, there have been winter recordings, as well as the open water season. We've tried a couple of times in the Beaufort, and we're trying again in 2012. There are nine recorders overwinter in the Chukchi. In the Beaufort, there are five arrays of seven recorders that have been out each year since 2007 that have the ability to localize bowhead whale calls. There is also a full season of 2010 data on walrus calls in the Chukchi.

An additional aspect of the acoustics program is sound source characterization (SSC) or verification. We are calling it characterization because with verification we model before the season and verify at

the onset of activities and set what our mitigation distances are. There have been conversations primarily around the seismic operations about shutdown distances, 180 dB, 190 dB, depending on the species and the need to verify those and then set them in place. Since our operations in general will not emit sounds in excess of those mitigation criteria, there will most likely not be shutdown criteria that will have to be monitored for. However, we want to understand and want to characterize the sound. We've done pre-season modeling and think we know what it will look like, but we're going to measure it. All vessels as they enter the operational zone will go through a sound source characterization process. One difference is we thought about the rigs and determined that it doesn't make sense to do a sound source characterization at the outset and have that be the characterization for the entire season. Instead we are implementing a rolling sound source characterization where there are several recording devices near the rig, one of which can transmit in real time back to the rig and packets of information sent back to shore and be processed weekly and reported to BOEM, NMFS, etc.

Acoustics Site Specific Arrays

There will be a few tweaks to the program than was structured in previous years and will be discussed in detail later. The desire to have masking capabilities and determine what happens to the calling behavior of animals when they are near proximity to industry activity has warranted the change.

Aerial Program

This is the newest wrinkle. In the past we have flown Twin Otters from either based in Barrow and/or Deadhorse. We will have two Twin Otters as part of the fleet and fly whenever weather permits. In the Beaufort, the aircraft will have MMOs on board to make visual observations and have both still and HD video equipment. This is the same type of sensors that would be in an unmanned system will be in the aircrafts in the Beaufort, along with the MMOs, and will be able to compare what each observed. One thing that has been done since 2006 in the Chukchi is we have flown a near shore program limited to within 25 miles of the shore with a saw tooth pattern all the way to Point Hope and along shore coming back. This will occur again in 2012 with MMOs on board if and when they cannot fly out to the Burger prospect. The preferred mode in 2012 is to fly the aircraft, pilot and co-pilot, but there will not be MMOs on the craft. It will have the HD and still frame capacities. They are hesitant to fly so far out with manned flights and has been a point of discussion over the last several OWMs. Shell has continued to work the issue internally. A helicopter is never farther than half-way to shore where it can land unlike a fixed wing aircraft which would have to return back to shore. We are trying to minimize risk by not putting MMOs on board and hope this is the gateway to lead to using unmanned aerial systems to collect data as early as 2013. We're excited about what we are hearing about the Federal Aviation Administration moving towards supporting that type of goal.

Drilling Monitoring Program in 2012

We will be doing a drilling monitoring program in 2012. Although the current General Permit does not require monitoring and has allowed and permitted the discharge of muds and cuttings, in the Beaufort we have agreed to not do that. We do intend to discharge in the Chukchi Sea but will be doing a monitoring program around both. Why would we monitor in the Beaufort when we are not discharging? There is minimal discharge like cooling water, but there is a high level of interest in understanding, and we want to have something to compare to what we find out about the Chukchi. What do you get for not discharging, for incurring those costs and the environmental implications of hauling discharge away? Generally speaking, there will be a before and after component looking at

sediment/water chemistry, biota community assessment, and repetition of joint studies evaluations localized at drill site(s). During drilling operations itself, they will use the ice management vessel to periodically obtain water samples to look at plume monitoring-turbidity, chemistry, deposits, and water chemistry. Before and after analysis will be detailed and extensive work, during will be a lot more focused.

QUESTIONS & ANSWERS

Q: Candace Nachman, NMFS: I was wondering on drilling monitoring, how long after operations do you intend to do the monitoring?

A: Michael Macrander, Shell: As soon as we can get the vessel in there. The plan is to utilize the same team and people who have been doing the Chukchi Sea Environmental Studies Program the past several years. They know the area, so they will be doing double duty. They will continue to support the CSESP and this activity. I can't say the moment we come off hole, that they will be on hole immediate thereafter. They will be there as soon as we can get them there. It may be what you are asking though is we intend to come back in 2013 and revisit and evaluate these locations one year out.

Q: Evana Burt-Toland: I just wanted clarification. You mentioned there would be a collaborative release of scientific data. How far back does it go, if at all, or is it for this year?

A: Michael Macrander, Shell: I will speak on behalf of Shell and let others speak on behalf for themselves. It goes back to at least 2006.

Q: Robert Suydam, NSB: A question about monitoring during drilling. You mentioned turbidity and water chemistry. You also mentioned discharge of cooling water has been a concern because it is millions of gallons and the biocides that are in there. Are you going to be doing any monitoring related to temperature?

A: Michael Macrander, Shell: Yes. Thanks.

Q: George Edwardson, Inupiat Community of the Arctic Slope: You will be more than one operator out there, everyone with your own rigs, right? Your own drilling rigs.

A: Michael Macrander, Shell: In 2012, Shell is only company that has exploration plans for drilling.

Q: George Edwardson, Inupiat Community of the Arctic Slope: You are the only one?

A: Michael Macrander, Shell: We're the only one. I think that's probably the case for 2013 as well.

Q: George Edwardson, Inupiat Community of the Arctic Slope: Okay.

A: Michael Macrander, Shell: So for at least the next two years it's just Shell.

Q: George Edwardson: Okay because I was going to ask if there were other rigs if you had any agreements that if you had an accident, your neighbor could come over and give you a hand. I see you are the only one there, so that takes care of that.

A: Michael Macrander, Shell: Okay.

Vessel-based Protected Species Observer Programs

MMOs are observers that are on vessels or in aircraft making observations. There were five to six MMO's on the airplanes in the Beaufort Sea and the Chukchi Sea when doing near shore, but not when doing further offshore near the Burger Prospect. There were one to five MMOs per vessel. There were five MMOs on drill rigs and five on each of the primary ice management vessels which enables us to have two on duty 24 hours a day and gives everyone ample amounts of rest time. We try to get an optimal mix of people with a professional science background and with degrees in science and some level of experience and expertise observing marine mammals. Some of the MMOs

work 12 months a year all over the world. These types of people comprise a large portion of the MMO group, but we also use people from local communities with experience hunting, etc. The MMO workforce this year will be approximately 150 people. We are looking for an equivalent mix from locals and professionals. It is an important task, and we encourage you to encourage people that are knowledgeable and trusted by the communities to apply. AES and NANA are recruiting for us this year. All of our MMOs go through an approximate week long training program. The groups of MMOs are trained together. There may be different training sessions so not all the MMOs will be together all the time, but those deployed early will be trained together to promote information sharing and learning across regional and cultural bounds. Every effort is made to maximize the amount of time where there are eyes on the water. One of the things we are trying this year is having voice recorders available. There are times when days can go by without seeing marine mammals, and there are times when a lot of animals are seen in a very short period of time. When that happens we want people to be able to go to a back up information gathering plan so they can dictate, and when things quiet down they can catch up. We've been encouraging locally hired MMOs to share information and observations about species and record them. We haven't gotten a lot of information, but the possibility of giving them recorders they can dictate into when something occurs to them that is information that should be shared will be encouraged.

Big eye binoculars are on both the drilling rig and the primary ice management vessels. Night vision equipment will also be available on all the vessels. We are trying out a new computerized information gathering system that will standardize the data and make it easy for the data to go into a central database and be transferrable to GIS. One concern is not getting people so distracted about working with a computer that they take their eyes off what they are supposed to be watching for.

The peer review panel has stressed that if you can't clearly identify an animal, don't guess. Instead, MMOs are encouraged to write down the species as unidentified but record any information that was observed that might help us determine what it could've been. If it is obviously a whale but you can't tell if it is a bowhead or not, call it an unidentified whale.

Relevant environmental data will be recorded every 30 minutes. Behavior observations will be recorded, but limited to immediate information so they are not distracted. MMOs onboard airplanes will visually monitor, and there will be communication between the airplanes and vessel based MMOs.

QUESTIONS & ANSWERS

Q: Candace Nachman, NMFS: You mentioned the MMOs in the airplanes will communicate with the MMOs on the vessels but that's obviously only in the Beaufort Sea. If the pilot or co-pilot in the Chukchi Sea see marine mammals will they also communicate with MMOs in the Chukchi Sea?

A: Michael Macrander, Shell: It could be done. Their primary responsibility is to safely fly the plane. They do make observations and will be reporting what they see. Their communication will be real time.

Q: John (unidentified last name): In our experience being out there as an MMO, they should be required, after the ship is over, to put them in the computer. I know from experience after two or three in a row you can write them down but getting them in to the computer might be a problem.

A: Michael Macrander, Shell: There will be a laptop available for real time data input. We are hoping to cut down on transcription error by having data go directly into the laptop. Correct?

C: (unidentified speaker): Correct. And, in addition, like Michael mentioned with the voice

recorders, if you do get into a situation where you have a large group of animals you capture what you can with the computer, but then after the ship you can run through the voice recording and capture any additional data and details as you are suggesting.

Q: Robert Suydam, NSB: I mentioned yesterday that the peer review panel was interested in and concerned about observers on all these different platforms and merging data. What have you thought about transferring information amongst the vessels?

A: Michael Macrander, Shell: That's not a part of the program at this point in time. I think it's going to take a bit of trial and error. We are doing a lot this year in terms of real time data capture and transmission. Transmitting real time acoustics back to the vessel; picking up the radar and doing analyses from that; real time transfer of ADCP data on to the rig, etc. We have to find out how much bandwidth we have out there, and since I just saw the peer review panel input on Friday we really haven't had a lot of time to put thought in to it but we will.

Q: Robert Suydam, NSB: One thing to think about is at the end of each day emailing files back and forth so someone has data from all the data collected from the Chukchi in one day and then plot that and send it back out to all vessels. Kind of like having a daily instead of real time approach.

A: Michael Macrander, Shell: That is possible. We are to the point where all the data come in to Anchorage on a daily basis and ingested into the GIS and those coverages are transmitted on to BOEM and NMFS. Whether or not every vessel will have the ability to deal with GIS in live but we could send out PDF files and that sort of thing.

C: (unidentified speaker): I think we need to prioritize sightings. As nice as it would be to be aware of all the seal sightings, it is important to prioritize those with potential mitigation implications so that critical information gets shared within the group. These data do come together at the end of each day compiled into a Chukchi and Beaufort specific report and then gets sent out to all the leads. We try to make sure boats are not just isolated units out there in the greater theater.

Q: Vera Metcalf, EWC: I have two questions: 1) when are MMOs on board the vessels and 2) how was recruitment from North Slope and NANA determined? Why NANA and North Slope recruitment only?

A: Michael Macrander, Shell: In regards to the MMOs, the MMOs are on board when the vessel transits the Bering Sea. Once the vessel is there, there is a 28 day rotation, and people come and go with the rest of the crew for the duration. You won't have the same group of MMOs on the boat from July through October. Some people do a couple of shifts during that time. In regards to recruitment, up until this year we had focused only the North Slope Borough since it was the primary and affected area. However, we recognize that Kotzebue and other areas in the Northwest Arctic Borough are potential impact areas, and we wanted to give people opportunity there, and people there have a high degree of marine mammal expertise.

C: Megan Larsen, AES: We have done quite a bit of recruitment thus far. We've been to each of the coastal whaling community for recruitment. Interviews begin next week. Also reached out to marine mammal co-management groups for their recommendations on MMOs as well as Bering Straits because they have four whaling communities in their region.

Q: Robert Suydam, NSB: There's a lot of people in the Bering Strait region and from communities where the Walrus Commission has members. It might be worthwhile to talk to Vera with the Eskimo Walrus Commission to get the names of some folks.

Q: Robert Suydam, NSB: Regarding night vision devices and observer eye fatigue, is it really appropriate to use these things? Do they help or hinder observations of MMOs?

C: Craig Reiser, LGL: I will acknowledge limitations for using to detect marine mammals. Darren talked about our efforts yesterday to try to quantify what the potential limitations might be. Some may feel they might be a magic tool, and we wanted to define this a bit more. Some of these

devices have been stipulated in previous IHA's to be used during nighttime monitoring operations, so it was really also to comply with these requirements that their use has been implemented in the past. But we have recognized their limitations. We recognize some of the limitations and look for further guidance on these.

C: Robert Suydam, NSB: I think that collecting additional data on how useful these things are or how worthwhile is important. If they are a hindrance and make it harder for MMOs to keep watch on the water, to me there is no point to even having them on board. Continuing to pursue some type of IR devices might be more suitable than night vision goggles.

C: Gary Ramoth, NANA: I just finished making a recruiting trip to the region. I travelled all 11 villages, and we have some good folks who are motivated, and these are folks that harvest the ocean.

C: Bob Day, ABR: Our company has been using night vision goggles for 30 years. Realistically I can see these being extremely difficult to use at sea. Because they are a light amplification system, any extraneous source of light causes haloing and decreases performance capabilities. There should be serious questioning as to whether or not requiring them on ships at sea is useful.

Q: Harry Brower, AEW: I'm trying to think back with regards to observations of whales and something that occurred a couple of years back in regards to cow/calf pair sightings. Observers from one group indicated there were these cow/calf pairs and another group sighted some similar sightings and how did that end up getting resolved in a way that was more meaningful instead of just having the communication back and forth. Who is going to be making the call that the operation may need to shut down in the event there are these sightings. In regards to the aerial survey and the vessel based observations and how is that going to be worked out?

A: Michael Macrander, Shell: There were a couple of dialogues that occurred as a result of that. There was the Shell Aerial Program that was operating, and there was also the BOEM sponsored BWASP Bowhead Whale Aerial Survey operating at the time. There is a bit of difference in terms of methodology. The Shell program objective is to collect quantitative data that can be used to estimate densities and therefore exposures and takes, so there is some value in staying as much as possible on transect and not going off. That's been the preferred method. As I interpret the peer review comments received a few days ago, they agree that we should not be circling to maximize. The BWASP program apparently will continue to circle. There were other components of that event a few years ago: the circling was a part of it, and there was also the real time plotting. When we plotted the data, if I'm remembering correctly, there was at that point in time a criterion that if there were four or more cow/calf in the 120 dB zone around the ship that we would be required to shutdown (that was in the case of seismic). We are not doing seismic this year and that for the most part, as I understand it and as I read the draft IHAs, we don't have those large area shutdown criteria like we used to. When we plotted the final observations we didn't have four cow/calf pairs in the 120 dB zone, so the call was done correctly.

C: Robyn Angliss, NMFS: One key issue this year is because there is no requirement to shutdown to cow/calf pairs there is less benefit to circling. If there were shutdown requirements, I think I would still recommend circling to confirm group size and group composition. We just aren't in that kind of situation this year.

C: Robert Suydam, NSB: That's what the peer review panel was thinking. We want to tackle deflection issues, and if whales are deflected how long do they stay deflected and so breaking off transect and circling for cow/calf pairs may not be the best approach for drilling, but if there are mitigation measures that involve cow/calf pairs, in my opinion there should be effort to circle and look for cow/calf pairs. The peer review panel also said that trying to correct the sightings from Shell

sightings based on circling data from BWASP data to correct for possible cow/calf pairs in the area would be appropriate or worthwhile to look at.

Acoustics Programs: Sound Source Characterization Strategies

We are doing sound source characterization to quantify industrial sound levels at 1/3 octave bands and making those measurements to gauge potential impacts on marine fauna. Every vessel will undergo sound source characterization. For the most part, the vessels will be arriving over a relatively short period of time, and we struggled with how to do this operationally. There are only certain vessels that can go into that circle because of the air permit. The plan is that one of the earliest vessels will likely be an ice management vessel, and when it gets close to that 25 mile circle it will deploy two recorders. Then, as the other vessels arrive and enter the theater, each one will cruise by going as close to over the top of the A recorder as they can and within 200 meters of the B recorder. When those have been completed, one of the vessels will go back and recover those recorders, and the data will be downloaded and interpreted so each vessel will have a sound signature, and that will be part of what is submitted to NOAA.

C: Dave Hannay, JASCO: We did receive comments back for possible modifications to this particular plan, and those are under discussion.

It didn't make sense to do one sound source verification for the drilling operation when the drilling rig is going to go through all kinds of activities on a daily, weekly, monthly basis. We wanted to have the ability to do a rolling sound source characterization so that we can calibrate the noise level of the various activities it will be performing. We've come up with a design where, at approximately 500 meters from the rig, there will be a recorder so at the end of the drilling operation we'll be able to recover it and download the data and it will also be connected to a buoy at the surface that will be transmitting back to a receiver on the rig, and there will be a computer processing the data, and it will be available for JASCO staff to download information and process it to provide NMFS and BOEM with a weekly update on what we are getting. In addition to the transmitting buoy, we will also have three to four other buoys in varying distances helping us to generate the propagation curve, and those will be collected at the end of the drilling of the well, and the information will be included in the 90 day report at the end of the season.

QUESTIONS & ANSWERS:

Q: Bill Streever, BP: What was the bandwidth recording the drilling at?

C: Dave Hannay, JASCO: 48 kHz and the low end down to below 10 hertz.

Q: Robert Suydam, NSB: The peer review panel talked about the linear array monitoring the drill rig. Are you going to talk more about that and whether you might offset some of those to get the potential directionality of drill sounds?

A: Michael Macrander, Shell: We'll either do it or we'll explain why. One of the things is that in the Chukchi with the Discoverer, that vessel will be weathervaning. We may get that just from the array we have in this plan. We're talking about that, and there will be more to come. The monitoring program was submitted as part of the IHA application several months ago. Things have changed since the peer review panel and this meeting. The aerial program on the offshore Chukchi is a change. A lot of things will change between now and implementation and as soon after this meeting and the dust settles we'll update that.

C: Candace Nachman, NMFS: I want to mention in Michael's defense, he did just get this information on Friday. We've spoken even before he got back the report, and, after this meeting is

over, we're going to work together to address the issues of the peer review panel, and when I do get the revised monitoring plan it will go up on the website for everyone to see.

Beaufort Regional Acoustics Program

We've been doing this program since 2007. There are a lot of data. There are five arrays of DASARs. These recorders are special in that they have ability to detect sound, get a vector on it, and if that sound is detected by two or more recorders you can get a location. We've been using that for four to five years now to follow the migration. There are limitations, some will be discussed tomorrow. In 2010, in preparation for a drilling operation that would have occurred within that area if it had occurred, two additional DASARs were added to give more localization capability on the western side. We set the arrays in 2007 on the basis of where we thought we were going to be drilling at that time. We had a full week workshop back in October, and we looked at the hard question of: 'is the way we've been doing things the right way now that we know what we know?' and so we added these two and they will remain a part of our program.

In our 2012 proposal the two drill sites are the Sivulliq and Torpedo. The number four array and the number three array, the two closest proximity ones and so bowhead whales will be moving from east to west through these arrays. We decided to move the A through G line to the east side. One of the concerns we had was that the drill rig would be emitting sound relatively continuously, and it may mask the calls that are detected on the recorders so that if the recorders are too close to the sound source it may not detect bowhead calls not because the whales aren't there but because there is too much background noise. We wanted to get as much ability to detect calls in this vicinity, so we moved those four recorders to the east to get them out of the sound field of the rigs.

C: Susanna Blackwell, Greeneridge: One other important reason we wanted to put in the two new recorders was because Shell was not going to drill, and so we figured we'd get some no-drill background levels, and we got that for two years if Shell drills in 2012.

Michael Macrander, Shell: Another thing we are also recommending for 2012, in looking at distribution over last five years that we've been gathering data out here, we think we did a good informed job of putting these arrays along the sweet spot of the migration, but when we looked at cloud of detections around number four, we were also saying 'if there are a lot of animals deflecting further north would we have the ability to detect that with the way the arrays were designed' so we extended the array northward to see if there is a big cloud of animals going further to the north more than they normally would. Susanna looked at the data from all the different arrays, and she looked at line one, and it was array that had seven DASARs in it, and when we put that array in place back in 2007 there were some recorders in pretty shallow water and they've recorded less than ...

C: Susanna Blackwell, Greeneridge: Some of the southern DASARs have recorded as little as 1/100th the number of calls recorded by the top DASARs of the whole project, so basically they don't detect a lot of calls because the whales go further north at that point.

Michael Macrander, Shell: The plan is to borrow some recorders from line one and put them at the north end of line four to increase the capacity to detect northerly detection, if any. The other thing we are adding to the program is what we're calling the 'triplet'. It is a triplet of recorders to the west. The further the call detection is from the recorders and array, the less certainty you have about the location you get from them and the less ability you have to detect if you are competing with noisy environment. By putting the triplet there, we will have something relatively near field that are DASARs to detect vocalizations of marine mammals and to understand the sound field that

is being generated by industry and the sound field that is just there and ambient. These three recorders will be there when we drill the Sivulliq well, and they will be moved when we drill the Torpedo well. In addition to all the recorders that you see on this map at this point in time, if you think back to the sound source characterization, the rolling SSC four recorders will also be there.

C: Susanna Blackwell, Greeneridge: What I did was look in old reports and papers and measurements done especially on the Explorer and Kulluk that are the same or similar types of drill rigs to see what kind of levels people have recorded in the past. That's what is shown on these colored lines on this graph. The reason the lines are not all the same length is that I only plotted them over the distance the measurements were made, so there is no extrapolation of levels at this point. People had made measurements at a bunch of different distances. The three dots are more recent measurements by JASCO in the South China Sea by the Frontier Discoverer. They had three recorders in the same distance from the drill rig, and I picked out the drill measurement, which is the lower dot, and the two highest measurements, which were anchor retrieval and turret turning when they turn the vessel around, to give you an idea of what the levels are that were measured in the past. You can see there is a pretty big range.

The DASARs at 4H and 4I were put out in 2010 and 2011. This graph displays broadband levels across the DASAR range of 10-450 Hz for 2010. You can see how the levels vary. There is a correlation between the wind and what you see in broadband levels. You can also get a percentile level for the whole season, and they are shown here on the right. 4H, the median was 102 dB, over the whole season. The 95th percentile shows that 95% of the time the levels were below 114.

This graph shows all the DASARs and distances to the DASAR. We will be getting some measurements from distances a few kilometers away (four to five) to about 40 kilometers away. It should give us a good range of distances over which we can see how far the sounds from the whole operation can be heard.

We were worried about masking, so I did a little exercise to see how far could you hear a bowhead call in different situations of background sounds. I took an average bowhead call at 150 dB source level and used drill ship regression from the Explorer and assumed ambient sound levels are below those produced by the drill ship and used a spreading loss of $15 \log(\text{distance})$ and $10 \log(\text{distance})$. The green circle shows the distance at which a 150 dB bowhead call would start dropping below background levels and at the near DASAR (4.1 kilometers from the Sivulliq) it came out to be 80-710 meters using the two difference regressions. One of the triplets came out higher at 122-1220 range. As you move away from the drill rig the circles get pretty big pretty fast. These are just ballpark estimates.

The point of all that is that with a drill rig operating, emitting sound as it will, it has the potential to impact our ability to detect and localize calls, so we retooled distribution of the DASARs to try to optimize that as much as possible.

QUESTIONS & ANSWERS

Q: Bill Streever, BP: Neat graph about drill ship noises. Were any of those lines tugs or did you think about overlaying a tug line to get a perspective of how loud and how far it carries relative to tugs that are commonly used?

A: Susanna Blackwell, Greeneridge: It would be easy to add it on. Most of these measurements were done in situations where other things were happening, i.e. other ships, deliveries, etc. Only the drill rig is listed but it really is drill rig plus stuff.

Q: Bill Streever, BP: Do you want to speculate as to where the tug line would be on that?

A: Susanna Blackwell, Greeneridge: Well, I've published that. I just can't recall. Instead of taking a guess... it certainly wouldn't be far from that black line. What the propagation would look like would depend on the situation you were in.

Q: Harry Brower, AEWC: Were there comparative studies in terms of whale surveys with the aircraft in terms of their movement patterns and overlaying what's happening here?

A: Michael Macrander, Shell: Yes, and we'll talk about that tomorrow.

Q: Robert Suydam, NSB: I want to reemphasize the peer review panel's agreement on moving DASARs and what you've proposed here. The peer review panel agrees and thinks it is a good idea. My question is on removing the four DASARs from line one. To a degree that compromises what is happening at line one. Maybe that's not a big deal, and so my question is about Shell's interest in Harrison Bay and what you think Shell might be doing in Harrison Bay in the near future and whether compromising the ability of line one to record bowheads might create some difficulties for us in the future.

A: Michael Macrander, Shell: That's why I used the word "borrow" when I talked about this. We now have five years of data; two years conducting seismic in Harrison Bay and (unable to hear), we've got 2010 and 2011 when we weren't doing very much or anything, so we've got a good base of data there. When and if we develop a plan to drill in Harrison Bay we will certainly adjust our plan, perhaps looking at something like this that will optimize that. Harrison Bay may be at a different time of year. We'll make that adjustment. If this becomes a long term sort of thing we might look back and say we need to replenish those. We will have two arrays that will be to the west of the drilling operation. Based on what we've seen from seismic, we think it will give us a good idea of what the migration is doing and then having those northern three will give us a pretty good capacity on line one to localize calls.

Chukchi Regional Program

Michael Macrander, Shell: The Chukchi Regional Program started in 2006 when Chris Clark and Cornell put some arrays out in the first 50 miles. In 2007, we added doglegs on to those, so we have a pretty broad expanse across the Chukchi Sea. In 2008 and 2009, we added clusters around Klondike and Burger prospects to add an ability to localize calls (not the same technology as the DASARs). This is the regional array as it was implemented in 2011. We are getting that data as we speak. This is what we are proposing for 2012 with a drilling operation occurring in the central part of Burger prospect. We've had a Cape Lisburne line, a Point Lay line, a Wainwright line and a Barrow line. In 2011, we added additional recorders around and on top of Hanna Shoal so that we could get these portions of the bowhead populations (displayed on map), so we can get histograms of call counts across this entire area.

When we started looking at the data we spent a good bit of time thinking about if we had those clusters of seven recorders like we had in 2009 and 2010, we might be able to localize but would they be masked, or would they have the ability to hear the same calls on multiple records, and we reached the conclusion that they probably would not; that being in close proximity to the drilling rig and the other vessels the masking would be too great to make a lot of localizations possible. So what we did in preparation was expand that circle by moving those further out (approximately 16 km) to give us a cluster of data close to the area where we're operating but far enough out to get away from some of the masking, but arrayed upstream/downstream of bowhead and/or walrus movement so we can get relative numbers (not localized calls, but relative numbers). The peer

review panel encouraged us to continue to look for ways to localize, and we certainly are and will continue to discuss this.

C: Dave Hannay, JASCO: The hexagon pattern of recorders will also be useful for characterizing noise from the rig, and there was a comment from the review panel about directivity and those are positioned well for looking at the sound propagations in different directions from the drill rig.

These next slides were useful when we were talking to the peer review panel in terms of an entire year of bowhead distribution calls in 2009 and 2010 showing there are a lot of bowhead whale calls around the Barrow area, and there is a vector of a lot of calls coming out. Very similar pattern, but a bit further north, in 2010. This is the same display of information only for walrus calls in 2009 and 2010.

QUESTIONS & ANSWERS

Q: Robyn Angliss, NMML: There's a high call rate and then a high call rate and then it narrows in the middle and there's no data there that shows it would narrow in the middle. How do you get that?

A: Dave Hannay, JASCO: It is a bit of a problem. The way you interpolate between those sparsely sampled locations can affect the shape of those contours. However, that particular line, that Barrow line sampled from north to south, so if you assume all the animals cross that line somewhere in this north/south extent and if they're calling at the same rate, then you would expect to see the highest levels at the location where the highest density of animals is.

C: Robyn Angliss, NMFS: Interpolating along the path of the acoustic recorders that seems pretty straightforward, it's the interpolating of the big distances where there are no recorders which seems a little more problematic.

C: Michael Macrander, Shell: These are interpolations and take it... I'll come to David's defense on this. Over the past few years I've pushed him for this kind of a graphic because it's easy for your eye to look at and draw something from, but you have to be aware that in areas where you don't have sampling it's the computer taking a guess at what's actually there. The alternative is what we've done in animations in the last few years of these bubble plots, but I find it is hard to integrate that in that time frame.

Q: Robert Suydam, NSB: I like these plots but had similar concerns as Robyn did that interpolating between some of the recorders may provide a false sense of what is going on. Another problem may be that it sounds like it is data from all year long and some of the recorders are from wintertime and some are just from summer?

A: Michael Macrander, Shell: No, it's just during open water.

Q: Robert Suydam, NSB: And so there may be differences from early and late in the season that need to be accounted for, but I think visualizing things this way is helpful and it may be worthwhile at some point in the not too distant future is to try to get the satellite tracks and overlay those or merge the data. It may give us a better idea of how bowheads are using the Chukchi Sea in the fall.

C: Robert Suydam, NSB: The peer review panel was excited about how things were changed for the Beaufort Sea but did have concerns for the Chukchi Sea due to a couple of reasons. The panel was less enthused about having histograms of calls as a measure of what the impacts might be to bowheads or walrus, and so having a bunch of instruments out there that don't provide locations seems to be an issue. It's an issue because the data that we have in hand for the Beaufort Sea and the Camden Bay area in particular from the 1980's and 1990's show that in a big area around a drill operation there were very few bowhead sightings, and those were all visual sightings without really acoustic locations. Trying to get a better idea of acoustic locations in the Chukchi Sea around this

drill operation would be very helpful. If there is anything that could be done to move those instruments so maybe they are threesomes or triplets north and east and south or something would be a worthwhile way to go so we can get locations of animals instead of just histograms.

C: Michael Macrander, Shell: In response, we've already seen this kind of impact of masking around seismic activity. In the proximity of seismic there is a big void of acoustic detections. I think a portion of that is deflected bowheads, but, on the basis of the aerial data, it's pretty clear that it is not; that there are animals in that void of acoustic detections, but we just are not picking them up because of the sound levels. We're trying to design a way to get the most data with what we've got.

C: Susanna Blackwell, Greeneridge: Before you forget the plots shown before, I just looked up in my paper about the levels, and so these measurements were made during the sea lift at Northstar. I think there were two of them and a bunch of tugs, so it's not just one tug, but actually the levels measured, the sort of higher end where you look at all the points and you draw a line are almost exactly on the black line I showed on the previous plots, so it is a very comparable set of sound levels.

Beaufort Aerial Program

Michael Macrander, Shell: The Beaufort Aerial Program was initiated in 2006 as part of an integrated monitoring program with manned flights in 2006, 2007, 2008, and 2010. In 2012 we will fly in the Camden Bay area in the proximity of our drilling activity with MMOs aboard to evaluate the impacts of drilling activities on migrating bowheads and other species. The flight pattern will be modified per recommendations. The peer review recommended power analysis, which is a look at ability of the sampling design to detect a particular kind of change. You look at the abundance of data. One of the issues is the closer we get to a sound source, if you're looking for a big change of distribution; you have all these lines of data. The closer you get and the more narrow the impact, the less data you have. At some point you get to a statistical point where you don't have enough data to make any conclusions. Having done that upon recommendation of the peer review panel, we've modified the 2012 aerial program to have an increased density of transect lines in the close proximity to the drilling operation to increase the power of the ability to detect the change in the 160 dB range.

The aircraft will have both MMOs, two still frame cameras, and a HD video camera overlapping images as we progress down the line. It will be automated so it won't require a person to take the pictures. The long term goal is to utilize unmanned aerial systems, perhaps by 2012. It reduces safety exposure, it reduces fuel consumption, it reduces the amount of sound put out there, and it reduces potential disturbance. Dual observations will allow for direct comparison of results. Photography will provide lasting record. Photo analysis will be done when not flying. We are evaluating the possibility of adding a multispectral scanner. The two still cameras are Cannon 4D Mk II digital SLR cameras, one with 20 mm lens and other with 20 or 100 mm lens. The two still cameras, while operating in the Beaufort, will be pointed in slightly different directions with enough overlap that will give us a broad swath of 1,400 meters. The swath we are anticipating for the video camera is 600 meters. We have an option in the Chukchi Sea when we're focusing on the bowhead migration we'll do the same thing as in the Beaufort with the two cameras. In the Chukchi however, when we are over the Burger site during the time we're more concerned about walrus we may try focusing one of the cameras with a stronger lens so that it can identify bearded seals and walrus and use the other one for a wider field. We'd like to experiment with it a bit.

Chukchi Burger Prospect Aerial Survey

In the Chukchi we've been doing just the near shore version. We will continue to do the near shore version on those days when we can't fly out over Burger, but our preferred mode is to survey over Burger with photographic equipment and no MMOs on board. When MMOs are not flying, they will be analyzing the data.

QUESTIONS & ANSWERS

Q: Harry Brower, AEWC: When you are talking about pixels and swaths, do you have any photos or videos documentation regarding using those types of cameras?

A: Bill Koski, LGL: No, we don't actually have pictures of whales and things because we haven't been able to fly the UAVs offshore, but we have done tests on military ranges in California. We've put out targets (squares and things like that as opposed to whales) and over flown them with various cameras and lens and at different heights, and that's what has given us the guidelines for these surveys. Now the camera systems are even better than when we did the tests because two years ago the cameras weren't as good as they are now. The cameras we have now have substantially better resolution.

C: Harry Brower, AEWC: I haven't seen any pictures, but it's been mentioned several times that we're going to get to see how these things really function.

C: Bill Koski, LGL: I can show you pictures of cars and things that you can relate to.

C: Michael Macrander, Shell: We also have the video we shot back in 2007 with the UAS. We showed it a couple of years ago, and I have it on my computer. We were constrained by the permit that we got. We could only fly within a mile of our vessel, but we lucked in to some gray whales, walrus and you can see them, you can identify what they are and you can tell what they were doing. That is like three to four generations ago in terms of the ability of the cameras now. Bill, you had said that a pixel at this resolution would be 12 centimeters...

C: Bill Koski, LGL: Yes, for the cameras that are covering a wide area I think is 12 centimeters.

C: Robert Suydam, NSB: I just want to re-emphasize the peer review panel encourages just using the 20mm lens. Even though the pixel is 12 centimeters, that pretty good resolution and one of the main reasons that the panel suggested staying with one lens throughout the survey is so we have enough data to make comparisons. It seems like often we end up with a dozen sightings, and it is hard to make conclusions, and if we start messing around with different lenses it makes things more complicated. For this untested approach, using one method throughout the season has a huge amount of benefit.

Q: Robyn Angliss, NMFS: I'm curious to hear if you have already figured out how many paired sightings you would need to have in order to get a good comparison of the video, the camera and the people observers, and do you think that you can get that with the survey that you guys are planning?

A: Michael Macrander, Shell: It depends on how many marine mammals are out there. If there is a significant deflection, we may not see a lot of stuff. It will depend on weather patterns and how much actual flying time we get. We're hopeful we get enough to do some statistical analysis.

C: Robyn Angliss, NMFS: I'm hopeful too. I think this is a really great next step to figure out how cameras could be mounted in UAS and human observers will work but getting that really good statistical comparison I think is key, and if you don't have the densities available in order to do that it could be problematic.

C: Michael Macrander, Shell: As we've seen in some cases in terms around the deflection issue it has taken two to three years to get enough sightings to really start thinking we understand it. I

would love to get to a point where we could say in 2013 we could make that transition but that might be a bit pie in the sky. We'll commit to the long term of getting the data and being there before making the transition. We may make the transition more quickly in the Chukchi Sea because it might be this or nothing, but in the Beaufort we'll be watching the data carefully.

Statoil Future Chukchi Sea Exploration Activities

Lars Andreas Sunde, Head of Alaska Operations, Statoil

Statoil is pleased to be here. We feel this is an important venue for us to be able to talk about our plans for Alaska. I am an engineer by education. I have worked for Statoil for almost 30 years. I've worked in international positions for many years and about one-half of my career was spent in Norway. I am grateful to be in Alaska. There are many similarities between Alaska and Norway. We share a lot of the same values. We like living in a cold climate, and we like to live in an environment where we can enjoy the outdoors and living close to nature.

Statoil operates in 36 countries, is 67% owned by Norwegian Government and has 40 years of experience. It started as a national oil company in Norway in 1972 and has grown to be the third largest seller of crude oil in the world and is the world's largest offshore (in water depth beyond 300 feet) operator. It has an excellent health, safety and environmental record. We have about 20,000 employees worldwide. The exploration and production of oil in Norway is less than 50 years old, but it has contributed significantly to the growth of the Norwegian society, and today it is the largest income to Norway. Norway's second largest export is oil and gas support activities.

Working in the Arctic is in the long term future plan for Statoil. Our focus now is in the Arctic around the entire globe including Greenland, Faroe Islands, Canada and the Chukchi Sea. Most of our activities have been in Norwegian Arctic. We've drilled more than 50 wells and made several major discoveries in the Barents Sea in this region north of the Arctic Circle. Our position in Alaska arises from our lease acquisition in 2008 in the Chukchi Sea about 100 miles northwest of Wainwright. We did 3D seismic in 2010 and opened our local Anchorage office in 2011 at the same time we conducted our shallow hazard and geotechnical coring surveys. We are currently firming up plans for drilling our first exploration well planned for 2014. 2012 and 2013 work will be mostly well planning and activities related to permitting.

Overall 2014 Exploration Well Timeline: We have secured the main contractors that will help us prepare, and we are staffing the Anchorage office to ensure we are doing this in accordance with regulatory requirements and in accordance with Statoil internal worldwide requirements. We have started drill planning, the oil spill response plan, and the work required to submit the oil spill response plan application to authorities. As a comparison, this slide shows exploration well permitting process timelines and how they differ around the world. In sensitive areas in the Barents Sea, the total timeline for a permit to drill is about 8 months. In the Gulf of Mexico we currently estimate about 14 months. In Alaska, we are planning for a permit period of 32 months.

An important part of the activities is stakeholder engagement. To date we have attended AEWG conventions and meetings, a North Slope Science Initiative Workshop, Open Water Meetings (2010, 2011 and 2012), Arctic Economic Development Summit in 2009 and 2011, Plan of Cooperation Meetings (2009 through present) and ongoing meetings and conversations with many marine mammal co-management groups, the North Slope Borough, the Northwest Arctic Borough, colleges, foundations and the Alaska Federation of Natives. We are dedicated to working with the communities on the North Slope and the stakeholders anticipated to be affected by the work we do.

We were fortunate to have a stakeholder engagement meeting in Point Hope in November 2011. Some of you might remember the winter storm that came through during that time. It was a pretty bad storm. Street signs were folded around the street posts. The power went out, and it was clear that our flight would not be leaving for several days. We were evacuated to the school. We got to meet and interact with a lot of people that we otherwise would not have had the opportunity to meet. The school was very well organized, and the emergency plan worked well. We really felt a sense of belonging. The support we received from the Point Hope village left no one untouched. We were impressed with the school, the serving of hot meals to the evacuees with smile. We have a lot to learn from the Inupiat culture. Culture is about sharing, and we really experienced that during those days in Point Hope. We saw how important the sense of belonging to a unique culture is. We thank Point Hope for their contribution and support to us during our time there.

QUESTIONS & ANSWERS

Q: Harry Brower, AEWC: What kind of drill rig is Statoil planning on bringing to the Arctic?

A: Lars Sunde, Statoil: I did not mention this in the presentation, but we are looking to source a jack-up rig. We are in the process of doing that now, and we hope to have a rig nominated by the middle of the year.

Q: Candace Nachman, NMFS: Thank you for your flexibility in presenting today rather than tomorrow. I realize Statoil is still very early in thinking about permits, but do you have a sense of how many holes you'd like to drill in the Chukchi Sea?

A: Lars Sunde, Statoil: We are still looking at it, but we've made a total of five well location surveys. At the moment we are prepared to drill up to five over multiple seasons.

Q: Robert Suydam, NSB: Statoil has, in the couple of years you've been active in Chukchi, been working closely with Shell and ConocoPhillips on the science. We feel that's a good combination and having the companies work together is very positive. For 2014, is Statoil thinking about partnering with Shell or ConocoPhillips for oil spill response, continued monitoring, or other support activities?

A: Lars Sunde, Statoil: I think there is a lot to gain from cooperation with other companies including optimizing equipment, optimizing processes, and minimizing the environmental footprint. We are committed to finding solutions where we can cooperate with other companies and will work hard to make that happen.

Q: (unidentified speaker): I know the Norwegian regulations for drilling offshore are pretty tight. Are you going to implement what you've learned in Norway and what the Norway government has requested from you in order to protect resources there, over here? Are you planning on implementing the same things over here? There may be different regulations over here where you don't have to do it.

A: Lars Sunde, Statoil: I think there are two sides to this. We will have to meet all U.S. regulations and federal regulations, and we are committed to doing that. In addition, we have our own internal requirements that originate from the Norwegian continental shelf, and we are committed to meeting those internal requirements, as well as U.S. federal and state regulations.

C: George Edwardson, Inupiat Community of the Arctic Slope: You saw how friendly Point Hope was. I'm based in Barrow and want to invite Statoil to meet with our regional tribal government. I conduct eight town hall meetings simultaneously, and you would be able to meet the eight communities. When we look at offshore, Chukchi lease area, we look at it as threatening our lifestyle. The Arctic Ocean, from where the Chukchi is, the gyro brings the water back to that same location every ten years. What you are attempting to do is a very scary thing for us as a people.

Being a regional tribal government, we need to have you come before our councils when you happen to be in the area. You need to talk to the people face to face in the Inupiat community.

C: Lars Sunde, Statoil: I appreciate the comment and thank you of the invitation. I'm sure that we will take you up on that invitation. We don't have to be in the area to do it. We will make the trip to do it.

Q: Harry Brower, AEWC: I'm not sure if you are familiar with the AEWC's conflict avoidance agreement. Are you looking to hold discussions with us at some point in time regarding the signing of the CAA?

A: Lars Sunde, Statoil: I think we would like to continue the dialogue with the AEWC, as we have started. As you know, we have no activities in 2012, but that doesn't mean we would not like to continue the dialogue. I hope to have the opportunity to meet with you again very soon to continue those discussions.

C: Harry Brower, AEWC: Thank you. I have a lot of constituents I have to respond to and have to ask the question publicly. Now I can respond back to them that I have asked the question in a public setting. I just wanted to share that with you as to why I asked the question. Thank you.

Day Three – March 8, 2012

The session with a safety minute by Nicole Giles of the Egan Convention & Civic Center reminding attendants of how to exit the building in case of emergency.

C: Harry Brower, AEWC: A question to Candace. In regards to the PowerPoint presentations that have been given and we don't have any of that information to reference back to or make comments or discuss issues that are presented. We see the presentations, but only for the first time and then try to think about what are the real comments we'd like to make regarding the presentations and we don't have anything to reference back. If there could be materials that could be shared with us we could reference back and forth back to the presentations that would be helpful. Thank you.

A: Candace Nachman, NMFS: If you are talking about having them here at the meeting I don't know, but I always put them up on the website after the meeting so you can actually go back as far back as 2009 and start looking at the presentations.

Q: Harry Brower, AEWC: I mean for this meeting. The thing is Candace, I am absorbing all this information, but there's so much information being presented. How do we go back and identify some of the concerns we need to voice in regards to this meeting?

Q: Lisa O'Brien, Facilitator: What happens in the report if you just link some of them? Is that possible? I'm just talking off the top of my head. Because there is going to be a report... (*Talking in the background*). Oh, right now you need them; in real time. We have tried mightily and presenters...it just hasn't happened. So talk to the presenters because we've made that request year after year.

ConocoPhillips Future Chukchi Sea Exploration Activities

Mike Faust, Chukchi Program Manager, ConocoPhillips

I'm going to talk about ConocoPhillips' plans. They are out in the future a bit, but we thought it would be a good opportunity to give information as to where we are headed and when we plan to do our operations. ConocoPhillips has a lot of experience in the Arctic. ConocoPhillips has drilled 50 exploration wells in the Arctic in Alaska since 1998 with 20 of those in the natural petroleum reserve in Alaska, so many of those in remote locations. We have a lot of experience in drilling in the Arctic and the difficult logistics associated with that. We have good relationships with the communities and work hard to maintain these relationships and are sensitive to needs and to ensuring our seismic operations are not interfering with subsistence or gathering activities.

There are two prospects in Chukchi Sea. The first prospect is Burger. This is the prospect that Shell talked about previously. ConocoPhillips has a number of leases on the same structure, but at this point has no plans to drill right away. There are a number of leases on the Devils Paw prospect, a structure that was drilled in 1989-90 with a well called Klondike. We have 100% leases there with partners Statoil and OOGC, the U.S. branch of the Chinese National Oil Company. This is where we plan to conduct drilling operations in the future.

At Devils Paw we are about 120 miles almost due west of Wainwright. The closest community is Point Lay, 93 miles; Point Hope is approximately 50 miles to the south, and Barrow is almost 200 miles to the northeast. The closest landfall is about 80 miles offshore. ConocoPhillips plans are to drill only in the open water season. There are no plans to drill when there is ice on location. They plan to be out there from mid-July thru mid-October. Based on previous ice data, that is typically the open water season. If the ice came in early, they would leave early; if it remained ice-free past the October 15 timeframe, they'd like to stay on location until the ice returns. In order to conduct

that, they have developed a very robust ice alert plan which includes Synthetic Aperture Radar (SAR) imagery and curtailment plans. A lot of great satellite imagery has become available through military technologies now available on the commercial market. There is now tremendous satellite imagery available on a daily basis, and, in the case of the Chukchi, up to two to three times per day. SAR sees through clouds, storms, and at night and gives us an excellent image of where the ice is at all times during operations.

ConocoPhillips plans to drill one well in one season. They would like to drill two, but it depends on ice, weather, and any possible issues with drilling the well. The plan is to drill one well, although they will be prepared to drill two; the high likelihood is only one will be drilled in a season. It takes about 30 days or so to drill the typical well depending upon what evaluation is done and logging completed. The open water season is pretty long, 90-110 days, so theoretically two wells could be drilled. Current plans focus on detailed operational planning and procurement of equipment. Vessels have not been contracted. They are in process of going to the market and tendering opportunities to industry and will evaluate bids this year with contracts awarded by end of 2012. ConocoPhillips plans to drill in summer 2014. It takes a couple of years of detailed planning and coordination of contractors. We spend a lot of time ensuring that all safety precautions are in place along with communications and simultaneous operations activities are really well tied together. They are moving slowly and cautiously. A lot of time is spent in the community to ensure they understand and address concerns. We heard clearly in 2008/2009 that North Slope residents were concerned that things were happening too fast and too much, so ConocoPhillips tried to step back and take a paced approach to understand and address concerns. We believe the time is ripe to step out and actually drill. This means 2014 for us. It will take us two years to do the proper job of putting plans into place and getting the equipment there.

Chukchi Environmental Studies Program from 2008-2011

ConocoPhillips started with the environmental studies program in 2006, and it has grown into a robust program. We are proud of the ecosystem approach to baseline data collection. ConocoPhillips worked hard at the beginning to put this type of plan together, putting a lot of thought into the program and working closely with the other operators. We believe it is a very robust program that has been built on the historical data that was already out there. We are using these data to assess the potential impacts of oil and gas activities and develop monitoring and mitigation plans for actual activities. In the six years of doing these types of operations, we are proud to report zero incidents or injuries. It is impressive when you have vessels of this size, pulling together scientists from all over the country, equipment coming in from various places, putting this all together on one boat, ensuring a robust safety program and going out in a harsh, difficult environment for 90 days at a time and coming back without a single injury or incident is a testament to the chief scientists sitting here, the crew, the vessels and is a good example of what the industry can do when they put their minds to it in terms of safety and precaution.

Permitting

ConocoPhillips has filed all its permits. The Exploration Plan (EP) was submitted on March 1, 2012 to BOEM and is under review. Once deemed completed, the plan will be posted for public review. We have committed to the North Slope Borough to come in early April and do a detailed workshop with the Mayor's office and staff walk through the permits in detail to ensure understanding. We will do that in any other communities that would like this type of detailed discussion. The EP is the document that describes the operation in detail. The Oil Spill Response Plan was submitted to BSEE on Feb 13, 2012 and is being reviewed. We will be working with BSEE to ensure the plan is robust, meets requirements, and is acceptable. The application for the Incidental Harassment Authorization

has also been submitted and letters of authorization to NMFS and USFWS. These documents for the 2014 project are in now, and we feel it is appropriate to start working on the applications immediately. There is a lot of work that went into building them, and we want to ensure there is good, open dialogue with the agencies and that the authorizations are in hand before ConocoPhillips commits funds on equipment. They have received approval under EPA Region 10 discharge general permit. As many know, ConocoPhillips is in the midst of a new general permit being issued so when that is finalized, we will need to reapply for individual discharge permits under new regulations.

ConocoPhillips' operation is quite different from the other operators. One of the advantages is that the location is furthest south of all available leases in the Chukchi Sea. This means the ice clears first and returns last in this area, resulting in a longer open water season. Also, looking at the historical ice data, when it leaves it does not return for at least 80-90 days. We are in a very favorable location for a jack-up rig. We were concerned about using a jack-up, but as we worked through the details and looked at the technology available today, it is really the best solution in our minds. We are in 160 feet of water, an ideal depth for a jack-up. They are bottom founded rigs that sit in place. The legs are jacked down and sit on the sea floor making it a stable drilling platform that does not move. The stability provides tremendous advantages as you can put the blowout preventers or well control equipment directly on the deck or rig floor. This makes the ability to shut in a well if there is any type of well control incident and is much simpler; you can just walk over and turn the valve. There is no remote control vehicle to try to get to a well head on the sea floor. This set up is essentially a land rig sticking up some meters above the sea. You can operate in much heavier weather as you can jack up above the waves so even in storms you can operate. The drill is not moving at all, so it is very stable in that regard. It has much less noise as it is not moving around in the water as the propellers are not turning. Another nice thing is they are brand new, state-of-the-art rigs. The ones ConocoPhillips is considering are just coming out in 2012/2013 and have the newest emission equipment available worldwide. The biggest advantage is the blow-out preventers and the control equipment on deck. It is a fantastic system as we are operating in the Arctic, in the Chukchi Sea, an extremely sensitive area. We are going the extra mile and adding additional redundancy in safety equipment, so we have placed a pre-positioned capping device, or a capping stack, the same as was used to shut off the Macondo oil spill in the Gulf of Mexico. The stack will be put in place before we start drilling. The stack will be set, and we will drill through the stack down into the subsurface. The equipment on the jack-up rig (the true blowout preventer that has all the safety devices with the ability to shut in the well), is the main line of defense with redundant systems, rams, etc., to shut the well. If all of that failed, there is another complete capping stack that sits on the sea floor to shut the well. The stack can be triggered from the rig or a boat using a Doppler system and serves as a secondary system.

We really want to talk about the measures in place to prevent a spill in the first place, and it comes down to planning. The well that will be drilled is the same as Kuparik. ConocoPhillips has drilled over 1,000 wells. These types of wells are drilled daily, and there are currently three wells running there today, so we are constantly working in this same type of geology. We understand the pressures, what is in the subsurface. We have a well already on this structure, so we understand what the pressures are, and they don't expect any surprises. It really comes down to planning appropriately, ensuring there are redundant systems in place, and drilling the type of well we drill every single day. It comes down to personnel. The drilling team has over 90 yrs of experience of drilling Kuparik formation wells, this exact geology, between the three primary engineers. That is unparalleled anywhere else in the world when drilling wells. These guys have seen it all; there is probably nothing that they haven't already encountered at Kuparik that they don't know how to already deal with and have planned for. ConocoPhillips will always maintain a minimum of two

barriers, meaning we never count on only one barrier to keep the well from flowing. There is always a second system in place.

(Showed picture of Devils Paw historical ice conditions to demonstrate when the ice leaves and returns within 25 miles of the prospect.) When the box is blue, it indicates no ice within 25 miles of the prospect; green indicates 1/10-3/10 of ice. The North Sea jack-ups are capable of operating in 1/10-4/10 of ice with no problem at all. If the ice comes in and is greater than that, say 7/10, they won't be there. In this type of situation, they would jack the rig down, move out of the way, come back on the well and finish it when the ice recedes. Looking at historical ice conditions as far back as 1996, there is no time between mid-July to late-October they would have to leave. It may be at the beginning of the season they would not be able to start until the third week of July, but there has never been a time since 1996 that we would have to get off the well during that period. It is our goal to operate during that time frame; we won't push it on either the front or back end.

It's a big fleet, and there is a lot of equipment involved. Drilling the well is the easiest part of the project; the marine logistics is the challenge. There are a lot of vessels involved for spill response, to maintain the operation, and bring supplies to the rig. It is a robust fleet to drill one well and very expensive, so ConocoPhillips is spending the time to contract in 2012 and the safety issues with the equipment going forward.

Marine Mammal Monitoring

The IHA application has been submitted. Because it is a stationary drilling rig, the sound levels are very low. The one activity that will be done that will put sound in the water is a vertical seismic profile (VSP). It is something that is done near the end of the well and lasts approximately 8-10 hours and will probably be completed twice. The plan is to do this process twice during the drilling of the well. This will result in 16-20 hours of seismic noise in the water, at the rig, while this is completed. We have put together a mitigation plan.

Distance from drill site	<u>120 db</u>	<u>160 db(m)</u>
Drill rig only	210	<10
Drill rig + ware vessel (dynamic positioning)	7900 (8 km)	71
Vertical Seismic Profile	≥71000	4700 (< 5 km)

There will be MMOs on the drill rig, the ice management vessels and on the research/monitoring vessel throughout the entire season. They will also deploy three passive acoustic buoys to understand the location of any mammals that are not spotted on the surface.

Discharge Monitoring Plan

The discharge monitoring plan was permitted by EPA under the existing program. There are 13 discharge types permitted in the Chukchi Sea, and the general permit is in the process of being reissued overall and requires ConocoPhillips to reapply. The discharge monitoring plan was submitted as part of the EP, and it is out there for people to review. Primarily, we are looking at a three-phase monitoring program. We will go out before the season and establish a baseline and make sure we've sampled everything around the well site. During the drilling, we will monitor and sample any dispersion, cuttings, etc., that would be discharged. They would then return after the well is drilled, both in short-term and long-term in the following year, to make sure samples were the same as when they started.

Why Chukchi Exploration Is Important to Alaska

The importance of exploration is based on estimated volumes out there. BOEM has estimated over 15 billion barrels of oil and 77 TCF of gas available in the Chukchi Sea. Drilling to date is not conclusive. There are only five wells out there, one of which can only be called a true discovery, and it found gas. As many may know, there are 20 TCF at Prudhoe Bay, and the industry and the state are struggling with how to get that gas off the North Slope. If you are struggling with how to get gas off Prudhoe Bay with already 15 bore holes in it, it's that much more challenging on figuring out how to get gas out of the Chukchi Sea another 350 miles away. It needs to be a very large oil field for it to be commercial; if it isn't a large oil field, you won't see industry out there. But if successful, and we believe there is a good chance for success, oil development would lead to significant training opportunities, jobs, careers, increased community investment, significant tax revenues for state and local communities. A pipeline coming across NPRA to the Trans-Alaska Pipeline (TAPS) would generate a significant tax base for the North Slope Borough. Most importantly, production means an extended life for TAPS. The message is getting out that producers are very concerned about TAPS. Production at one point was 2,000,000 barrels/day; today production is around 600,000 barrels/day. It is significantly less and at some point, the volume going through the line is what keeps it warm and allows oil to flow, when the volume gets low enough the line freezes. Something has to be done. Either invest millions, probably billions, to wrap the pipe in insulation or make a smaller pipe inside TAPS to increase the velocity of oil. There are a lot of things that can be done, but the only thing that is going to change that is a major discovery offshore. The Chukchi Sea has, by far, the biggest potential. We are all hoping someone has a major discovery, or the TAPS future is limited.

QUESTIONS & ANSWERS

Q: Candace Nachman, NMFS: You mentioned a couple of times that the IHA has been submitted to NMFS. None of us here have seen it. When did you send that?

A: Mike Faust, ConocoPhillips: I think it went in the first of March. Yeah, March 1st.

C: Candace Nachman, NMFS: Okay, so maybe it came when we were here.

A: Mike Faust, ConocoPhillips: Maybe you were on an airplane headed this way.

C: Candace Nachman, NMFS: Okay. Thanks.

C: Harry Brower, AEWC: Thank you for your presentation Mike and again, it is a lot of information in trying to structure questions or comments in regards to it. I don't have the remote to flip back to the areas I'm interested in commenting on. Again, that's a lot of information about going forward, and you made comments for energy needs for the nation. That's all good and dandy, but my concerns are the resources we depend on for subsistence and the state that they are in - healthy food that is provided for our communities and yet, you are looking at conditions that are imposed on conducting this activity and the NPD permits you will comply with. But does the company take the extra step to help, in a sense, protect resources that we depend on? You want to get out there and do the drilling. You know, we will follow rules and regulations as much as we can, but is there an extra measure you can take as a company to help protect these resources that are needed by the communities that are in existence and have been in existence for 1,000s of years. This is a new level of activity, and I raise my concerns because of what I have learned over time. It's not just overnight. Again, this is very informative. I share my appreciation for you and the company to provide that information. What I am looking for is the resources that I depend on for food and their health state, and when you are talking about discharge of your effluence and drilling mud into the ocean, that still raises the flag for me. I have to voice the concern. I'm not trying to stop the drilling or stop the activity, but I want to make you aware there are concerns to the operations. The AEWC is not here to stop exploration, or development, or whatever. It's just that the concerns are real. These are real things that are happening before us. We're being put at risk. An incident occurs; we are taking on

the risk—without any costs with it. We don't have the sufficient funds to go try to identify how to best meet our needs in the midst of an incident. These are hypothetical situations that we are discussing, but these are things that are coming down the road. Just a couple of years down the road with Shell's operations next year. I have to share these concerns with you and your company along with our federal agencies. I have to repeat and state what my concerns are regardless if you get tired of hearing them or not. I'm going to continue. These are the things that are real for us. Concern: oil spill, discharge--these are real things being put into the ocean that the resources I depend on for food are going to swim through. What is the impact to that? To the resources that I hunt that swim through the drilling muds or have to swim around it? What impacts are being associated with that kind of information? I understand the nation's energy needs as well. They are for real, just like I'm talking to you about the food I depend on for subsistence. That's for real, and yet we are being put at risk, the unknown risk. Like I said, I thank you for your presentation. Candace and Jim, you folks from the agencies, again, not having the materials, it's hard and difficult trying to coordinate the comments appropriately to address the issues here. I wish I could read through some of these materials before we get here to make comments accordingly and how we could best steer, in a sense, our meaningful comments. I don't mean to pick on you Mike. It's how things are occurring and the risk that is before me and my constituents. It's not just bowhead whale, it's the other resources as well that are in the environment. The other marine mammals. I just want to make you aware that these are real concerns to us. I have to look back at some of the NPDES permits that are being subjected to and I see some of the employees coming in and out from the EPA, but the concern is they have their limitations as well. We try to work with them, and yet they have their limitations. The government can only do so much. Even look at the federal governments financial situations they are dealing with. They are being asked to cut back on their funding, their expenditures, having a presence in the communities to discuss these serious issues. When agencies' travel funds are being slashed in half or three-quarters, the budget taken away, what meaningful input do we really have to address or voice concerns? I'm trying to think of other matters. Like I said, I don't have all that information before me and the different organizations that we have to deal with and voice our concerns, and yet some do get heard and some don't. Working with a company like Conoco, we've struggled at times. We know we've had good working relations and we've had some bad working relations. It remains to be seen how we go forward in the future. Still, AEWG would like to continue being on the table to help steer, maybe provide some ideas, meaningful ideas, that having communications and working with what limited tools we have in our assets to work with you. I share these concerns with you because I've been chosen as the commissioner to voice issues and concerns of my constituents, 167 whaling captains. They are not all here, and we are not in the villages, and these are their concerns and issues that are before us. Like I said, we are the ones that are put at risk with very little tools to work with and financial support in a sense. I share these concerns and again, thank you Mike. I'm not personally picking on you. It's how things are occurring and how we perceive things.

A: Mike Faust, ConocoPhillips: It is totally okay, Harry. I certainly appreciate your concerns. I'm not a subsistence hunter, so I probably don't truly appreciate it personally, but I am a hunter, and I hunt every year. If someone came to me and said where I do my moose hunting, they are going to come in and drill, I would be pretty concerned. Your concerns are absolutely valued, and we don't ever get tired of hearing about it. You keep saying it over and over, and we will keep trying to listen and trying to work with you and figure out a way to strike a balance and not cause a problem. One thing I can promise you is we won't discharge anything harmful. We have got to work through a clear understanding of what that means. We don't plan to use oil-based muds. We are going to use a water-based muds system, and we can demonstrate the chemistry of that and show that it is really extremely benign and won't cause any kind of a problem. But it is incumbent upon us to convince you of that. We need to bring that forward and show you in a way that makes sense and that you

are comfortable with. We pledge to continue to work with you. We deliberately have gone slow to make sure we understand and work these concerns and are happy to keep doing that.

C: Lisa O'Brien, Facilitator: Okay...

C: Mike Faust, ConocoPhillips: Lisa, one thing. I think there is a copy of the presentation on my seat. Could you give that one to Harry? It's at least one copy--sorry. We'll bring hard copies next time so everyone has them. I apologize for that.

C: Lisa O'Brien, Facilitator: And just for the record, the five years I've been involved, we ask presenters to send their information ahead of time. We ask presenters to give it to us after the sessions so it can go into minutes. All we can do is ask and those of you who actually read the meeting notes, knows the results of those requests. That's all we can do.

Q: Robert Suydam, NSB: Mike, welcome back to OWM. I'm sure you really missed it over the last couple of years. We certainly appreciate ConocoPhillips coming in, and Statoil yesterday as well, years in advance to talk about plans. I think that is a real positive and helpful way to go forward so thank you for that. Just a couple of quick questions for you and a question for NMFS; have all of the site clearance and shallow hazards work been done for the drilling or is Conoco expecting to do anything like that in 2013? There's my first question.

A: Mike Faust, ConocoPhillips: We are complete with all that kind type of work.

Q: Robert Suydam, NSB: Okay, that's what I thought. And then, your description of the jack-up rig was helpful for me and interesting. A quick question about the capping device that is sitting on the ocean floor; when I think of a capping device, I think of something that is lowered down onto a well head or something like that. The way you described it, it sounds like the riser actually goes through the capping device and it's more like a BOP [blowout preventer] instead? Could you clarify?

A: Mike Faust, ConocoPhillips: It's not a BOP. There is a well head that sits on the sea floor and then the capping stack sits on top of that, attaches to that, and that is the device that would actually shut the well in down there. The riser then attaches to the top of the capping stack, and the drill pipe goes through all of it. It's kind of like a BOP, but you'd have...I should have brought a picture. It really is a large, square device; it weighs 150 tons, so it is an enormous piece of equipment. It has a bunch of high pressure tanks that are hydraulic, so you can trigger these tanks, and they will release all the gas and force the hydraulics to shut the well in. It is very strong. It can shear through the drill pipe. It can shear through drill collars. It is not a full BOP. It doesn't have all of the same capabilities that a BOP has. It doesn't have chokes; it doesn't have flow lines to allow the oil to get out of the side or gas to escape out of the side. It truly is just a cap. It just shuts everything down. So in terms of containment, the wellbore itself and the way we have designed the casing is, regardless of whatever pressure we encounter or what is down there, there is no way the hydrocarbons could breach around the casing. This is the ability to then cap it at the top so you would contain it all in the well bore.

Q: Robert Suydam, NSB: Alright. Thanks for that explanation. Candace or Jolie, I guess I've never seen an IHA submitted two years before activities are planned. How does NMFS deal with that in terms of timing and when something might be federal registered? That kind of thing.

A: Jolie Harrison, NMFS: We have had people before hoping to get authorizations in advance to help with contracting and permitting issues, and we've only indicated that we would be comfortable issuing an authorization up to a year in advance, but not really more than that.

Q: George Edwardson, Inupiat Community of the Arctic Slope: I am President of the regional tribal government for the north where you are proposing to go. I have a question and a quick comment for you. My question is, there is a piece of ice coming in 20 miles in diameter, four feet thick coming at you at four knots; how many hours do you have to move?

A: Mike Faust, ConocoPhillips: How wide is it did you say?

C: George Edwardson, Inupiat Community of the Arctic Slope: Twenty square miles.

A: Mike Faust, ConocoPhillips: We would be able to see that several hundred, at least 200 or 300, kilometers away. We would be tracking and watching that probably for days and moving ice vessels up near it to push it out of the way. Essentially to push it out of the way would be our first defense. We have an ice alert system that you put a ring around the well, and if ice comes into that ring, you stop all operations. There is another, closer ring that says once it comes to that point, you have to shut down, jack the rig down and get out of there. Those rings change. They are based on what operation we are conducting and on the speed and the motion of that ice. If it is moving quickly, obviously that ring is a lot bigger and it's all based on the calculation of how quickly it would take us to finish what we are doing in the well, completely jack down and get out of there so the ice doesn't collide with the well bore.

C: George Edwardson, Inupiat Community of the Arctic Slope: I'm looking at time.

A: Mike Faust, ConocoPhillips: A lot of these things are on the order of, depending on what we are doing, less than 12 hours. Some of the operations, depending on what we are doing, may take more like 24 hours. That's why we monitor it. Typically it would be 50 miles. If you had ice enter 50 miles within the rig, you would begin shutting down operations. Certainly by the time the ice got within 25 miles, you'd be out of there.

C: George Edwardson, Inupiat Community of the Arctic Slope: So are you saying 12-24 hours is what I was looking for.

A: Mike Faust, ConocoPhillips: That is for a typical operation. It depends on what you are doing, but that's about right.

C: George Edwardson, Inupiat Community of the Arctic Slope: That's a lot of time.

A: Mike Faust, ConocoPhillips: It is.

C: George Edwardson, Inupiat Community of the Arctic Slope: And just a comment here for you. I live in an area where people have to live off the ocean. The fat in the animal is what I cannot produce, and I need that in order for us as a people to live there. In the whole North American continent, I have the highest suicide rate, and it's fear about what you are about to do in the Arctic ocean, that's what causing a lot of the children, young people to do themselves in. There is no way to keep them alive. You know, when I see your pressure coming in, it gets hard. The federal government, of all agencies, I deal with the U.S. federal government on a government-to-government basis and every time they let an oil lease go, or go into the process of letting a lease, we do not receive a single penny from the federal government in order to talk to people like you. The federal government is renegeing on their responsibility. I receive nothing to deal with oil development. I receive nothing after its been discovered, after its been produced. As a tribe, we never received a single penny from Prudhoe Bay or from the NPRA. This is our jurisdiction. This is our land. And you deal with the state and the federal government. I hear you comment on how well the state is going to do. This is making money off of federal land. I get nothing as a people. I just wanted to add on top of what Harry said. Thank you.

C: Bill Streever, BP: I just wanted to comment about requesting presentations and papers before the meeting. The issue with that is the agenda continues to change, not only here, but even right up to the last minute before the meeting, so we really can't have both. We have to have a locked-in agenda so people know what they are talking about well ahead of time, weeks ahead of time. I was still having materials requested as of last Friday, so that just doesn't work. I think it's hard on the presenters to say they need to turn in things early. They can't do it. It's not really possible.

C: Lisa O'Brien, Facilitator: Fair point.

Q: Dolly Norton, Barrow: With all the scientific data that you have, did you, or have you, tracked the migration of the mammals since 1996? Have they changed drastically from where they end up? You know, the weather is, and I was just wondering if you did actually track all the migration of the animals in the ocean?

A: Mike Faust, ConocoPhillips: That's a great question. Thank you. I know we have been involved in tagging activities that the government has done. We provided funds for that. We have also been involved in others of those kinds of studies, but I'm not the biologist, but I have her right here. Caryn, can you answer that for me please?

A: Caryn Rea, ConocoPhillips: Like Mike said, we have provided some funding for ISC to do some tagging in the last number of years, but not certainly not since 1996. In the early 1990s, scientists like Janet Clarke did some work. They did some marine mammal monitoring around the well sites. Since we've been looking at marine mammals since 2006, there are animals that were not seen visually but were detected on recorders like Minke whales. We've seen some transient orcas moving through our lease blocks. We've picked up calls of fin whales; we've seen or heard some humpback whales, so there are definitely some changes going on. We, as a scientific community, don't have 30 plus years of information, but certainly within the last five-six years we're hearing and seeing some interesting animals moving through. The work that AEWG, NSB, and Fish and Game have done with the bowhead tagging has been phenomenal. Right now our scientists are talking with Janet Clarke and Megan Ferguson doing the NMML work, and I think Janet's going to speak next, trying to see if we look at all of our data holistically. Looking at data the BWASP program has been collecting, the data we've been collecting, not only on our vessels, but with our acoustic recorders, then looking at the data the Borough and AEWG have collected on tagging, and even some of the ice seal work that John's group has been doing, we're trying to piece it all together. In short, we are seeing and hearing animals that I don't think have been heard moving north.

Q: Kate Clark, NOAA: NOAA has not seen your exploration plan or your oil spill response plan, but we do look forward as a cooperating agency to looking at those in the future. One of the things that NOAA is concerned about is a late season spill, you know, last day of operations. Can you just comment on the October 15 date and if you feel that date is sufficient for addressing a spill that could occur on that day?

A: Mike Faust, ConocoPhillips: Yes. The open water season generally runs on our location until very late in November. Our plan would be to ensure that we have penetrated all, any horizon that could potentially have hydrocarbons in it, and leave us enough time to be able to drill a relief well. If you have a 30-day relief well and ice comes towards the end of November, then we would be able to deal with it as long as we were done drilling by the first, maybe the third, week in October. That is very much part of our plan, to ensure we have enough time to completely kill the well. Again, we have a surface BOPs that are like an onshore rig; very easy to manage and handle that. Then we have a redundant system on the sea floor to cap and shut off the well before the spill ever occurs. If all that fails, we have enough time to drill another well to kill the well we are on.

Q: Earl Kingik: I am 100 percent behind what Harry had to say. Because when Shell, ConocoPhillips, all you other people, go out to the villages, you hear people ask the same questions what Harry is talking about. While we are here, the mammals are beginning to migrating north right now. What are they going to go home to? What are the sea mammals going to go home to? They will see a lot of activity that they've never seen before. They saw a few during WWII when America brought all their ships up here. They saw a few when Prudhoe Bay oil field was being developed. Now they are going to be seeing a lot of ships. It reminds me of my brothers and sisters down in the Lower 48 when they were losing their buffalo. They were crying for their buffalo, for their meat. Now we will be crying for our sea mammals to help protect them. My question to ConocoPhillips is how many MOUs and how many CAAs have you signed with the impacted communities? That's the question that always comes from the villages. Do you have a MOU signed and ready to go? Do you have a CAA ready to go? That is the question I am asking you because our sea mammals are migrating right now. They are heading home. They are going to have their young ones and then they are going to head back south. We are concerned about the sea mammals up north.

A: Mike Faust, ConocoPhillips: That is a very good question. Thank you. I don't know the exact number of CAAs that we've signed. I know we have signed several in the past. Every year when we have operations and we are out in the Beaufort or the Chukchi Sea, we work diligently, carefully and thoughtfully to try to reach agreement and sign the CAA. That is our goal every year. We didn't have operations last year, but we participated in the discussion, and we told Harry and everyone that if we had operations, we would sign this year. We were happy with the way that worked out. Our goal will be in the year we go out there and have operations is to sit down, do the same thing and work out an agreement we feel comfortable with signing. Absolutely. Does that answer your question? Yes, okay.

NMML Arctic Marine Mammal Studies Update

Janet Clarke, SAIC

Introduction by Robyn Angliss: I'm with the National Marine Mammal Laboratory (NMML) which is part of NMFS in Seattle. We have a number of Arctic research projects going on right now, some of which is funded by BOEM. We are lucky to have Janet Clarke with us today to present one of the most important studies that provides us with long term information on the patterns of marine mammal distribution in both the Beaufort and Chukchi Seas. So Janet, thank you very much for your help and take it away.

My name is Janet Clarke. I work with Megan Ferguson on the aerial surveys on Arctic marine mammals program. I am going to start with a bombshell: BWASP--the program we all know and love--is no longer with us. It has been replaced by Aerial Surveys of Arctic Marine Mammals (ASAMM). It's young, it's hip. It might help if we all say it together, but we'll do that at the end if there is time. The program ASAMM is sponsored by BOEM, as it has been for so many years in the past. The objectives have remained the same, they have increased over time, but the main ones are to monitor bowhead whale migration and investigate inter-annual variation in mammal abundance, distribution, habitat and behaviors of all mammals observed. Our program definitely has a cetacean focus, but we do collect information on all marine mammals we see, as do the other projects you have heard about. Bowheads remain our principle species of focus. We're interested in looking at the migration pathway, temporally and spatially, but we collect information on abundance, distribution, habitat and behaviors of all the marine mammals that we see. One thing about our project that is a little bit different from a lot of the projects we've heard about over the last couple of days is we have very wide areas, so we do bring to the table a broader-based approach to looking at Arctic marine mammals and ecology.

(Displayed slide that showed study area from the Canadian waters to the International Date Line.) This incorporates not only the BWASP area but also the area formerly known as COMIDA (Chukchi Sea Offshore Monitoring in Drilling Area). ASAMM has absorbed both of those projects and now manages them as one. The slide shows the 2011 flight. There was a Barrow-based aircraft from June 17-October 21, which was our last flight. We were based out of Deadhorse from August 19-October 24, which was our last flight. Our protocol is essentially the same in both areas. We fly perpendicular transect lines in the Chukchi Sea. In one year, we always fly the same lines, so what looks like not a lot of effort actually is because it's (flown) over and over again. In the Beaufort Sea, we fly random based transects, so every day we fly will be a slightly different line. Our survey areas do incorporate the active lease areas in both the Beaufort and the Chukchi Seas.

In 2011, we flew almost 400 hours with about 190 on transect; over 100,000 kilometers with about 40% of that on transect. The best effort was in September. We had two aircraft present the entire time and decent weather. October you will notice was not so great. Even though there were two

aircraft present for most of the month, we had strong winds, low ceilings, snow, ice, fog, and sometimes all of those at the same time, so we were not able to survey nearly as much in October as we normally do.

2011 Sighting Summary

All the usual suspects showed up this year plus one new partier. I highlighted some of the results that stood out to me. First, was the number of bowheads: 112. That is extremely low from what we normally see. In any given year that we have been surveying, we can see upward to several 100 bowhead whales over the course of the season. This is probably due to a few different things. One I just mentioned. We weren't able to fly a lot in October, which is normally a time period when we see a lot of bowhead, not only in the Beaufort but also coming into the Chukchi Sea. As was mentioned yesterday, the migration for all intents and purposes was late in 2011. We saw that from our data in September (not a lot of sightings) so not being able to fly in October probably cut down on the number of sightings. The other thing we did not see in 2011 was any large aggregation of bowhead whales. In most years, we generally see large aggregations of feeding whales often times near Barrow, but not always. It can be scattered around. We didn't see that at all. The largest group in 2011 was six bowhead whales, and that's pretty different for us.

Belugas

I highlighted that number because I look at that number as an old timer and think, well, that's not so special. But from 2007 to 2010, beluga sightings were extremely low. In one year we actually saw 15 belugas total. Not sightings, 15 belugas, so while this number doesn't stand out in general, it stands out to me at least in that it is different than what we've been seeing in recent years. This is much more normal to what I expected to see. Minke whales are our new partiers this year; new to us, at least. I know other projects have seen Minke whales. We had six confirmed Minke whales and five probables. Finally, the number of walrus is quite high, over 110,000 walrus. That does include repeated sightings of the Point Lay haul out, but even when those were taken away, we still had several thousand walrus sightings. That is a species we see a lot of.

Bowheads

For those of you who are used to seeing this data presented each year, the bowheads are kind of spotty. In the Chukchi Sea, you do see a couple of outliers out mostly in June (those are the yellow boxes on this slide). We saw bowheads in every month that was surveyed. The Beaufort Sea sightings are where we normally see them, on the shelf for the most part, depths between 20 and 50 meters. The sightings (displayed in green) in the central Alaska Beaufort are kind of unique. This is a rather unique circumstance that we had this year. Most of you are familiar with the satellite tagging program that has been going on for several years also sponsored by BOEM and done by ADF&G and several other organizations. One of the bowheads that was tagged in summer of 2010 in Canada underwent a normal migration down to the Bering Sea in winter, migrated back into the Canadian Beaufort, but in June started to come back into the central Alaska Beaufort Sea and hung around for several weeks. In mid-July, our survey crew based in Barrow had an opportunity to check out the position of that whale. We received the position of that whale, flew directly over there at a higher altitude, descended our survey plane down to survey altitude and immediately found several whales. There was a minimum of 12; there were likely more. Our plane stayed in the area for a little over an hour doing concentric sorts of survey lines, squares, around the central location of the whale and then flew farther to the east and found four additional bowheads before they had to return to Barrow. The sightings are interesting for a number of reasons. First, it shows really good collaboration between two different types of projects, aerial surveys and satellite tagging, and how

the two work hand-in-hand. This was of sort of a ground truthing of the satellite tagging. We know that satellite tagged whale represents one whale; it's a whale that has a tag on it. In this case, that tag represented at least 12 bowhead whales. Another interesting thing about these sightings is while bowheads have been seen in the area in summer; the summer in the Beaufort hasn't been surveyed that much. In the past, in July, this area was often times completely ice covered. We assumed that all the bowheads would be in the Canadian Beaufort, the Mackenzie Delta, and Amundsen Gulf. There are few circumstances where bowheads have been found in this area in summer. They have often shown pretty directed movement to the east. The behavior of these whales was not directed in any way, shape or form. There was milling, one whale had mud on its rostrum, displays including breeches, body slaps, resting. In other words, between what we saw--albeit in a brief time--what the tagged animal had shown us over a few weeks, these whales were just hanging around there. The tagged whale, about a week after these observations, headed back to the Canadian Beaufort, and I think that is where the tag finally expired. This does show the central Alaska Beaufort could be very important to the bowhead whale, not just as a migration path in the fall, but also during the summer.

2011 Gray Whale Distribution

These are all sightings, all efforts (displayed). This is the principal species that we see. We saw them in all months, with peak sightings in July. Sightings dropped off after that. A lot of the green sightings on the slide are July sightings. A lot of sightings were near Barrow and Wainwright. We can pretty much take off from Wiley Post Airport and see gray whales as soon as we take off, so it is a very common species, and we over fly the area as it is also our transit path to get to our survey areas, so we overfly that area quite a bit. We are starting to see gray whales a little bit farther off shore in this area (*displayed on slide*), and we see them creep off a little bit more each time we are flying. We did see gray whales near shore between Pt Hope and into Ledyard Bay, which is an area they have been seen before both by this project many years before and by these researchers. The top circle indicates Hanna Shoal and once again in 2011, we had no sightings of gray whales, which is quite different from what we used to see in earlier years.

Minke Whales

Minke whales are our new players. There have been other Minke whale sightings up in the Chukchi Sea; these are new for our project. We had six confirmed whales. There were some probable sightings as well. They were categorized as possibles as these are whales our observers would see, sometimes briefly for the first time and they'd be pretty sure it was a Minke whale, but unable to verify the species. Every Minke whale we saw was reported with the same behavior: very flighty, hard to re-sight, not really very obvious about themselves.

Belugas Sightings

Belugas sightings were more the norm that has been seen, especially in the Beaufort Sea. Belugas have been seen, and are consistently seen, out on the slope. Scattered sightings in the shallower water but for the most part further out on the slope. Noticeable absence from these blocks (*indicated on slide*) which would be significant unless you remember back to an earlier slide that we didn't fly there. In the Chukchi is where I find the beluga data even more interesting. We saw them every month, not just in summer and later in fall. Our largest sighting was very near shore south of Point Lay with groups of 150 on more than a few days in late June/early July. Many of our other sightings were of single belugas rather than pods. The July sightings were on the same flight we saw the bowheads.

Walrus Sightings

Walrus are the only pinniped I'm going to talk about because of time. Walrus are pretty significant; we see a lot of them up there. In June and early July they were on the shore fast ice, what was left of shore fast ice and off shore on the ice. The ice was pretty much gone in the study area by mid-July. After that time, all the walrus seen were swimming and heading toward shore. In early August there were a lot of walrus near shore, but not onshore until August 17, which was the first documented haul out near Pt Lay. The group size of the haul out was anywhere from 1,000 minimum to 18,000. They definitely weren't all there because on any given day we saw them swimming off shore as well. The walrus were on Hanna Shoal as well. This is confirmed by the tagging data from the USGS.

Cumulative Data 1982-2011

As you know, ASAMM has been doing this project for many years. This is a data set for 1982 through 2011 for light ice years (displayed). For the most part, the distribution in the Beaufort is consistent with previous years. In the eastern part of the Beaufort Sea, sightings in 2011 were significantly closer to shore and in shallower water. We generally see that when there are feeding groups, but we didn't see any feeding groups this year, so there is something else going on there. In the western part of the Alaska Beaufort, there was no significance in the distance from shore or depth between 2011 and previous light ice years. We are adding to database bowhead whale sightings in the Chukchi Sea. We did manage to pick up a few outliers in 2011, so the Chukchi data set is expanding, but we are finding from our data, the acoustic data, and tagging data, bowheads don't have a very defined migration corridor in the Chukchi, at least not like we see in the Beaufort.

This slide (displayed) shows feeding/milling by month and group. Essentially, wherever we flew in the shelf in the Beaufort Sea, we found feeding and milling bowhead whales. One thing that stands out is there are a few places where feeding and milling whales in larger groups tend to be found. Areas between Point Barrow and Smith Bay, near Cape Halkett and northern Harrison Bay, and another group close to Flaxman Island. The larger the symbol, the larger the group size; the largest size indicated is 20. We actually have groups of feeding whales of over 100 animals in one area. The database goes back more than 30 years; trying to pick out parts of it to do a presentation is somewhat difficult.

This slide shows gray whale sightings (displayed) and it is similar to the bowhead slide shown previously. The green diamonds are cumulative, black diamonds are current year. The slide shows the whales moving a little bit off shore. The predominate behavior for gray whales is feeding. Looking at gray whale habitat preference, the area closest to shore is the shallowest water, around 35 meters. The two tan areas are 51-200 meters, and the area between the two is 35-50 meters. I have divided the data between historical years. The ASAMM in the Chukchi was from 1982-1991, a gap of 17 years, then started again in 2008. I refer to earlier years as historical versus recent. Looking at the distribution (dark blue diamonds versus light blue), you can see a change during the 17 year gap. There were only two or three sightings in recent years at Hanna Shoal, and the whales were not feeding. The highest sighting rate for depth zone, whether looking at historical or recent data, is in 51-200 meter south depths. Pretty much in any month in summer or fall that they fly that area, they find gray whales, usually feeding, in that area. But if you look at what was observed in the early years, the highest sightings were in shallower water near shore. What we are seeing now is that they are farther offshore so the highest sighting rate in recent years when you eliminate the southern 51-200 depth sightings, is going to be in slightly deeper water. Because they are feeding, it is most likely because that is where their food source is located. They are probably following where the food is.

Belugas

What we saw in 2011 is pretty indicative of what has been seen in the past for beluga sightings. Our efforts in 2011 in the Chukchi allowed us to greatly augment what we've seen there before. That is one of the things we are going to look at it in more detail.

2012 Plans

We will be flying again next year. Flights are scheduled for the Chukchi component, Barrow based, from July 1-October 31. We will fly out of Deadhorse starting July 16-October 20 in the central Beaufort Sea. We are always looking at ongoing analyses and because of the size of the database, the possibilities are endless. We are looking at new bowhead whale migration corridor analysis and updating Sue Moore's work that was published in 2000 on bowhead whale/gray whale/beluga habitat preferences. These data went through 1997, and we now have another 15 years of information for the Beaufort Sea and want to incorporate these data. We are interested in integrating our visual data with acoustic data. We fly off shore farther than anyone else and fly over all those records and so we are interested in integrating these two data sets. As we collect data on all species, we'd like to look at bearded seal and other pinniped habitat analysis. We are also interested in talking with other researchers about collaborations, i.e., looking at ASAMM aerial data and the data that have been collected by industry vessels. We are working closely with USGS and USFWS with the walrus information. We have, especially for the off shore areas, the best data compared to these agencies, so we have been working with them in the field and on analyses. The NMML website, <http://www.afsc.noaa.gov/nmml/cetacean/bwasp/index.php>, is where during the field season, reports are posted within 24-48 hours, along with a variety of annual reports and a link to the ASAMM historical database.

QUESTIONS & ANSWERS

Q: Harry Brower, AEWC: Thank you Janet for your presentation. I just wanted to share your observations on sightings for gray whale and bowhead. I noticed on some of the depictions up there you didn't see any gray whales in the Beaufort, but when you showed your COMIDA (*Janet moves to slide Harry is referring to*)...there you go. The gray whales were sighted in Barrow and eastward. You are right. We see a lot of them in the runway in Barrow and more recently we seeing them further east in the Beaufort Sea right out of Cooper Island and Takaluk Islands. These were the areas we were sighting last summer. In regards to the bowhead, I wasn't sure, I didn't get the date when your project ended in the Beaufort Sea. I wrote October 24 for some reason, but is that the date you quit your aerial surveys or was it earlier than that?

Q: Janet Clarke, SAIC: In 2011?

A: Harry Brower, AEWC: Yes.

A: Janet Clarke, SAIC: We were flying in the Beaufort until October 24. That was our last flight.

C: Harry Brower, AEWC: Okay. Yeah. That is about when we were just getting started with our whaling activities, and we were seeing them right off of Point Barrow and further east. I agree with your comment about the whales not having a presence early this year. There were some sightings early on, but then later the numbers seemed to diminish. The whales being caught at that later time, we're having to travel outside the ice fringes, where the open water and the ice edge, that's where we found them. A lot of whales just north of Barrow. This was from like the 24th of October to the end of October. I just wanted to share that observation with you.

A: Janet Clarke, SAIC: We actually tried to stay until the end of October. I should mention that those were our last flights, October 21 based out of Barrow and October 24 out of Deadhorse, but it

doesn't actually give you the whole picture. The plane actually remained in Barrow until October 26 and in Deadhorse I believe until the 27th, but we weren't able to fly so when we looked at the forecast for the next several days, it was pretty clear that we weren't going to be able to fly so at that point we basically said it's not worth spending this money to stay when we are sitting on the ground.

C: Harry Brower, AEWC: The weather was different in terms of what we have observed in the past and coincides with our observations, in my observation I guess I should say, in terms of whaling activities last fall. We had some weather fronts that were kind of unusual at that time. Thank you.

Q: Leandra De Sousa, NSB: I know you didn't represent seals, but I'm curious. What was the most abundant seals you had and if there was any difference in their habitat distribution?

A: Janet Clarke, SAIC: See, I'm prepared. (*Showed slide with seal distribution.*) The most abundant seal we saw is known as an unidentified pinniped. We fly at 1,200-1,500 feet, and distinguishing between a ringed seal and a spotted seal at that altitude is pretty freakishly hard. We can distinguish, obviously, walruses and bearded seals and so the bearded seals you can see up there are pretty well scattered. The unidentified pinnipeds...we haven't looked at the data to tell you the truth to see if there was any big difference in 2011 versus previous years. But, just looking at the distribution over the course of 2011, without going into details about temporal changes or anything, I'd have to say that it overlies what we've seen before. That's a nothing answer, isn't it?

A: Leandra De Sousa, NSB: Thank you.

C: Jim MacCracken, USFWS: The COMIDA surveys have been a great service to us in finding where these coastal haul outs are showing up and the timing of that. I understand COMIDA surveys are only funded through 2013, and I wonder if there were plans to pick that back up or if that's even correct?

A: Janet Clarke, SAIC: I would defer to somebody who is not me.

C: Jim MacCracken, USFWS: Okay.

C: Janet Clarke, SAIC: Personally, I would like them to go on indefinitely. Dee is going to take that.

A: Dee Williams, Alaska BOEM: Funding is always a year-by-year case. Right now we do intend to continue with the program. We've consolidated them, as Janet explained, mostly for ease of bureaucratic management. Janet, can you confirm the funding cycle is good through 2013? It is what my memory is, but the point is we have no plans to change our ongoing survey efforts. There will be a time at which we have to look at the urgency of the continued information of an annual survey effort as opposed to a less frequent survey effort.

C: Raphaela Stimmelmayer, NSB: Leandra kind of asked the questions about whether there was anything unusual. The North Slope Borough would be very interested to look at 2011 data in respect to seals. It doesn't really matter if it is unidentified seals--pinniped is good enough. Thank you.

A: Janet Clarke, SAIC: We would be happy to work with you on that. Seals, as I mentioned, is a rather cetacean-centric survey. We do collection information, but in all honesty, cetaceans end up taking most of our time, but we are happy to work with other researchers who are interested in the data as well.

Q: Darren Ireland, LGL AK Research: Thanks Janet. We talked a number of times about the data and some of the derivatives that can come out. One of the things we heard a couple of times was about the delayed migration perhaps this year in bowheads. They didn't show up as early and so on. The data set serves a wonderful purpose for long term monitoring of these types of things. What do you think the power of it is to really tell us on annual basis the difference from one year to the next is? With the sampling design and the effort, in that way it seems pretty limited. We're often challenged looking at our industry surveys and impacts, to analyze and look at what we really can

say from the data and how much power and meaning there is behind that. What do you think the ability is to look at on an annual-to-annual basis at some of the differences we are seeing on those?

A: Janet Clarke, SAIC: I will defer to Megan Ferguson for that. Megan? Dang, she's not here.

A: Robyn Angliss, NMFS: Thank you for that question. I don't remember the exact change in migration that BWASP was designed to detect, but I remember it was lines about ten miles of change in migration. The purposes of the Chukchi Sea surveys are a little different. I think they are more for broad scale distribution, and so I don't know if we've done a power analysis, but bottom line is that the objective is different and so we would have to look at it a different way.

C: Janet Clarke, SAIC: To add to that, MMS did a power analysis several years ago. Megan Ferguson has done a more recent power analysis and based on that power analysis, we are looking at other ways, new ways, more refined ways that we can look at the migration corridor on an annual basis so, I jest, but Megan would be the person to talk to about that. We are definitely looking at that. Because we have such a broad area we need to cover, there are limitations as we talked about. We can cover an area tightly and get a lot of data or you can cover broad area and our objective is this very broad area. There are always going to be limitations, and in a year like this one when we just didn't have as many sightings, it certainly is harder to talk about what the migration corridor was.

Q: Susanna Blackwell, Greeneridge Sciences: I just have a question regarding the different sampling regimens in the Chukchi and Beaufort. I imagine it is because of historical reasons, that is how it used to be done, but now you have a new name, have you thought about trying to sort of standardize it so that there are not those difference in how the data are collected?

A: Janet Clarke, SAIC: There are actually very few differences in how the data are collected in terms of what our survey protocols are. The only differences really are in how the lines are set up. The Chukchi Sea area was flown for many years in the same kind of, roughly north-south with randomized lines. In fact, in 2008, when we started flying in the Chukchi again, we did that. But, we reoriented the lines perpendicular because we feel that is a much better sampling for the Chukchi Sea, going across bathymetry, across currents, across perceived migration paths, and came up with using the same lines. I should mention that those lines change every year, so the idea is over several years, we'll essentially sample the entire study area. We choose to stay with the BWASP model in the Beaufort because there is this 30-year database and to change it now, we just didn't feel there was enough good reason to do that. I didn't show a figure that shows our effort in the Beaufort Sea over the 30 year database, but I can describe it to you. If you just look at the Beaufort Sea area and color all of those blocks, with the exception of eight, nine and ten black, that is what it would look like. We've essentially covered every square foot of that and that is our intention, to do the same thing in the Chukchi as well. So with the exception of how the transect lines are flown, in other words the start and end points, the survey protocol in the two areas are exactly the same.

Chukchi Sea Environmental Studies Program

Robert Day, Senior Scientist, ABR Inc.

This is presented on behalf of myself and all the members of the research team. The funding for this program came from ConocoPhillips, Shell, and Statoil. It went to Olgoonik Fairweather which has done a magnificent job of organizing us, keeping us heading where we need to go, and Sheyna Widsom, in particular, of Fairweather Science deserves an award for being able to herd all of these cats you see in the lower part because these are all various groups--universities, private companies--that have all come together to put together this really good scientific program. The Chukchi Sea Environmental Program is a multi-year, multi-discipline oceanographic study prior to oil exploration in the northeastern Chukchi Sea. They obviously are needed for a variety of reasons: permit applications, NEPA documents, its baseline data, and input into planning future operations and mitigation.

The Program from 2008-2010

The program has ten components altogether; we will talk about nine today very quickly. It is set up on a pattern of three cruises per year: July-August, August-September, and September-October, with pretty good temporal overlap in the three years of our sampling. There are a total of three main study areas. In 2008 and 2009, we only had Klondike and Burger. Statoil came on the scene in 2010, and we added the Statoil study field that year. Along with scientific data, you will see some sampling from what we call the transitional stations. Each study area, Klondike and Burger, is 30 x 30 nautical miles, a little over 3,000 kilometers in area. Statoil is shaped slightly different, but has the same total that sampled. So our total study area is about 10,000 square kilometers. I want to point you to a couple of important things. One is the depression in the shelf, this is called the Central Channel, and I will talk about this quite a bit. There is a current that flows through it. Along shore you have another depression. You have Barrow Canyon; the head extends quite far up the shelf, all the way to Wainwright. And then you have an additional shallow area that affects the flow of water. There are a series of both fixed and random stations. The fixed stations are 7.5 nautical miles apart in a grid. The random ones are used to provide better statistical power, for the benthic studies in particular. They are randomly selected and are added to the grid area in the transitional area. One of the important things to point out is the story I am going to tell you that emphasizes the fact that these areas are extremely different. They operate very differently, and we're only talking about 14 miles apart. If you sent out three different scientific teams, each studying one of these areas, what each team would conclude, you'd point to each other and say you are crazy. It doesn't operate this way at all. I've never seen a system where you could have such dramatic changes environmentally in such a short distance. I think it is really fascinating. The really nice thing for us is that as a scientific team, we've all been able to do the work in all three areas which I think has given a lot more scientific power to determine what is going on. We try to sample all of our primary lines if we can, and secondary survey lines are surveyed as time permits. We go up 30 miles on one survey line, go over two miles, and go back down the next one, over two miles, up the next one. On a good day we can get three in a day. On a bad day, like we had last year, you don't get very many. We also have a third type of sampling, the acoustic program, led by Dave Hannay and the folks at JASCO. The acoustic moorings are laid out in a series of lines so, there is a Cape Lisburne line, Point Lay line, Wainwright line, and a Barrow line. Within each of our study areas, there were arrays of moorings. We ended the array program in 2010, but we also have one or two moorings in each box now.

Tigersoft Data System

There has been some discussion on data entry issues. I just want to talk quickly about our Tigersoft data system. The software was created by a guy out of Las Vegas that consists of two parts, TigerNav and TigerObserver. TigerNav has a steady stream on navigation information; on ship speed direction, those types of things, plus environmental information. We have a weather station on the boat that is continually downloaded and a flow through salinograph, so we are constantly recording sea attributes including salinity and I think flowmetry. This goes into one part of the system. At the same time, we have custom written software for each of our disciplines under TigerObserver. It's really nice. For example, if you are recording and studying marine mammals, you hit a button and it automatically logs the location, all the water depth, environmental information, those types of things, and you fill in your marine mammal information. The two components are merged together in a database that is standardized and REI does the data management for us here in Anchorage.

Currents in Chukchi

Think about the Chukchi as a slightly tilted table so that the water flows northward into the Arctic Ocean. The sea height is actually higher in the Bering Strait than it is in the Arctic Ocean, and the table is tilted slightly so the water flows downhill. What you have are high and low points on the shelf that actually orient this flow into set currents. You have Wrangell Island, Harold Shoal on the Russian side, and Hanna Shoal on the American side. This creates avenues for water to flow. You have the Alaska coastal current, which is low salinity, low productivity water coming out of the Bering Sea, and it exits a shelf via Barrow Canyon. On the western side, you have the Siberian coastal current which is seasonal. It only occurs in the summer. There are some very large rivers, and this water flows out and to the southeast and eventually mixes in this area where the bowheads feed in the fall. In the central part of the Beaufort is Bering Sea water and is a mixture of two water types south of Bering Strait. One is [inaudible word] water, a very high nutrient, high productivity water, and you have Bering shelf water. They mix and form this pretty high nutrient water that flows northward into two channels. One is through Harold Valley and the other is through the central channel with a side branch going through a shallow depression shown on the earlier map. This is productive water, particularly in the Hope Basin where the current slows down. This area has one of the most highly productive water in the world. A lot of the productivity falls to the bottom, and you have an enormous benthic community down here. Very high biomass; very important feeding areas for many marine mammals. There is a similar area closer to the study areas south of Hanna Shoal in the Burger and Statoil area. This water isn't flowing very fast. The currents are flowing, but the water up on the shoal basically sits there. It stands in place and therefore operates differently from what you see in this more pelagic system. This is the difference I am going to convince you of today.

Physical Oceanography

The water comes south of Bering Strait and brings heats, nutrients, plankton, fishes into the system affecting production in the Chukchi. The currents and winds affect ice melt off and movement patterns. You have warm water coming in and that melts a lot of the ice during spring and early summer creating the open water season. You can also have conditions under which you have very strong easterly winds that will push the ice that gets trapped onto the shoals and into the current where it can be melted or advected away. The winds are generally from the northeast and because of that, they are pushing against the current and the ice that is sitting on the shoals gets stuck there and has to melt in place most years. The result is we have two surface water masses in our study area, the Bering Sea water that is flowing in the current, the central channel, and up on the shoals you have what is called melt water, a very cold, low salinity water created by the melting of the sea ice.

This slide shows satellite images from current affect of ice retreat. It shows Wrangell Island, Harold Shoal and Hanna Shoal. You can see the warm water current, the coastal current, is melting the ice; in 2007, all the way past Barrow. It comes into the central channel, into Harold Valley, and between Harold Shoal and Wrangell Island. You see the same in 2008, but there is variability in the melt off and how it occurs. In 2007, all of a sudden the ice is basically disappeared from the shelf very quickly, but in 2008, the ice in affect sat there for another month or so. Winds can also affect the ice retreat in the spring bloom. There are two types of bloom. One is an ice bloom they figure is 10% of total annual productivity in the Chukchi Sea and the rest occurs in open water. Most occur at the ice edge, but occasionally under certain conditions can happen when you have a large open area form. This slide shows the difference on specific dates from 2008 to 2010. In 2008, what you see is there was pretty good easterly winds, but then it closed up quickly. In 2009, there was no open water at all. In 2010, there were very strong easterly winds. It opened up a large area. It became stable.

There was some melt off water which stabilized the water column; a massive spring bloom occurred. All of these things affect productivity system works and where that energy eventually goes.

Water-Column Structure

This slide shows the water column through Klondike and Burger study sites. On the bottom is winter water. When sea ice forms in the fall, it creates brine excursion which pushes all the salt to surface and out below it. This actually increases the salinity of the underlying water. In the middle of winter this is what the entire water column looks like, but as the ice starts melting and the Bering Sea current, that current in the central channel, starts flowing, it changes seasonally. You will see the edge of the Bering Sea water in the current, but over in Hanna Shoal you get a big patch of melt water that is very cold with very low salinity. Higher salinity water is starting to come out of the Bering Sea. As the summer progresses, the current gets stronger and starts forcing out some of the water and by September/October, in effect a large part of this area has Bering Sea water in it. Over in Burger, it is almost always winter water in the bottom with melt water on the surface. But there is a lot of inter-annual variability. One of the other things we learned was in 2008, the Bering Sea basically only made it to about northeastern Klondike. In that year, there was a real difference. You only had Bering Sea water over Klondike and only melt water and winter water over Burger. In 2009, it was very warm early on. There was no ice on the shelf by the time we got out there. The Bering Sea central channel current had cranked up, quite warm water with high salinity and had actually already pushed out much of the winter water already to the point by August/September, the entire study area except for a little sliver of northeastern corner of Burger which was melt water, the rest was all Bering Sea water. 2010 was fairly similar, sort of intermediate between the two. You had a layer of winter water but then the Bering Sea central channel got cranked up a little bit later than in 2009 and really started flowing bringing in really warm water.

This slide shows the Burger and Statoil study areas. Statoil was introduced in 2010. Here again you see this big pool of cold winter water sitting at the bottom over Burger and part of Statoil, but you can see this warm Bering Sea water coming around the edge. In effect what you have here is a current flowing around Hanna Shoal, a branch of it crosses through Klondike through a depression, and in some years actually covers much of the study area. The current seems to flow quite strongly in some years, and we're not quite sure why. The net result is these two systems are quite different within a distance of 14 miles. You see very cold water on bottom on Burger and Statoil, but can be quite warm at Klondike. In certain years you can push quite a bit of that cold water out, but it never seems to be able to push all of it out. There is quite a bit of inter-annual variability. 2008 was very cold with a lot of ice. It was persistent, and the Bering Sea water only occurred over Klondike. In 2009, it was warm early on, there was no ice on the shelf, and the Bering Sea water occurred everywhere. 2010 was intermediate. It was cold at first, but then warmed up quickly. It was warm later in the year. There was ice, but it was gone quickly.

Chlorophyll & Nutrient

In terms of primary productivity, this is where the energy flow comes from and feeds everything that is out there in the system. A lot of these nutrients are stripped out of the water further south, and the ones that are still left, by the time they get up here, are stripped out by this bloom. We rarely catch the spring bloom; in 2008 we caught the tail end of it. As a result, all the nutrients are trapped down low in the water column. The productivity falls down to the bottom. The only way the plants can get new nutrients is that it has to decompose the existing plants. That's what happens at depth, and it's called regeneration of nutrients, but generally the bloom occurs before we get out there. This slide shows various chlorophyll and nitrates in July to August and August to September over Burger, Klondike and northern Statoil. What you see is that in the surface layer there is no

chlorophyll. It is all at depth in all three study areas, and the nutrients are down there too. What has happened is the bloom occurred earlier, and the only nutrients that are available are the ones being regenerated at depth by the plankton that has fallen down there. By August/September, there is nothing going on in northern Statoil or Klondike in terms of productivity, but Burger seemed to have a small bloom that chunked along much of the summer.

Acidification

Ocean acidification has become a big issue. Carbon dioxide enters the atmosphere and is dissolved in water at the ocean's surface. Because cold water can hold more of this gas than warm water can, most of the carbon dioxide enters the water at high latitudes. This increases the acidification of the water. In addition, you can also have acidification occurring at depth because the primary productivity that is down deep decomposes, and it is also releasing carbon dioxide into the system. Therefore you can have acidification occurring in two different areas. The main structural compound that marine mammals use for skeletons is calcium carbonate. There are two types: Aragonite and Calcite. We use it in our bones, crabs use it in their shells, clam shells are made out of it, etc. There are two types of it, Aragonite and Calcite, with slight differences in the molecules. Aragonite is much easier to make than Calcite, and as a result acidification seems to affect it more. If we look at the plot (displayed) called the aragonite saturation state, in Klondike and Statoil it is quite similar. This is by depth, and we have sampled it at a variety of depths, and you see that it becomes more acidic as you go farther down. The dashed line that is marked at one, the thinking is that anything above it is that calcium carbonate is not going to dissolve; anything below it has a pretty high probability that dissolution will start to occur. Burger was very interesting. On our third cruise, it became acidic enough to start having dissolution of some of this calcium carbonate and aragonite form occurring. Calcite is a much more common form that you see. Aragonite occurs in otoliths, middle ears of fish, a few pelagic snails, and the thinking is that it occurs in many of the zooplankton that eventually settles to the bottom.

Zooplankton

There are two main faunas, oceanic and neritic, a shell fauna. Many species occur in both areas to some extent, although some are much more common than others. Seasonal onset conditions for zooplankton can change dramatically from year to year. There is also seasonal evolution of the community itself. These data (displayed slide showing Klondike in black bars and Burger in white bars) from 2008 show large zooplankton and large copepods. What you see is that oceanic faunas only occurred in Klondike. This matches what we saw in the physical oceanography. The Bering Sea water only occurred over Klondike that year. The shell fauna basically occurred everywhere and are much more common, but were more in Burger than in Klondike. Because of the dramatic physics that can occur among years, you can get annual variability in the zooplankton community. This slide compares 2008 and 2010. In 2010, which was warmer, the maximal number was twice that in 2008. Another area was ten times more than in 2008. A third area was eight times greater. So abundance can change dramatically inter-annually because of some of these onset conditions and as the spring season turns into summer.

Habitat Difference

In 2008, oceanic fauna essentially only occurred in Klondike, which is where the oceanic water was. In 2010, where this water was spreading across the shelf, you can see that it occurred everywhere. The zooplankton is just being dragged along by the currents and effects higher trophic levels that feed on them. In this slide, the comparison between 2008, 2009 and 2010 shows the change in overall levels of biomass abundance of small and large zooplankton; 2010 was a gangbuster year.

There are some years where it really is a good time and good place to be zooplankter and other times when it isn't. There is just not a lot there.

Benthic Differences

You have primary productivity where little of it is grazed by zooplankton in most years. In effect it falls to the bottom. Looking at the benthic community, Klondike is warmer and has less saline than Burger. This results in differences in circulation patterns in general. Burger has more mud and less sand, indicating a depositional environment. Statoil is in between. These plots (displayed) are for Klondike and Burger for 2008-2010 and Statoil for 2010. You see the percent of mud is much lower in Klondike than in Burger. It is about 25-30% higher at Burger than at Klondike. Statoil is intermediate. What does this do to the infaunal community? The same species are found in both areas, but in terms of abundance some are much more at Klondike, while others are more common at Burger. In terms of density and biomass, density in Burger is three times that in Klondike, and the biomass is about two times. Statoil is in between. It has about the same density, but the biomass is actually higher. There are fewer organisms, but they are bigger in terms of infauna at Statoil.

Another way to look at this is to look at the total community that occurs there through multi-dimensional scaling. This slide has dots representing a sample at a station. You count and identify all of the organisms that are there and then compare that community to all the other ones. Klondike stations pretty much all cluster together, the Burger stations cluster together with very little overlap with Klondike. The transitional stations are more like Burger, and when we added Statoil, it shows a fair amount of affinity with Burger, but there are some stations sort of like Klondike and some sort of unique to Statoil. In effect, we have very two different environments out there that is being shown by looking at the entire community as a whole. You can see that with some underwater camera images we had. This slide shows pictures of infaunal area differences. Klondike shows a diversity of species and tends to be sandier, sometimes rockier. Burger is basically mud for all practical purposes. It is covered with sea stars, brittle stars and a lot of other species. Statoil is in between. There are a lot of worm tubes, arthropod tubes and brittle stars.

Epifauna

Epifauna is the stuff that lives on the bottom. With the bigger species, we see similarities where the same species are found in both areas, they just differ in relative abundance. At Burger, the density and biomass both are about four times than at Klondike. Statoil is more similar to Klondike in terms of the epifauna. If we look at the MDS plot of the total community (displayed), again Klondike and Burger don't overlap very much with very little similarity in epifaunal community. Statoil shows, again, more of an affinity to Burger, some Klondike and some on its own. This slide shows what it looks like when you do an epifaunal trawl. Klondike is very clean, not much mud, and with pretty distinct organisms. Burger is just a massive pile of mud. It is a pain to try to clean the organisms out of it, but there is a lot of biomass in there actually.

Fish

The fish community has turned out to be one of the most interesting parts of the whole study. I want to talk about the benthic, the demersal community. These are pretty much benthic-based invertebrate feeders. There does not seem to be many fish out there that feed on other fish. Arctic cod and sculpin are the primary species, especially arctic cod. This is a generalist and occurs both in the midwater and when they get older and larger, they move to the demersal environment. There are fewer fishes in this area, much less than you see near shore. One of the most interesting things is the average size of a fish out there is on the order of two to three inches. I've never seen a system

in which there are no big fish. There are no big fish out there at all. We've tried different types of trawls, and we just don't seem to see big fish. It makes it an unusual system in many ways. A big fish out there is less than six inches long. It's very different from the near shore community. Abundance is greater at Klondike than Burger and Statoil. I'll show you why this is such a weird system. This slide shows a demersal fish trawl, and the question is 'what is wrong with this picture?' The answer is, 'there are no fish.' These are the only fish in the trawl. This is a demersal based invertebrate system. They are the main predators on the bottom. It is a very interesting and kind of a weird, cool system. The highest abundance occurs down at Klondike. If you think back to the benthic data, you would expect most of the fish to be because that is where most of the food is. The species richness patterns also show a weird thing in that you see up to 18 species in a trawl down here in Klondike. Most of Burger and Statoil is three to six species. The question is what is going on here? It is exactly the opposite of what you would expect. If you go back to the bottom temperature information, this pool of very cold water is just above the freezing point for sea water. Many fish will freeze at these temperatures. What we think is that this cold pool forms an effective thermal barrier for many species of fish to go into it, and, as a result, there is not that much predation on the benthic community that occurs. There is a lot of food falling to the bottom, but not much that eats it in terms of the fish community, which are usually the main grazers.

Seabirds

There are primarily eight to ten comprising mostly zooplankton feeders and very few fish feeders. Generally Klondike has higher densities than Burger or Statoil. The system is dominated by zooplankton feeders. The zooplankton are flowing northward out of the Bering Sea, and the birds are picking up on it. There are six main groups, but three of them feed primarily on zooplankton. Crested Auklet, Short Tailed Shearwater and Thick Billed Murre are the zooplankton seabirds that were observed and documented. This slide shows Klondike and Burger in 2008-2010 and Statoil in 2010. What you see is that most of the time the system is dominated by zooplankton feeding birds. This is very different from southeastern Bering Sea where there are enormous amounts of fish. This is where the trawl fisheries are and where large numbers of feeding seabirds occur. The whole system switches over farther north into a zooplankton system. The interesting difference was in 2008 at Burger. It was a very cold year, a lot of ice, and this Bering Sea water never penetrated into Burger. What you had was a very different community that consisted primarily of gulls. The birds follow the oceanography just like the zooplankton do; they are following the zooplankton. Crested Auklets, which feed on oceanic zooplankton, were found only in Klondike in 2008. However, in 2010, they basically occurred everywhere because the oceanic water occurred everywhere. Short Tailed Shearwaters have a different story. They move into the Chukchi Sea in mass numbers in September and flow the entire system. It changes between years most likely because there is more zooplankton in 2010 than 2008. The Thick Billed Murres occur only in Klondike because that is where most of the fish are. The seabird community is a similar type of thing. Klondike and Statoil were very similar. Burger turns out to be much more variable, and this gets back to the 2008 data. This slide shows three cruises worth of data on community at Burger. Most of the time, Burger is more similar, but in 2008 it was quite different. So there are some years where these communities can be quite different, and some years quite similar.

Marine Mammals

The marine mammal community is dominated by pinnipeds: seals and walrus. They break into two groups: pelagic feeding and benthic feeding. The seals follow oceanography, and there is an inter-annual effect on abundance due to changes in ice. They also know what the water is even if there is no ice there. If you look at ringed and spotted seal abundance, they are more common at Klondike than Burger in all three years. Bearded seals, the benthic feeding ones, and walrus are

more common at Burger and Statoil than Klondike because this is where the food is. The cold pool doesn't seem to have much effect and hamper the feeding ability. In the at sea data, in 2008 we had a fair amount of ice--in 2009, 2010 there wasn't much ice--and the bearded seals were in all areas and near the ice edge. In 2009, they are up in Burger. In 2010, they are in Burger and Statoil. The acoustic monitoring program confirms what the observers saw, which is in the summer you have your highest number of call counts for bearded seals up in this area (*indicated by circle on slide*) than you see down in Klondike. Walrus show a similar story. The ice confused things in 2008, but in 2009 and 2010 they are concentrated in Burger and Statoil. Again, the highest number of call counts was in the area where there were very dense biomass benthic communities.

Summary

Klondike is more like a pelagic system although it operates imperfectly. It is a flow through system, but most of the nutrients are already stripped out farther south, so it's not as productive as it could be. This is where more of your pelagic feeding sea birds and seals occur. They are following the zooplankton. Burger is more like a benthic system. Most of the carbon, the primary productivity, falls to the bottom creating a dense benthic community. This results in more benthic feeding, pinnipeds and whales for example, but it does cause problems for the fish. Statoil seems to be more like Burger, although the western end operates more similarly to Klondike. It catches the central channel current at the western end, but the central and eastern parts are mostly the cold pool on the bottom. There are also odd ecosystem attributes. Occasionally there is a fall bloom, which is not considered to occur in the arctic. There are very few large fishes anywhere and very few fish in general in Burger and Statoil. Also, there are few benthic feeding seabirds anywhere. This results in a system where the main benthic predators (things like crab, shrimp) are out there and benthic feeding mammals. It's an odd and interesting system. The program was expanded in 2011 to include all the whole area from the central channel to northeast Hanna Shoal. More areas were added, but monitored with slightly less intensity than in prior years.

QUESTIONS & ANSWERS

Q: Harry Brower, AEWC: Thank you for the presentation, Robert. It's very informative. You've given lots of information to digest again over a short period of time. And it took you how many years to collect this information? Trying to identify what you are talking about and discussing and presenting here is a...again, new words, new things I'm learning again through this presentation and trying to understand and what to make of it. In regards to your findings, I see it's very limited in a sense I have to say because you are indicating there are pelagic, benthic systems and then what you did in terms of your trawling that you found only these species. One of my questions is was there any trawling in the midst?

A: Robert Day, ABR Inc: It's primarily arctic cod up there.

Q: Harry Brower, AEWC: Arctic cod. Yes

A: Robert Day, ABR Inc: And they are not particularly abundant there, but there are also questions people have about are they arctic cod? Many of them fall when the ice retreats back. They may be much more abundant in the winter in the areas that are covered. We just don't know at this point.

Q: Harry Brower, AEWC: One of the bigger questions is that you've learned all this and talked about acidification...

A: Robert Day, ABR Inc: Acidification. Yeah.

Q: Harry Brower, AEWC: ...and effects on *metabolism*, I'm not sure how to pronounce these things. Anyway, like I said, the new words are coming out, and I'm trying to figure all of this. And yet, we are looking at having activity there, okay? There's going to be a discharge of drilling mud and effluence and what happens when all that gets added to the system in your observation?

What's going to occur to this system if the drilling fluids and the drill muds are discharged into the water? That's one of the questions I have. Maybe I'll stop here and have you respond to that.

A: Robert Day, ABR Inc: At this point, I can't predict. I'm not a chemist, but what we have, the same scientific team doing the baseline work, we are going to be doing intensive monitoring immediately prior to the drilling, immediately after it's done, and have some folks who are going to be continuously monitoring or near continuously monitoring the drilling as it occurs for things like mud. Is that correct Michael?

Q: Harry Brower, AEWC: A follow up comment in regards to--again, I'm trying to learn. I thank the industry for conducting this research but, you know, question marks just start coming up when new information is provided. We learn from new research that is being conducted. I guess that is one of my main questions. What would happen if these things were to occur? The other part of that is what is the significance, the importance, of these resources you found to the overall food chain? Walrus? Seals? Whales? In that sense. And if they were removed from the area, would you find these resources in the area again?

A: Robert Day, ABR Inc: I think that the benthic community that occurs there is probably very stable over time. This winter water forms every year and becomes quite cold, quite dense, quite high salinity and sits there during the summer, so it is reformed annually. Even as ice retreats, it is still going to continue to form either later in the fall and retreat earlier in the spring over time. One of the things our physical oceanographer thinks is that the pool of cold water will probably remain a pretty stable area which would result in a stable benthic community, and that is what we would guess at this point, although we haven't looked at it in great detail.

C: Harry Brower, AEWC: I guess again, not having this information before us and trying to communicate, just being responsive to what we are learning off the bat and on the screen. It's just a bit embarrassing trying to communicate and being time crunched. That segment, it's disheartening trying to communicate effectively concerns that we may have another opportunity three months down the road to ask them similar questions. I will stop there because I'm going to probably get frustrated over this.

C: Harry Brower, AEWC: Thank you for giving me that opportunity to comment again. Like I said, we learn of all this information in a short period of time, and one of my other questions I was going to comment on and ask questions about is about the current. That's something that we've been dealing with over time and understood that, just from hunters' observations of the ocean, having three currents. Your arrows kind of pointed in one direction, but in our observations the current switches if it is a moon tide or whatever it is and the direction shift back and forth. It's not just going one direction and so there...

A: Robert Day, ABR Inc: Yes, I agree, and I am just showing you a schematic of what the overall mean flow is. There are cases, and I agree with you completely, in which that current, according to our physical oceanographer, actually starts flowing instead of the northeast at times under certain circumstances and we are still trying to understand what those circumstances are, but it certainly matches with what your hunters are seeing.

C: Harry Brower, AEWC: And Robert, thank you for your presentation. It is a lot of information and again in a short period of time and I'm learning a lot. Thank you.

A: Robert Day, ABR Inc: Thank you.

Q: Robert Suydam, NSB: Bob, congratulations to you and your team and thanks to Conoco and Shell and Statoil. This program is a great example of how to take a look at the system and better understand what is going on. The baseline information, the information you guys are collecting, will be really helpful to address some of the questions that Harry just raised, those potential changes with activity that might happen out there. A quick question about fish: it is curious that there aren't any large fish or you are not catching any large fish out there. We know there are large fish in the

Chukchi Sea. We catch lots of salmon in the communities. There are white fish and other things. Where are the fish?

A: Robert Day, ABR Inc: I think it's an interesting thing. The big fish appear to me, from the limited information, to be in that coastal current, in the near shore waters. That is where the salmon are. That's where bigger fish are. I think Bob Felchem of LGL did some work years ago and was getting fish this big. For us a big fish is this big. An average fish is this big. A very different system I think offshore. It doesn't seem to operate the way the near shore does. It is one of the things I find astounding about it.

Q: George Edwardson, Inupiat Community of the Arctic Slope: One of our MMOs was out on one of the ships with the oil company and every time they brought their net in, he took pictures of salmon fingerlings from the middle part of the ocean and the top part. Everywhere they took the samples he took pictures of those salmon fingerlings and then gave me GPS readings of them. Some of those places were over 130 miles out. They called them ocean Cohos. You never ran into those?

A: Robert Day, ABR Inc: No. Our zooplankton people never caught large larval salmon, and we never caught any, to my knowledge, in the trawl nets, and we've tried different trawl nets. Last year we brought up the trawler from the Bering Sea that does the NMFS trawler surveys down in the southeastern Bering and they came up. They never caught any either. I'd love to see the data. I'd like to see the photos. It would be very interesting.

Q: George Edwardson, Inupiat Community of the Arctic Slope: I will bring my chip with me and you can take the pictures. You can copy my chip with photographs. The pictures taken with GPS coordinates for each of the pictures.

A: Robert Day, ABR Inc: The only circumstance in which I speculate at this point that that could occur is sometimes as the coastal current comes spinning around Cape Lisburne, the Lisburne Peninsula, you will sometimes get little eddies spun off. They can actually contain patches of this coastal water and can get spun further offshore. That may be what they ran into. We've had three years of sampling, and we haven't seen that.

Q: George Edwardson, Inupiat Community of the Arctic Slope: Then spin offs are in the whole Arctic Ocean then according to the GPS coordinates. The samples he had.

A: Robert Day, ABR Inc: It could be.

Q: Robyn Angliss, NMFS: I have two questions for you. The first one is that I see your study area expanded pretty dramatically in 2011, correct?

A: Robert Day, ABR Inc: Yes.

Q: Robyn Angliss, NMFS: Was that for the full suite of environmental studies you were doing?

A: Robert Day, ABR Inc: Yes, it was. One of the really nice things is that we got to know these boxes and really understand the biology of them quite well. Like I said, they were so different early on, but one would have never expected such dramatic differences. I think that what it is doing is that now we feel more comfortable to expand over the entire area. It's going to help us interpret what is going on.

Q: Robyn Angliss, NMFS: I think that's really great and wanted to complement you for taking that step. We've been wondering for a while kind of what the context is, and it sounds like this is going to answer a lot of those questions. My other question is that you guys have really pulled together a lovely dataset, and, in the unfortunate event of an oil spill, it would be very useful to have access to that in a NRDA context. What is going to be the availability of these data in that event?

A: Robert Day, ABR Inc: I will let Michael and Caryn answer that.

A: Caryn Rea, ConocoPhillips: We were going to talk about this a little bit later, but just to mention that Shell, Statoil and ConocoPhillips signed a MOA with NOAA last August to share data from this project, and we are currently in the midst of developing annexes for different data sets. For example, metocean data is first in the cue. Next will be biological data, and so to answer your

question, they will be available either with NOAA for metocean data, but probably all of them with the Alaska Observing System where the data will reside.

C: Michael Macrander, Shell: Just one other thing, at least as far as Shell is concerned. Not only the data from this program, but from virtually all of our environmental studies and monitoring programs, will be included in that data sharing effort. Onshore as well.

Q: Raphaela Stimmelmayer, NSB: I also have a question about the fish...the small sized fish. The question is do you think the size of the fish is a reflection of nutrient constraints there or is it actually that you have a younger age group and then you would maybe be seeing immigration to the near shore environment? Or do you just have very successful seals out there eating the bigger fish? I want to hear what you think.

A: Robert Day, ABR Inc: I'd be speculating, but Lord knows I've done that before. I think it's a combination. Many of these fish are coming as youngsters out of the Bering Sea in this current that flows northward, so to some extent that is part of the story. Part of it is some of the species really don't grow that big. The sculpins that are out there, some of the important benthic predators, their maximal size is only a few inches long. I guess I'm just astounded. I have never worked in a system before in which there weren't any big fish, and I'm mystified and fascinated by it.

Q: Raphaela Stimmelmayer, NSB: But are you going look at aging of the (*unable to hear—no microphone*) to actually look at our size?

A: Robert Day, ABR Inc: Our report from our 2009 and 2010 program has aging information, and that's available on our website.

Q: Raphaela Stimmelmayer, NSB: Thank you so much.

Q: Nancy Deschu, USDO-BOEM: I think we've talked before, Bob, about fish, and I'd like to follow up. It seems like the system is very unusual and interesting. We are measuring, I think, points in time of standing crops of fish and that's useful, but until we get to what he's mentioned, the age, life span and whatnot, I'm not sure we can say there are very few fish as much as we can say there is a biomass out there of x-amount, and we need the biomass budget and biomass movement, so how do we start getting to that? Because obviously they are an important prey for many of the species out there, and how do we start thinking about not few or small fish, but the biomass and how that fish biomass moves through the system?

A: Robert Day, ABR Inc: That's a tough question. Let me think about that one for a second. Certainly our trawling is occurring mostly in September, and this is during the season when the fish are really growing pretty well because they are temperature dependent and warmer at that period of time. I can certainly see the fish growing bigger over time, but the biomass I don't expect to become an order of magnitude bigger by October than what we see in September. I agree with you that it is a point in time sample, but I'm not sure how we can get around that. We've tried every sampling we can including this Bering Sea trawler that came up, and they are just little fish.

C: Nancy Deschu, USDO-BOEM: I was thinking more in terms of modeling the size of the biomass.

Q: Robert Day, ABR Inc: In terms of modeling what the size would be?

C: Nancy Deschu, USDO-BOEM: We have a set point in time. How do we begin to model and understand how that fish biomass is moving through the year and through the system and also through the three dimensional? The other thing is, too, that we are focused really on adults here, so we don't have the larval egg component in terms of how fish are moving. So right now I think it's accurate we have small fish, and we have relatively few fish, but it is just the skim on surface. We need to start looking in terms of that conveyor belt and other life history stages to start talking about what fish are out there and the importance of them to other species at different times.

A: Robert Day, ABR Inc: Okay. Yeah. Point taken, I think. We can talk about it a little on the side.

C: Nancy Deschu, USDO-BOEM: Sounds like a good BOEM project.

Q: Leandra De Sousa, NSB: Thanks Bob. That's a really cool study, and congratulations to all of you guys. I have a question for both Shell and you. I'm not sure about the discharge and the cooling water and all of that used for drilling. How far does that go? What is the radius that warm water goes into the ocean? So is it a few meters? Is it several yards? And how warm is that water? Do you guys know?

Q: Michael Macrander, Shell: Sure. So you're asking primarily about the temperature aspect of it?

A: Leandra De Sousa, NSB: Yes, please.

A: Michael Macrander, Shell: The temperature differential between the intake water and the output water is 1.0-1.5 degrees centigrade. The mixing is such that, and this kind of thing has been studied all over the world, but we expect the temp plume to be indistinguishable between 100-200 meters of the release.

Q: Leandra De Sousa, NSB: Thank you, and then just one more question. I think it was 2010 that you said there was a subsurface bloom. Was that correct?

A: Robert Day, ABR Inc: Yeah, appeared to be.

Q: Leandra De Sousa, NSB: Yeah, so what was the depth again?

Q: Robert Day, ABR Inc: What was what?

Q: Leandra De Sousa, NSB: The depth. It was like 20 meters?

A: Robert Day, ABR Inc: Ah, below the pycnocline. Around 15-20 meters.

C: Leandra De Sousa, NSB: 15-20 meters. Okay. Now just a comment because the zooplankton of the bloom that you saw. Quite a few of those that's the depth stratification in other areas, not the arctic but in the gulf and other areas, there it was quite high in the pycnocline, so if you are having that bloom that could definitely be part of the reason. Just an observation.

C: Robert Day, ABR Inc: Russ' opinion is that certainly many of the vertically migrating zooplankton, particularly up here in the arctic, are just sitting on the bottom, I think is what he thinks. I was surprised. I figured they would continue to migrate, but he said it is so bright out that they are vertical migrators.

C: Leandra De Sousa, NSB: The large ones don't vertically migrate though. They are on that layer for most of the time.

Q: Robert Day, ABR Inc: They are hanging out in the pycnocline?

A: Leandra De Sousa, NSB: Yeah on the pycnocline. That is where they are. Thank you.

C: Sheyna Wisdom, Fairweather Science: One of the things that I just wanted to point out for the fish, we have tried each year to add new materials and depths to try to figure out what is going on. One of the things we added in 2011 is a hydroacoustic tow. You saw that huge map with all those sea birds and mammals...we actually had hydroacoustics going the entire time, not necessarily being able to identify the species of fish, but at least target strength of some school sizes. We're trying to look at different ways to collect this data.

C: Robert Day, ABR Inc: And as I recall, the preliminary finding was that there were not many fish based on the hydroacoustic sampling.

C: Bill Koski, LGL: Bob, I think that the fish eating marine mammals might be a way to find where the large fish are going. During this open water period that the belugas, for instance, are moving up into the pack ice and the more northern area. Perhaps the fish are doing the same thing.

Q: Robert Day, ABR Inc: I agree with you. Certainly there are some suggestions and suspicions that the arctic cod in particular, which is the main prey for most of these marine mammals, that many of them migrate northward staying near the ice edge or on the ice, and I agree with you. Certainly that would explain it. The belugas move through our area, according to Dave Hannay's acoustic data, before we get out there, and we basically don't see them out there during the summer, and then they come back through in the fall. Is that correct Dave or is it just only in the spring on the way north?

A: Dave Hannay, JASCO: The belugas don't appear to be sticking around in the Chukchi very significantly after the initial migration up along the coast. Probably Robert would be the best person to talk to about that though.

Q: Gene Augustine, BOEM: Very good presentation Bob. I really appreciate how you put together the trophic levels and worked through information on the whole system. Truly an ecosystem approach. My question goes back to your slide on the method of recording data. I was wondering if maybe you could elaborate a little on that? Maybe there is something that can be used in that for how the MMOs could record their information maybe without the paperwork or something?

A: Robert Day, ABR Inc: I certainly think it's a much more efficient system, and a really nice part of this is you have all the time in the background all this environmental information and ship navigation information, water depth, ship speed, ship direction, and so on. So that information is just being recorded in the background and every once in a while you see a marine mammal, you hit a button and it locks that into the database, and all you have to do is enter your marine mammal data. I think it is a pretty elegant and efficient system. It is quite impressive. I am really wowed by it. I think it is quite an efficient system. Sheyna would be the one to talk to and Waverly who is sitting next to her; they know far more about it than she would like to know.

Evaluation of Impacts on Marine Mammals Based on Industry Science and Data

Michael Macrander, Science Team Lead, Shell Alaska Venture

Overview of Significant Marine Mammal Investigative Efforts

Introduction by Candace Nachman, NMFS: I just wanted to give a little context for this and give a brief history and disclaimer. For the last couple of years, the peer review panel that has been meeting has recommended to NMFS as part of the OWM that we dedicate some time to discuss data collected by various oil and gas industry companies over several years to talk about a synthesis of that data and are there impacts on marine mammals from what we've learned so far. In putting together this year's agenda, I talked to some of the companies, and basically what we are going to hear today is a subset of the data that has been collected, a subset of the studies that have been conducted. Shell is going to be presenting on studies they have done since 2006. I'm sure Michael will give you the dates in a minute. I just wanted to note that not everyone from the industries were partners on the studies you are going to hear about today and not all of them have seen this. Keep in mind that this is a topic that is really broad, and there are a lot of data that've been collected, and it is bigger than what we we're going through today. Maybe something to look forward to in future years is them talking about other data sets that have been collected as well. With that, I'm going to turn it over to Michael Macrander.

Michael Macrander: Again, the following hour or two of presentations materials is to draw together information that has been flowing from industry studies. I will admit there is a significant Shell influence here, and for that I apologize to all, most of all to my industry partners on this. We had a conference call a week-and-a-half, two weeks ago, to talk about this, so we've done the best we could.

Recent History

I am going to give a few minutes of overview, historical perspective so to speak, what's included and what's not included. After lunch we will get into the meatier information, including sound propagation in the Arctic, results of SSVs, modeling, acoustic monitoring, mammal movements, behaviors and inter-annual variability, bowhead whale interactions with industry activities, walrus movements and responses to ice recession. You've heard about a lot of this over the last two days.

We are going to try to bring it all together and make it mean something at the end of the day. There are a lot of sources of information, and one of the values of this meeting and meetings of this type, is that we see all the data that is being collected, and it was interesting hearing about the ASAAM program this morning. Thanks for stealing our thunder. We were going to talk about the central Beaufort anomaly and the bowheads there in late July, early August from the acoustic stuff. We weren't the first ones, but we have some interesting data to go along with that. One of the benefits of this venue is we get to see all the information. The scientists get to speak to one another and speak to people from the communities and share that information.

Going back to 2006, there has been a consistent call for interpreting cumulative impacts, and, at least for some of us, one of the first pieces of a cumulative effects sort of assessment was looking at all the data. Each of the industry parties is responsible for their own monitoring program, and so each year they pull together and generate what we refer to as a comprehensive report which is an effort at least to pull all that information together and present it in one place. Over the years, Shell has sort of been the shepherd of that process to a certain extent. It's co-funded at times by Shell, ConocoPhillips, Statoil. BP and Pioneer have provided some of their data from some of their monitoring programs to be included in those reports, etc. ENI and GXT at the time, now ION, was one of the early funders and participants in that program and process. As far as the presentation today, we tried to follow the kind of format and topical review that we normally put together in the comprehensive report.

Historical Perspective

Our knowledge of marine mammals in the arctic, as you know, did not originate with industry. It did not originate with oil and gas. It did not originate with the U.S., etc. It originated with the strong observational, investigative ethic that is part of the culture of the region. We always have to touch back to that, and again that's one of the benefits of the Open Water Meeting, to have the opportunity to sit down and compare notes, compare words, compare ideas, etc. There is a history of western science in the arctic that when you actually sit down and start looking at it goes back far and is a little bit more robust than immediately meets the eye. This is a Shell effort about a year ago to look back over the last 100 years, and certainly there has been an episodic character to the advent of science and the conduct of science in the arctic. You can point to specific things like the Cold War, no pun intended. During the Cold War, when we thought the next attack on the U.S. was going to come over the pole, there was huge investment by the Department of Defense in terms of understanding the arctic and learning about it, the physiology, the animals that live there. That was one period in the 1950 - 1960s when a lot of work was done. A lot of work was done around the efforts to develop a water port south of Point Hope. A number of environmental studies were done.

Another significant effort, initially by BLM and MMS, was the OCSEAP program in the 1970s - 1980s. Then, periodically, as industries interest in the Beaufort and the Chukchi increased and decreased, you've seen episodic periods of a lot of work going on there. A lot of monitoring efforts and methodologies that we employ today have roots in the 1970, 80s, and 90s. The BWASP program has been going on for 30+ years. When Shell was active in the Chukchi Sea in the 1980s and 1990s, there were overflights to look at walrus. It's always good to go back and mine data from those efforts. A lot of the acoustic programs were initiated. Charles Greene and others were pioneers during that time. The point is, we stand on the shoulders of giants in terms of moving forward and implementing new technologies in what we are doing.

Recent History

More recently, I think there are some significant learnings and advances as far as what we are paying attention to; a couple of landmark sorts of efforts. Certainly a study funded and implemented by Western GECO in the mid-to-late 1990s that utilized a combination of aerial and vessel based monitoring and acoustics primarily using hydrophones, etc., raised a number of issues, and some of the upcoming presentations will touch on those data. Northstar was beginning the use of directional acoustics recordings and working with that. Going back to 2006 and Caryn and Robyn and Robert, I recall at the Open Water Meeting that year, there was a breakout session where we went to the Conoco offices and said okay, these are the components of a monitoring program. It ended up with an aerial component, vessel-based component, and an acoustic component. So a lot of what we've done over the last five to seven years has grown from that meeting. I think back on that time as a sort of seminal event.

Extensive Arctic Studies

As far as learning about the arctic and the potential interaction with industry, etc., it's not, by a long shot, all industry funded. There are a lot of players here who we've heard from over the last couple of days. BOEM has significant programs like COMIDA, the BWASP, and a diversity of offshore studies that I don't have complete knowledge of like I should. Bowhead tagging has been implemented with participation by Lori Quakenbush, but also with a lot of input and participation from local whalers, etc. NOAA has implemented the CHAOZ program over the last few years. I shouldn't necessarily attribute the Distributed Biological Observatory Program to only NOAA, but certainly NOAA is a strong proponent of that along with Sue Moore. The National Science Foundation (NSF) is a player. EPA and the State, through the EMAP program, are doing a lot of sampling in the near shore. The North Slope Borough and others are participating in beluga tagging, USGS doing walrus tagging and polar bear work, as is USFWS. I would have liked for this effort that is going to be presented over the next few hours to have been way more inclusive than its going is. At times we will reach out and reference some of the tagging data, etc., but the focus primarily is on industry work. It is not for lack of respect in that. It's more to the point that it is what we had time to do.

We will make an effort to simultaneously draw from several streams of data and reference the comprehensive report over the last several years, and I will share some of my frustrations here. We've tended to have chapters on vessel based monitoring in the Chukchi, another chapter on vessel based monitoring in the Beaufort, another chapter on aerial in the Beaufort, a chapter on aerial in the Chukchi, etc., and what I'm beginning to look toward is a more integrated species-by-species approach. If we talk about bowhead whales, what do we learn from acoustics, vessel-based monitoring, and aerial all together? Some of the main stays of the monitoring data that we have at our disposal are again vessel-based observations from MMOs, acoustics data, aerial data and the ecological studies that Bob talked about and that others have been doing as well, like tagging studies. I guess what is missing here is that reaching out beyond the industry data to include a lot of the additional information. I'm hoping we have some time at the end to talk about how we get that accomplished.

QUESTIONS & ANSWERS

Q: Harry Brower, AEWC: Thank you for that overview. I'm trying to debate if it's the right time or are you having another presentation after lunch? Is that what you are saying?

A: Michael Macrander, Shell: Yes.

C: Harry Brower, AEWC: Okay. It might be at that time I might raise the question or the concern I was mentioning from yesterday's presentation. I want to follow-up. I need some clarification in

terms of what you indicated yesterday, and I had some mixed interpretations in my own mind about how best to approach that. But if this is just part of your first segment of your presentation, maybe I will wait until then.

A: Michael Macrander, Shell: If I know what you are referring to, it is not going to be covered specifically in the other presentations.

Q: Harry Brower, AEWC: Again Mike, thank you for your presentation. Like I said, I needed some clarification. I wasn't sure how I interpreted information that you presented. Again I don't have the materials before us, but it is oral communication and I didn't want to be speculating on hearsay. The thing I heard you indicating was that Shell was going to sit down and evaluate the cost effectiveness of what the discharge situation is that we have in the Beaufort Sea. Whether you are going to continue that zero-tolerance discharge or if you are going to think about what the cost is and rethink of your permit in the Beaufort?

A: Michael Macrander, Shell: For clarification, let me step away from this kind of joint data, analysis and presentation because this is a Shell only issue at this point in time. I think I probably stumbled over my presentation yesterday. I think when this came up I was talking about our drilling monitoring program, anticipated for 2012, which is going to be conducted in both Beaufort Sea and Chukchi Sea. There have been questions raised on why you are monitoring drilling and drilling related discharges in the Beaufort Sea if you aren't discharging anything? There are two reasons why we are doing studies in both areas. First, to answer your question directly, it does not at this point represent a stepping back from our commitment to not discharge in the Beaufort Sea. Okay? To be very clear, we are not at this point stepping back from that. We are however, conducting our monitoring program there to, with our limited discharge... I won't say zero discharge because we do have to discharge cooling water, and there are legitimate questions about that and about the overall presence of a drilling program in Beaufort Sea. There were questions submitted in terms of comments on our IHA, and so we are implementing the same suite of studies in the Beaufort Sea, even in a very limited discharge scenario, that we are doing in the Chukchi Sea for a full discharge scenario. One of the things is that we need to understand what the implications of our very limited discharge are in the Beaufort, so we are doing that. We are also doing it to be able to compare a discharge program in the Chukchi Sea to a limited discharge program in the Beaufort Sea. Is there a significant difference between the two? It is to help inform the decision going forward in both seas and also inform the agencies that are making determinations about permits, etc. and make the data available to them. So just an effort to look at the two; we are doing it one way here, doing it the other way there and what benefits do we get from doing limited discharge versus full?

Sound Propagation in the Arctic: Results of SSVs, Modeling Exercises, and Acoustic Monitoring

David Hannay, JASCO, and Susanna Blackwell, Greeneridge Sciences

This presentation is a compilation of work that both JASCO and Greeneridge have done. It is less focused on the marine mammal noises and more on vessel and ambient noise. The sources of underwater acoustics information included in this talk are from three main sources: the Joint Comprehensive Study reports compiled each year from research performed by several oil and gas companies (these are published on Shell's website); the 90 day reports (these are studies performed mainly to satisfy IHA requirements); and the Joint Chukchi Sea Environmental Studies Project (sponsored by Statoil, ConocoPhillips and Shell).

The outline of the talk today includes ambient sounds, sources of sounds, temporal/spatial variations, weather effects, biological influence on the ambient levels, manmade sounds and an introduction to modeling of sound.

In the Arctic, wind and waves are the primary sources of ambient noise during ice free periods. In the winter, ice cracking and grinding noise dominate. Both in ice free and ice covered periods, wind is really well correlated with the noise. In the winter ice cracking contributes to the noise. These figures (displayed) shows wind speed during the open water season and the corresponding noise levels. The noise levels broadband above 10 Hz from the 80 dB range up to about 115 dB. From October 2010 to the start of August 2011 ambient noise levels range levels are about the same. Clips of noise measurements in the open water period, followed by noise clips of under ice sounds were played.

The characteristics of variability of ambient noise, the spatial variability, are relatively small at any given time. Sound levels at five different recorders between October 2009 and the end of July 2010 are shown here. When we see spikes due to weather events, they happen on all of the recorders, and the recorders are separated by 300 km so we're seeing good spatial coherence over a large spatial scale.

Marine mammal sounds contribute to ambient sound levels. Marine mammal sounds are common in the Chukchi and Beaufort lease areas. Specifically, bearded seal, walrus and bowhead sounds can lead to increased ambient levels that can last for several weeks at a time. In this graph (displayed) we can see that even on a large time scale, two examples of biological influence on the ambient field. The first one occurs in November and December shows bowheads transitioning from simple to complex call types and songs that can last several weeks. The second one is in mid-May when we see bearded seal calls. *Examples of bearded seals and bowhead sounds were played.* Five miles off Point Lay there is a recorder in the summertime, and it is picking up walrus from haul outs that occur in mid-May.

Switching to anthropogenic noise and starting with vessel noise, there has been vessel noise measurements made for several years in the Arctic. Here is an example of how we go about making these measurements. This graph shows a measurement example from Statoil's shallow hazards program/site survey program in 2011 in 37 meters of water on the M/V Duke. The vessel sailed a 15 km track over a JASCO OBH recorder. The sound spectrogram is plotted (displayed). What we do for sound source verification is we plot the received level in one second time steps as a function of vessel distance from the recorder. We can see the levels change from about 150 dB at about 37 meters directly underneath the recorder down to less than 120 dB out at about 4 kilometers. We determine the table of radii by picking a sound level threshold (for example, 120 dB), and we draw a horizontal line across the plot. Prior to that, we first fit a smooth line to the data. The second step is to shift that line up slightly in order to be a bit conservative, and that shifted line exceeds 90% of the data points. Then we get the threshold distance and find where the line crosses the threshold, and we choose off the distance.

Drilling sounds depend upon the type of platform being used because they have different contact with the water. That is important because sound has to transmit from the equipment on the drilling equipment and then get in to the water. Drillship equipment is more directly coupled because the vessel hull is right in the water than on gravel islands like Northstar. Lower frequency sounds can transfer even on places like Northstar from the island in to the water.

QUESTIONS & ANSWERS

Q: Bill Streever, BP: (unable to hear—no microphone)

A: Susanna Blackwell, Greeneridge: The recordings were made, I think, in the winter about late February. It was at a distance of one kilometer from the drill rig, and the conditions were very quiet, very low wind speeds.

Q: Bill Streever, BP: (unable to hear)

A: Susanna Blackwell, Greeneridge: It was in 2001 and there were activities related to construction, but the drilling was really the main activity. They were usually working on the ice roads and so on, but those sounds would probably not be that important compared to the drilling sound.

The next source type to consider is the seismic survey sound using airgun arrays that are used commonly in geophysical experiments that image the sea floor and the sub bottom. All of the 3D surveys since 2006 have had sound source verification measurements. Nine individual measurements have been made and are plotted in the table on the left (displayed). The distances to sound level thresholds levels are plotted at 120, 160, 180 and 190 dB that are important for various evaluations by NMFS. The levels, when plotted on an algorithmic scale, don't show a whole lot of scatter within a given threshold. However, because it's a log scale, lineally there could be up to 50% difference in the measurements. Some of that is dependent upon the environment the source is operating in, water depths vary, and there are slight differences in the arrays that are used to generate the sounds, but the numbers shown here is the average of the measurements for each of those thresholds (displayed).

This sound clip (played) are seismic sounds from Statoil's 2011 study at five seconds each for airgun shots at 5, 10, 20, 40 and 80 kilometers. The 80 kilometers would have been down near the 120 dB range. These were all on the same amplitude scale. Measurements were also done for smaller air gun arrays associated with Shell hazard surveys. These use 40 cubic inch air guns. The distances are much smaller than for the large 3D air gun arrays, and also for single 10 cubic inch air gun. (Sound threshold distances shown.)

This map (displayed) gives you an idea of what a typical noise footprint might be based on average values for the 3D seismic surveys. We placed a source on Shell's Burger Prospect to give an idea of how big these footprints are. There is the 120 dB distance at about 93 kilometers; the 160 is around 11 kilometers; about 900 meters for 190 and two kilometers to the 180. This shows the shallow hazard source gives a smaller distance.

Acoustic modeling has been used to predict noise footprints of several operations of seismic drilling and vessel sounds. The footprints are useful for evaluating the potential effects of these operations and are used to feed in estimate of takes for IHAs. Models can treat simultaneous operations, and they can be used to do cumulative effects/exposure studies and assessments. Models can also be used for planning by modeling different scenarios to see what the noise footprints for each of them are.

This (slide shown) shows a drilling operation model result. The models can show differences in the sound propagation when you have different water depths. You can see that sound doesn't propagate in the shallow water as well as it does in the offshore direction.

This (slide shown) is a seismic model result. Seismic arrays are directional and produce more sound in some directions than others.

This is an example of a model and data comparison from ION's 2006 study. The model result is shown in black and the data in red. The models show a lot of the additional attenuation that occurs,

especially at long ranges beyond about 10 kilometers. We use air gun array models to predict the actual sound that's emitted in to the water and the figure on the left shows the model result and data for 10, 40, 80, and 85 cubic inch individual air guns.

For drill rigs (graph displayed), we used previous measurements to feed into the acoustic models to predict the sound footprints of continuous sources like vessels and drill rigs. This is the type of measurement that comes out of our sound source verification and is useful for future modeling and that is one of the purposes for the sound characterization measurements.

The practical aspects of modeling including that it can show depth dependence which is important. You might measure at one depth and assume that the sound level is appropriate to evaluate effects at all depths, but that's not really the case. This shows that when we get a long way from the source, the sound levels do decrease quite substantially at the surface relative to deeper down. That also has implications for sound source verifications where we are trying to determine how far out these sounds propagate. It is important to choose your depth where you measure those sounds properly.

QUESTIONS & ANSWERS

Q: Ben Greene: I was going to ask ION, but instead I'll ask you. I'm interested in the effect on acoustic propagation of running seismic while ice is present. We have not only the ocean floor to reflect, but you also have an upper ceiling of ice. Can you comment on the propagation of noise through that environment?

A: David Hannay, JASCO: That is a good and appropriate question for a lot of the new studies being done in the Arctic where we are looking at some propagation that, even if you're performing in open water, it might be propagating under ice as well. There have been a few studies done on that. The primary affect is scattering. It has a slight reducing effect on the propagating sound levels because the bottom of ice is rough and scatters the coherent reflection of sound.

Q: Shane Guan, NMFS: Have you quantified ambient noise in general in the Arctic area and if so, what is your comment on ambient noise when there are activities at a far distance?

A: David Hannay, JASCO: Ambient noise levels in the Arctic vary with the weather conditions. Levels range from 80 dB to 150 dB, which is not substantially different than some other oceans at least during open water when you have more weather and wind and wave action on the surface. Those are relatively normal ambient levels. You have to consider that with respect to effects of industrial operations based on the source of those noises. For example, when we see vessels, the vessel sound levels, the 120 dB which is still about the highest ambient levels, we're seeing those levels out to one to four kilometers for most of the support vessels and so we are probably looking over 10 km or maybe even 20 kilometers before you get down to ambient levels so vessel noise would be above ambient for out to quite significant distances.

Q: George Edwardson, Inupiat Community of the Arctic Slope: At what depths do you get the maximum distance for the noises you are listening to? With whales you can sometimes cross the ocean with the noise they make at different depths.

A: David Hannay, JASCO: Water depth and temperature are key parameters that influence the propagation of sound. For example, in this plot (displayed), the maximum depth would be about 30 meters in the central Chukchi Sea in about 45 meters water depth and that's where you would see the highest levels. In deep ocean you get much longer propagation because sound can travel much longer distances without interacting with interfaces especially avoiding the bottom, reflecting off the bottom. You can get sound propagation of hundreds of kilometers from many industrial sources and you can detect them at very long distances.

Q: Chris Clark, Cornell: Can you talk a bit about reverberation?

A: David Hannay, JASCO: I think you are referring to seismic? Are you referring to coherent or out of plane?

Q: Chris Clark, Cornell: The point is, one of the things you bring up is the extreme variability you can have depending on the bottom structure, the water depth, the temperature profile. What you're predicting here is not necessarily how a seismic impulse would be propagated or received in deep water versus shallow water, but, in the shallow water, there's this paper that recently came out about reverberation, and we've talked about it terms of masking the human's ability to detect the whale calls but in terms of... I don't want you to get in to why it's masking whales but...

A: David Hannay, JASCO: Reverberation is really the persistence of sound in the water quite a long time after the main part of the seismic pulse has been received. It does have some significant influence on ability to detect calls, and that's not just detection by our recorders but also by other marine mammals. These long tails of sounds from seismic signals can hide or mask calls animals make and pick up from other animals. Those reverberations can extend fairly significantly. I believe more work needs to be done. I'll point out that we did look at that with walrus. We got reduced walrus detections in the presence of seismic sounds at fairly low levels and, after investigating that further, it was due to reverberation masking the lower level call detections that we would otherwise make.

Q: Bill Streever, BP: Could you back up to the Northstar slide please? What I took from the comparison as you presented it, was that you think that a steel drilling platform would have sounds comparable to those of a drilling gravel island? I find that surprising. Did I interpret your statement correctly?

A: David Hannay, JASCO: I did not mean to infer that. I'm just saying that some sound can propagate from on-island equipment through the ground and in to the water.

Q: Bill Streever, BP: Can you play the two sounds again?

A: David Hannay, JASCO: I can play them but I think the point we should get across here is the amplitude is not the same for both of them. We've amplified these for playback so you can hear them but almost certainly the gravel island will be a much lower level than the drill ship. I think that's what you want to get at here.

C: Bill Streever, BP: Precisely.

C: David Hannay, JASCO: Northstar sounds similar but has likely been amplified to a much greater extent.

C: Bill Streever, BP: Whenever we listen to these sounds, but we control the volume at the computer, so it is a little misleading when two sounds are played side by side.

Marine Mammal Movements, Behavior, and Inter-annual Variability

Bill Koski, LGL

I'll be providing a high level overview from various studies completed over the last five to six years. I will highlight some of the more important species and interesting things we've found out. We have significantly increased our knowledge of marine mammal distribution, movements and inter-annual variability over the past five to six years. One of the more interesting, but perhaps less significant, overall findings is that there have been sightings of a lot of species that previously weren't known to occur in the Chukchi and Beaufort Seas, or if they did, they were considered rare. This map (displayed) shows where a lot of these sightings are, many off of Kotzebue Sound, which is an area where there hasn't been much effort. A lot of these sightings may reflect that vessels transiting to and from areas further north have covered areas that previously not covered very well.

This table (displayed) shows several of the species and the relative sighting rates. These are made from vessels. The humpback sightings are one of the more notable sightings, and in recent years they have been seen up near Barrow, and they certainly weren't see there ten years ago. The primary species that are seen include gray whales, bowheads, and harbor porpoises from vessels. There are a lot of belugas, too, but they haven't been seen from vessels partly because they are not there at the time of year when the vessels are and partly because their behavior is such that they are one of the species that avoids vessels. Here are the densities based on sightings from vessels for bowheads, gray whales and harbor porpoises. The harbor porpoises are from both the Beaufort and Chukchi Seas. You'll note that the most abundant species in the Chukchi is gray whales, and the harbor porpoises are the second most abundant during the period of our surveys. This is probably surprising to a lot of people because a few years ago people would have thought they were an accidental species there. When you get over to the Beaufort, the bowhead whale is the most dominant species. In 2007, during July and August, there is a relatively high sighting rate for gray whales. Those whales were primarily right around Barrow. This map (displayed) shows our coastal sawtooth surveys of beluga sightings. I want to point out the tremendous variability in timing and number of belugas seen during our four years of actually conducting our nearshore aerial surveys. In 2006 we actually saw quite a few whales during July and August; in the other years we hardly saw any, and the ones we saw tended to be at the end of the season when they were returning from the summering areas in the Eastern Beaufort. These data (displayed) show the number of intervals at which calls were detected from buoys in the Chukchi Sea. This information is consistent with our past knowledge of the timing and distribution of belugas. They show up in mid-April and migrate through the Chukchi Sea during April and May and in to mid-June and then are largely absent during the summer, and we detect them again in mid-fall. You'll notice there are calls quite late in the fall, from mid-October to late November. In the Beaufort Sea, most of the belugas are seen along the shelf break in waters that are 50-100 meters deep, and probably the greatest majority of whales travels even further offshore along the pack ice, which at this time might be quite far north, but there are no surveys out that far. As the belugas continue across to the Chukchi Sea they are not being detected there in large numbers either. We suspect they cross the Chukchi Sea north of the shelf break and continue over towards the Chukotka coast before they head south.

During the four years of our nearshore surveys, in 2006 we had a lot of gray whales down between Point Lay and Cape Lisburne. Then, in 2007 to 2010, we saw them primarily up around Wainwright and Barrow and in the nearshore. Of course these surveys were nearshore, so we don't have offshore distribution, but the acoustic information provides us information about what was happening offshore. The call detections were strongest in the same area where we were getting our aerial sightings and the call rates further offshore were very low. That is consistent with what Janet found during her offshore surveys. This information (displayed) from the 2011 Statoil survey shows the general sound levels that are received near the areas where the majority of gray whales were feeding.

Past sources of information show that the whales pass Barrow in late April to early June, and we knew they were heading over to the Canadian Beaufort Sea and Amundsen Gulf and then we'd see them come in shore during late August. But satellite tagging information indicates they head directly from Barrow over to Amundsen Gulf along the (unable to understand) Shelf where they appear to be feeding and then they disperse slowly westward as the summer goes on. There are some bowheads in the Chukchi Sea during the summer. There may be a few more than previously thought based on the calls recorded. The majority, however, do go over to the Canadian Beaufort in the summer. The other exciting piece of information is that bowhead whales, after passing Barrow, head over to the Chukotka Coast and spend a considerable amount of time there. They stay over there until December and even, last year, until mid-January. Previously we thought the whales

headed in to the Bering Sea shortly after crossing over and migrating south to the Bering Sea wintering areas, but it looks like they go over there and spend two to three months feeding. This actually vindicates some earlier work that Don (unable to understand) did where his study found that the Bering Sea signature in the baleen indicated that the whales were doing a large amount of feeding in the Bering Sea. We had previously thought they were doing the majority of feeding in the Beaufort Sea. Now we know they are probably capturing that Bering Sea signature while they are along the Chukotka Coast in the fall. The nearshore aerial survey sightings show there are few bowheads right along the nearshore area except by Barrow and late in the season in October.

QUESTIONS & ANSWERS

Q: Robert Suydam, NSB: One of the reasons for doing the monitoring is to better understand the impacts. Based on the title for this presentation/session, I'm surprised there isn't more on what the data is telling us about how the animals are responding to activities?

A: Bill Koski, LGL: That is in the next talk.

Q: George Edwardson, Inupiat Community of the Arctic Slope: I'm 65 years old. I've watched the ocean my whole life out of Barrow. The finback whales you talk about frequent in the ocean up there all my growing up days. It hasn't been up there just a few times, but for my whole life. Gray whales get past Barrow when killer whales are chasing them. That's a given. The reason they get chased that far is because there's a whale trying to eat them. These kinds of observations should be..., and the animals are there more frequent than what you can see. You've looked at it for less than 10 years?

A: Bill Koski, LGL: I've actually been working up there for 30 years.

Q: George Edwardson, Inupiat Community of the Arctic Slope: That's good. Almost as long as I've been living. You hear what I'm saying?

A: Bill Koski, LGL: We appreciate getting that type of information in to our database. Craig George, who works with Robert, keeps a good database of all of the sightings that are unusual, and whenever people see something like a humpback or killer whale, I would encourage them to report that to Craig who is the best keeper of the data.

Q: Robyn Angliss, NMFS: I'm curious as to your reference to the Shell data and seeing the Bering Sea signal over on the Chukotka Coast. My recollection, and I could be wrong, is that the Bering Sea water went up the right hand side of the Basin, and so they could be picking it up over by Barrow or east of Barrow, so I don't think it is just a Chukotka Coast phenomenon.

A: Bill Koski, LGL: I didn't mean to imply it was just the Chukotka Coast. Barrow is an important feeding area, and it's been documented in many years as an area that is used heavily. In these particular years, the Chukotka Coast has been the major one, and if the whales are, in fact, staying there until December like we see even in years where they hang around Barrow until the end of October, the Chukotka likely contributes more to the energy accumulation than Barrow. Both are important; both have the same signature. What I was trying to point out was that we previously thought they got most of their energy while feeding in the Beaufort Sea, but now we know that in addition to the feeding in Barrow. They are also feeding in Chukotka for a long period of time. It coincides much better with the data.

C: Harry Brower, AEWC: Traditional knowledge is being verified through science again. My grandfather and my father and my uncles told us as children, we followed the whales we were hunting up in to Canada and the return movements of the whales as the ice was advancing south, so going across right out of Beaufort into the Chukchi. This research verifies what they were talking

about, and the whales' movements and that they use the entire Arctic Ocean to move and feed and raise their young, not just parts of it.

Bowhead whale interactions with industry activities

Dale Funk, LGL

I'll be giving an overview of some of the work that's been done over the past few years regarding bowhead whale interactions with industry activities that have been going on and specifically, looking at the activities in the Beaufort Sea and the fall migration. Studies in the late 1990's during the fall bowhead migration indicated deflection away from industrial activities at roughly 15-20 kilometers from the activity. The sound pressure levels measured at those distances using sonobuoys dropped into the water nearby the activities or nearby the whales were 120-135 dB.

During recent seismic operations, sound source measurements suggested that the 120 dB sound radius may be 50 to 100 kilometers from the airguns, and this led to a lot of concerns that offshore deflections during fall migrations could adversely affect whaling along the Alaskan Beaufort Sea coast and that fall migrating bowhead whales, which have been thought to be more sensitive to industrial sounds, might be deflected away from important feeding areas.

We've taken a several pronged approach to looking at this. One is with acoustic data collected in the Beaufort Sea by arrays put out by Greeneridge. (Several acoustic data movies were displayed.) The first movie is from 2011 with new data that hasn't been seen. No seismic went on during 2011, and then we'll play one from a year with seismic activity. This particular year, 2011, the recorders were out quite early. You can see the whales moving through the recorder array. They tend to come in pulses as you go through the season.

C: Michael Macrander, Shell: One point to make is that 2011 was a low activity year in terms of industry activities. There was no seismic in the Alaskan Beaufort Sea.

So we were out a lot earlier in 2011 than is typical, and we noticed there are a lot of calls up above the array farther offshore than we typically get them. We were wondering what was going on with that, and what we saw earlier in Janet Clark's presentation is that we saw whales out there during our earliest surveys this year, and it is kind of interesting we picked that up with recorders.

C: Susanna Blackwell, Greeneridge: I just want to add that we traditionally analyze sites one at a time, so we don't actually go and look for calls that are heard at two adjacent sites. A number of calls are probably heard by more than one recorder, and so the number of calls shown may seem higher than it really is.

Q: Bill Streever, BP: Do you guys do vector plots with these, and do you see the same phenomenon? It seems there are fewer calls to the west and east in general, but not always, and it might be due in part to call directionality. I wonder if you are seeing the same thing?

A: Susanna Blackwell, Greeneridge: We are seeing it in the shallower areas. As you go to the east in to deeper water there is less and less directionality, which is what you would expect, and this is mentioned in the paper, but you may have to be an echo statistician and pay attention to really notice that. Probably what happens is that in shallow water the lower frequencies that are least directional are stripped out, and so the calls become more directional in shallower water.

Q: Chris Clark, Cornell: You are showing a dot for estimate of position but would you comment on actual error or uncertainty of that of position as a function of range? And then, if you go back to the

animation, there are some interesting artifacts that when you see collection of dots often (unable to hear). If I didn't know better I would assume it is realistic representation of a distribution of whales that are all clustered along clustered along a particular bearing out from an array. Is that true or is that an artifact?

A: Susanna Blackwell, Greeneridge: Regarding your first question on error, we show the movies, but we don't do anything else with all those data points out there. If we limited the movies to those little sausages where we analyze our data, it's utterly boring, and you really can't see anything. The calls that are far away from the arrays have huge errors associated with them. The artifacts that you see were particularly striking in 2011, and I think it is because it is the first year we have a tremendous number of calls north of the arrays (we had a few in 2009). The arrays are positioned north to south because we expect the whales to come through. Imagine two DASARs almost in line and a whale call over there and you know that you have some error in your bearing and you change the bearing by just a tiny bit, suddenly your call gets shot off to New Zealand or something. Those big rays you see are a reflection of that kind of error, and it's a lot of effort to deal with that and because we don't use the data except to make movies, we haven't put the effort in to it. Then you see the calls come down in the usual corridor and those rays disappear.

Q: Chris Clark, Cornell: So what happens when you put this in bearing time space? And you just show the bearing to the position, not the range, and you animate that over time? Do you see tracks?

A: Susanna Blackwell, Greeneridge: We have not done that. The closest we've come to that is probably the plots that Bill Streever is referring to, those bearing plots, and actually we haven't done those either for these data.

Q: Chris Clark, Cornell: In case anybody is wondering, these are "friendly questions" because the data set is an extraordinary data set, and it's very rich. My interpretation is there is a goldmine of information there that needs to be extracted. And you've got five years of this data, and there is a tremendous amount of information that has yet to be extracted out of this wealth of raw data.

Q: Harry Brower, AEWG: This is my first time seeing this and not very many have seen this display as well. In trying to identify with observations by hunters and what you are recording is difficult. I'm not sure how to interpret the information. Like Chris was saying, there has to be some flexibility in the terms of the accuracy of what is being depicted here. I have concerns about how these things are being presented.

A: Susanna Blackwell, Greeneridge: It is just a visualization. Our human brains are good at seeing patterns and movements that are sometimes not that obvious when you just try to analyze the data. If we had all the time in the world, we would maybe have shown you the 1/2 hour movie. Each set of dots is four hours of whale calls. If you do the same thing except every 1/2 hour, you see much more detail. Of course you have to sit and watch it for six minutes or something. You can actually see dots moving eastward early in the season and then dots moving westward later in the season and so on. We don't directly do anything with those data, the movie, in some kind of analysis but it is good to show what is happening and see differences between years with and without nearby airgun use. The data set is used in other ways to look at specific questions.

C: Bill Streever, BP: I think this conversation during the presentations is valuable, and I thank the facilitators for allowing it especially since this was supposed to be representative of industry lessons learned and impressions and this is the first I've seen of any of these slides myself. As Michael mentioned earlier we tried, as he put it, everything possible to work together, but I wasn't able to really be aware of this until last Friday, and I'm really interested to see it. The comment I wanted to make has to do with (unable to understand) Chris mentioned earlier. On the Northstar dataset, the error often puts whales where they couldn't possibly be partly for the reasons Susanna pointed out, that if you are in line with the array, a minor error in the vector sends the call halfway across the planet before the two vectors cross and partly for other reasons, so based on acoustics we had

numerous whale strandings every year. Typically, as I remember, those dots were small enough in some years we left them in the map and other years we took the visualization dots out of the map. It is not to mislead people, it is just the simplification of the visualization. Outside of these Open Water Meetings, there are other groups that have been trying some really innovative approaches to help people visualize these complicated data sets, and I think even overlaying sound in some cases. I applaud the idea of visualization but remind everyone of caveats of what goes with it.

Dale Funk, LGL: The next movie is from 2008 and was shown previously at an Open Water Meeting. During this one there was seismic activity around Harrison Bay and the Sivulliq site near Camden Bay. You will see the arrays appear as they are put out, you will see the airgun activity presented as a blue dot, and the green stars are aerial sightings. You can see when the Gillavar is operating there tends to be fewer calls in that area.

As I mentioned, one of the things you see in the movie, when you have nearby airguns going off, you tend to see a decrease in the call localizations. So, this is more of Susanna's data looking at that (slide displayed) and in fact that is what was seen. Nearby airgun use caused a drop in bowhead whale calling rates. And the call detection rates drop off when the cumulative sound exposure level at the whale over 15 minute periods reaches 127 dB. In the next slide you can see the call detection or localization rates are reduced at sites near the seismic source; sites more remote from the seismic show no significant change in the calling rates.

There are several possible explanations for the fewer calls that are detected when seismic airguns are being used. One is that the whales have reduced their calling rates, and another is that the whales have deflected away from the sound source, or some combination of both of those. To look at that we pair aerial surveys with the acoustic work. Aerial surveys used standard line transect methods before, during and after seismic operations. They were done in the fall of 2007, 2008, and in 2010. In looking at that data, this slide (displayed) shows whales that were seen when seismic was not occurring, or in periods where the ship was not shooting. It also shows whales that were seen when seismic was active. One group of whales was actually seen in July, and they were headed over to the east. So we see whales in the area where the call detections have been reduced. Whales were sighted near seismic operations during aerial surveys well within the 120 dB radius and within these areas where calling rates were reduced.

So there were deflections of the whales in 2008. Deflections were about 9-15 kilometers and occurred when sounds were approximately 150-160 dB. We saw similar results in Harrison Bay. Most of these whales in Harrison Bay were actually traveling, rather than just feeding. In 2010 we also saw environmental conditions, in particular ice cover, which may have influenced the movement of the whales in that year more than the industrial activities in the area. That was a shallow hazards program in 2010. Looking at the call localizations you can see there are very few in the areas under the ice and when the ice goes away or melts, the calls spread southward into that area.

In summary, exposure to seismic decreased call detections, we think it is a decrease calling behavior of the whales; masking of calls by seismic sounds was accounted for statistically. Whales in these studies moved into and through areas with sound pressure levels of 120-150 dB. There was deflection away from industrial activities that occurred 9-15 kilometers from the activities. Measured sound pressure levels at these distances were approximately 150-160 dB. Feeding whales avoided areas of seismic sound that were greater than the 150-160 dB, but they didn't avoid the area in general. They often remained for several days before continuing on.

For comparison purposes, data from the Richardson surveys from 1996-1998 and these show a 20 kilometer circle. When they dropped sonobuoys at that distance they measured sound pressure levels of about 120 dB. Most whales are avoiding the seismic by approximately that 20 kilometer distance. In the non-seismic, whales went through that area.

Whales tolerated higher sound levels during the 2006-2010 study than during the 1996-1998 study. What factors contributed to this difference? In 1996-1998 most whales were traveling, whereas feeding was fairly common in 2007 and 2008. Seismic activities were near the coast in the 1996-1998 study and offshore during the 2006-2010 study. Whales in shallow water may be more sensitive to disturbance.

How do we reconcile data with previous Richardson study that suggested whales deflect at 120-130 dB? Avoidance by whales occurred at distances of 9-15 and 20 kilometers, but sound levels were different at those distances in the two studies. Factors other than just sound level may be important in determining avoidance behavior of whales around seismic programs. Of particular importance is 1) proximity to, or distance from, the sources/activities; 2) activities of the whales including feeding, type of industrial activity and how "localized" it is; and 3) proximity to shore, or water depth, presence and extent of ice.

Does observed avoidance result in whales being deflected outside of their typical migration corridor? If we look at Susanna's plots showing 2007-2011 call detections and BWASP sightings for years with low ice cover, most of the call detections line up pretty well within the typical low ice year migratory pathway. 2007-2008 had a lot of seismic, 2010 had some shallow hazard, 2009 and 2011 had no significant nearby seismic activity.

C: Susanna Blackwell, Greeneridge: I want to remind people that in 2010 we did not analyze data from site two because there was so much ice we couldn't deploy the recorders or enough of them to actually use the data.

Where we saw the whales during aerial surveys was not outside that typical migration. We didn't see too many whales towards the northern ends of those transects. In general whales were seen downstream of activity about the same distance offshore as those upstream, and the patterns of call detections were similar during years with and without seismic operations.

In summary, the observed avoidance behavior by bowheads didn't appear to take them beyond the boundaries of the migratory path. Environmental conditions such as ice cover had more influence in some years on the distances from shore that whales travel in a given year than did industrial activities. Despite oil and gas exploration over the last several decades and including the last four or five years, whales are still using the same habitat areas and returning each year and appear to be using those same sites in the same ways. The bowhead population has continued to recover at 3.4% per year.

QUESTIONS & ANSWERS

Q: Bill Streever, BP: Carrying capacity is a tough thing to get at especially on a population that was severely depleted by hunting in the past. What drove you to put that in there (on the last slide)?

A: Bill Koski, LGL: Based on a paper that Jon, Brendan and Andre published about three years ago.

Q: Bill Streever, BP: I'm not sure, but what I recall is people speculated on a carrying capacity that was somewhere between like something we're approaching and considerably higher based on stock reports. I'm sure there are others in the room that knows a lot more about that than I do.

A: Bill Koski, LGL: The lower end is actually below the current population.

C: Robert Suydam, NSB: That statement by John et al was about what the estimated population size was at the start of commercial whaling in the mid-1800's based on how many whales were caught by commercial whalers and then back calculating what the population size was, so I think this reference to carrying capacity is really about what the population was in the 1850's. Because the system has changed so much in the Arctic, especially in the last ten years, that in my mind carrying capacity has relatively little meaning. We don't know how many whales actually are supportable by the system at this point. It's probably fair to say the population is reaching a level where people thought it was 150 years ago.

Q: (unidentified speaker): Unable to hear (no microphone used).

A: Robert Suydam, NSB: I think the range was like 14,000 up to 25,000 or thereabouts. I'm guessing.

A: Bill Koski, LGL: I think it had a great deal of uncertainty, but it was actually around 10,400 to 22,000 or something like that.

Q: Todd Sformo, NSB: Just a point of clarification, when you showed the side by side plots of seismic and non-seismic, were those all sightings or was it a combination of sightings and vocalizations?

A: Bill Koski, LGL: Those were aerial sightings.

C: Robert Suydam, NSB: Dale, thank you for your presentation. I'm glad at the end you mentioned something about a set distance away from an activity and that 20 kilometers or so may have something about it. This is a topic that Bill Ellison has been pushing. It may be the physical presence of an activity and not necessarily just a received sound. I think it is something valuable to look at. I think we are getting a better understanding that how animals respond to sound and human activities in general is really contextual. Are they feeding, traveling, etc.? I think that more in-depth analysis of the more recent data is needed before we can reach some of these conclusions. Calling them preliminary conclusions or observations may be worthwhile. I'm getting at that in part because you asked a question in one of the last slides about are bowheads being deflected outside of the migratory corridor? That's really not the appropriate question and not the question folks have asked. We are concerned about the animals closest to shore that are available for hunting, and so it doesn't matter if the whole migration has moved or not but what's happening with the animals that are closest in terms of distribution but also in terms of their behavior. I think some care is needed in phrasing of questions.

A: Dale Funk, LGL: I think it is a relevant question as to whether we're seeing deflections of animals outside the migratory path. That's something we could look at with these data. I think it is relevant. It may not be the exact question that directly addresses the issue of whether whales are deflected for hunting, but it is a start to look at what we can with that data.

C: Robert Suydam, NSB: That is a good point, and I certainly overstated things. Looking at the entire migration corridor and how it shifts with ice or activity or whatnot is certainly important, but some of the pressure that's come from the communities in the north has really been about the animals that are closest to shore that are available for hunting, and, in large part, that's what has prompted a lot of this work as opposed to the entire shift in migration corridor.

C: Robert Suydam, NSB: In the five plots you showed I struggled looking at those because the plots from 2007 and 2008 included lots of locations of animals when seismic was shooting but also when seismic wasn't shooting. For those five plots it might be worthwhile to look at it a little differently. I struggled with the conclusion with how the data were represented.

A: Dale Funk, LGL: Fair enough. I think we were trying to represent that we were seeing the migration stay within these bounds over the whole time in a general way.

C: Michael Macrander, Shell: We have taken a much more detailed look at it. The graph here was a high level graphic as a part of this presentation, but if we had five hours to dedicate to that aspect we could go into a lot greater detail on it.

Q: Robert Suydam, NSB: That's good to know; I wasn't aware you had taken a great look at it, and it was one of my questions in general to NMFS about all of this information that you've provided, especially about impacts, how will it be distributed so people can look at it and evaluate it? If we had had the information ahead of time, it may have made the conversation more productive. What is going to happen from these presentations in relation to the evaluation of impacts to marine mammals so that folks can actually follow up?

A: Dale Funk, LGL: Part of it is we found out about doing this presentation not very long ago and pulled it together pretty fast. It goes back to what Bill said a while ago about locking in the agenda a little bit further ahead, then we could provide some of that to people ahead of time.

Q: Robert Suydam, NSB: I certainly appreciate that for this presentation and this question about impacts but it isn't certainly something that has come up in the last two weeks. We've been asking about it for years. It is good to see that we're moving that direction. My question to Bill earlier about when are we going to see information about impacts in the Chukchi Sea, and we haven't seen much of that at all and that's another thing to put on the "to do" list.

A: Dale Funk, LGL: I actually have some of that here. I don't know if we have time to go through it today, but I'm happy to show it to you.

A: Michael Macrander, Shell: Each year we try to pull the data together in to the comprehensive report I mentioned earlier. Certainly that report has grown, the last one was over 1,000 pages, and can be difficult to read. It's a huge amount of information, and we are certainly looking for a better, more efficient and quicker way to interpret this and put it in to something that is meaningful and that doesn't just end up as a door stop.

Q: Robert Suydam, NSB: I don't want to use the thing as a door stop, but I don't have a hard copy. We can download it, but it will take me five days to download it. One of the things on my list of recommendations for NMFS is to make sure these reports actually get distributed so people can review them. We can't review 1,000 pages electronically, I just can't do that. If you can make an extra effort to get hard copies to folks, that would be great. Getting some of these reports would be helpful.

A: Dale Funk, LGL: When the email goes out that contains the download site there is typically a statement to reply back to it if you want a hard copy.

C: Jolie Harrison, NMFS: One thing we started talking about, briefly with Michael, was rethinking how we look at the comprehensive report and coalesce it into more of this combined summary instead of a repeat of individual pieces. I think we are going towards that, but that requires work and some sort of digging down in to it with a group of people at the table. I guess I would say we have heard good input from the peer review, and I see you taking some first steps to address those things, and we appreciate that. Some of the other things are logistical issues: NMFS can work on getting agendas together earlier and talk with the companies about what sort of materials you could provide in advance to get at what Harry and Robert are talking about and having something in advance so we can have a better discussion.

Q: Robyn Angliss, NMML: Thank you, Robert, for comments. The first question I want to get back to is the question about when is this going to be provided in a written format. It would be really nice to have this officially incorporated in to the comprehensive report during the next round. You guys have gone a long way in putting stuff together on the Beaufort, and I'm very much looking forward to seeing what you've done for the Chukchi. It needs to be written down. It really needs statistics to back up some of the statements that you're making in the conclusions. In particular, one thing that jumped out to me was the comparison of seismic versus non seismic and even though, just by

eyeballing it, I can totally agree with you that there's an area of exclusion at the 150-160 dB, there's a change in distribution from the source in those two graphics that's not really reflected anywhere in the presentation and doesn't show up in the conclusions, so I think it's worth taking a closer look at some of that as well. Do you think you will be able to provide some of this material in the comprehensive report in the next round?

A: Dale Funk, LGL: Absolutely. Much of it is in the one that came out relatively recently. It is not quite as cohesive a story as what we tried to do here, but it certainly will be there.

Q: Raphaela Stimmelmayer, NSB: I want to follow up on what Robert said. One could also interpret the data with respect to when the whales are feeding they are not as easily deflected, that in a way you could also interpret it as this is the Achilles tendon of the bowhead, that during feeding an animal may endure situations that it otherwise would avoid. Some of that was presented at Tampa showing that feeding behavior, where a whale may choose not to respond, so it is very interesting, and I'm looking forward to more analysis.

A: Dale Funk, LGL: Certainly, the feeding and behavior the whales engaged in is a big part of it.

C: Jeff Childs: Tapping in to some of the things that Janet Clarke presented and Bob and Dave presented, and measuring potential impacts to marine mammals. It comes to mind as to whether or not what we've looked at here is rather coarse and our evaluation of it. Something that has come up over past several years is what are we impacting in respect to cow/calf pairs. We've acknowledged that different life history stages may be affected differently by sound. I would just make the recommendation that, if you think there's enough data, to go in and look at what you would think the typical migration corridor is just for the cow/calf pairs that have been detected/observed and then look at whether there is a change with respect to cow/calf pairs when you have seismic activity present.

A: Dale Funk, LGL: We have looked at that, and the issue is sample size. The number of sightings of cow/calf pairs is not great enough to really look at it at this point.

Chris Clark, Cornell: Like many others I'm struggling to deal with multiple levels of data and the results, but also how these results and efforts tie in to the larger questions that bring us here. My observations are that 1) you guys are the victim of your own effort and success. You have a lot of data, and we're asking you to make it available, and it is 2,000 pages, and we say we don't want 2,000 pages, we want cartoons and give pages, and yet in order to understand the complexity of this ecosystem and the potential influences of human activities on it, it is a very complex problem and we will not get any true answer, but, instead, all we can do is constrain our uncertainty. 2) The noise from the reverberation of seismic impulses has made it difficult for humans to detect the bowheads, so the hypothesis is wouldn't it be true that the same noise is making it difficult for the whales to communicate with each other? A question for you, Dale, is on bullet three on the conclusions. What would you expect the whales to do? Go to Siberia?

A: Dale Funk, LGL: No, that is what I'd expect them to do. We are trying to indicate there hasn't been a big change in that based on these five years of data, and, based on previous industrial activity out there, we haven't seen a big change there.

C: Chris Clark, Cornell: So then my last observation is back to my colleagues at NOAA in terms of asking you, and not just you but all of us, where are we going with all this? These guys spend millions of dollars every year and get all this data, and we're starting to gather all this, and what are we going to do with it, and how does it fit in with all the cumulative influences? Not just the impacts but the cumulative influences that we're seeing, the changes not only in the biotic and physical ecosystem, but the acoustic ecosystem. Imagine five years from now. We now have four 2,000 page tomes, and it's all pointing to change in the human infrastructure on the North Slope, and the animals are migrating through it, and how do we deal with that situation or do we?

A: Jolie Harrison, NMFS: Our goal is to use the information that we ask for. One of the reasons I decided to discuss a comprehensive monitoring plan at the beginning of this presentation is because clearly the amount of data being gathered is outstripping people's ability to analyze it. I would hope that folks focusing on a comprehensive plan would do, in addition to trying to figure out what work we should do, is devise the reason for why we're collecting it and what we'll do with it. We look at the stuff, and we use it qualitatively. The sort of tools that you and other people are working on to look at masking or other affects could benefit from quantitative inputs. That's one of the sorts of things we could use the data that we get for. We struggle with using qualitative analysis because it just sounds like an easy way to say well, we can't tell you exactly what we're doing with it but we're taking it in to consideration. Which is true, and we have to some, but I think especially with so many ways to collect data, we probably should be able to devise a way to use it more quantitatively than we are now. I think it is a good question, and I don't have a total answer, but I think maybe a group of folks thinking about it in a little more comprehensive way than we have been could be helpful.

Q: Harry Brower, AEWC: In regards to bullet three. Sure the whales are coming back and forth, but I'm not sure they are willing to move away from something that's been going on for the millennia. I don't think they want to move; they know what's good for them. I am trying to understand what we're really driving here. So what if the oil industry has been coming for the last two decades and the whale is still coming? What does that really mean for you? Is that a message the industry is trying to give? So what if we make noise, the whale is still coming? I have to look back at the MMPA and the language that's in there - no unmitigable adverse impact for the availability of subsistence use of the resources. We don't want them to move away from where we normally go to do our hunting. We are providing food for our communities. We want them to come back to our areas. It is raising the flag for me in trying to understand the question and the concern and will this create an easy permitting process in the sense that maybe the agency sees it as a plus. It leads to having some negative thoughts in a sense. It could be demeaning in a way, if it is to be taken in that sense. As a hunter I have to sit here and say what are you really getting at with that conclusion? We've asked and communicated. There's been interference and documentation of activity deflecting whales and making them less available and creating situations for the hunters, dangerous situations. We are not in big ships, we are in small skiffs. Weather patterns change. Everybody knows all this, yet we are here again trying to defend in a different setting, in a different time and a different perspective coming in and continue to voice issues. We learn of new research, and that's all great. It is good we are sharing this information. But it takes time as well. I'm not going to be coming here the next twenty years trying to answer the same questions. There needs to be a means of taking in this information and making meaningful decisions about what is going to be happening tomorrow, not 10 or 15 years down the road.

A: Bill Koski, LGL: Harry, two questions that have to be answered by NMFS, and one of them is the availability for subsistence hunters. Right now industry has decided they are going to shut down before and during the hunts so that the whales will be available to the hunters. The question we're trying to answer with bullet three is the other question as to whether the activity will have an impact on the population. I don't think any of the industry people here have any intention of impacting the hunt, and I certainly hope that remains in the future.

Walrus Movements and Response to Ice Recession

This presentation has far less to do with interpreting impacts of industry on marine mammals as it does to interesting information we are gathering and learning as a result of these studies. Things are changing out there, and the distribution and behavior of marine mammals is changing. It could be construed that the changes in the behavior and distribution of walrus was because of industry

activity. What I'm trying to do here is paint the whole picture, as far as we can tell it, about what's going on in response to ice recessions.

Walrus tend to spend winters in Bering Sea near St. Lawrence Island. In the summer, the males tend to stay behind and use haul outs. Many of the females and young move to Chukchi Sea following or riding on the ice as it melts back in to the Chukchi. Historically on the western Chukchi haul outs. Haul outs have been known for a while along the coast, but the large scale haul outs we've seen since 2007 on the Alaskan Chukchi coast are a newer phenomenon.

What we know about the history of the walrus is that they tend to utilize relatively shallow continental shelf habitats. They tend to feed on benthic invertebrates at depths less than 100 meters. They spend time between foraging and, when it's available, hauled out on ice allowing them to warm up and rest. If ice is not available, they will haul out on land. Generally speaking, when they are able to utilize ice floes, the distribution of walrus is not completely uniform.

USGS has been tagging in the Chukchi Sea since 2007. Animations are available on the web. It is a tremendous data set and provides an ability to follow the movements of walrus in the Chukchi through the season as movies. When we look at multiple streams of data, tagging data and acoustic data and some of the aerial survey data, and put them all together it strengthens the story.

The Chukchi Sea is a broad, flat, continental shelf habitat with a couple of topographic highs (various shoals), valleys and the coastal area with Barrow Canyon. Because of this, it influences the more significant currents. One of the big drivers is that water enters the Chukchi Sea through the Bering Straits, moves northward and is relatively warmer than the Chukchi Sea. The pattern of ice melt reflects those currents; ice retreats earliest over channels and latest over shoals. Ice over Hanna Shoal tends to persist late into the season due to slow melting and grounding of multi-year ice. Different melt regimes create different water bodies identified by temperature and salinity gradients. These water bodies evolve through the season.

Areas of early ice retreat have relatively warm, lower salinity water, and are characterized by early phytoplankton bloom followed by rapid growth of zooplankton. In areas where there is late ice retreat, there is cold high salinity water, late phytoplankton bloom, and slow growth of zooplankton. If you are a walrus and you feed on benthic animals, you want to be in this area (displayed) for two reasons: 1) there is a high abundance of food to eat and 2) that's where the ice is, and all you have to do for food is drop to the bottom, which is relatively shallow, you can forage and come back to the surface, haul out on the ice, warm up and rest. The Hanna Shoal area is an area that the walrus tend to concentrate in during the season.

Beginning in 2007, we saw record recession of ice out over the shelf break fairly early in the year. To be on ice and foraging the walrus would be over deep water, probably too deep for them to forage. Even though the ice is gone, the walrus tend to be there for a period of time. After that they come to shore and form these large haul outs. Large haul outs have been seen on the U.S. Chukchi coast beginning in 2007. We did not see them in 2008, but there was relatively later ice recession. It did recede, but fairly late in the year. In 2009 through 2011 we saw large haul outs forming.

One phenomenon we've seen, in tagging and acoustic data, is that early in the season there is a lot of focus and concentration of the walrus around Hanna Shoal. Then, later in the season they come to shore, but they don't necessarily stay there. There is apparent movement back and forth between shore haul outs and Hanna Shoal. To interpret this as displayed here, these are the recorders set at 5, 10, 15, 20, 35, 50 miles offshore of Wainwright and north 40. It shows many

walrus over Hanna Shoal area but about August 24th a mass movement of walrus passing the 20 mile recorder and a few hours later passing the 15 mile recorder and so on. Then, not a lot of activity for about three days and then waves heading offshore back to Hanna Shoal.

One of the spinoffs of some of this work is new ways of looking at data and new ways of asking/answering questions. An unanticipated benefit of this work is what JASCO demonstrated; that from one recorder within a limited amount of range they are able to track walrus paths, track a dive of a walrus both in the horizontal and vertical. This display shows a walrus track. From these data we can anticipate and begin to examine diving behavior and things of that nature through the season.

(Displayed 2006, 2007, and 2008 aerial over flight and vessel data.) Bear in the mind the aerial overflights were limited to within 25 miles of coast in those years. In July 2006 you see a lot of movement northward along the coastline; not a lot of results in August, September and October 2006. Vessel sightings in the offshore are pretty much where you would expect them to be because 2006 was a high ice year. 2007 was a very different pattern; a lot of early observations in the offshore and not much in the near shore. But in August it changed. There was a period when there was open water for a period of time, and one of the vessels saw about 3,000 walrus over a day and one-half period of time. In 2007 there was a rapid buildup along the coast late in August and then high incidences of observations along the coast and dropping off in the offshore. There was a similar pattern to that in 2008.

In conclusion, this is looking at the value of multiple data streams and the added learnings about the ecological information and being able to piece together an understanding of what's going on with walrus. We operate an ice monitoring program where we are looking at detailed ice maps on a day to day basis, and I have the advantage of knowing when ice gets below a minimum in the Chukchi Sea in the Hanna Shoal area, and, in the last three years, we've had an internal competition to predict the first day the haul outs will show up on shore. Generally speaking we expect them about seven to ten days after the last ice disappears from the Hanna Shoal area. Instead of being able to loaf and rest on the ice and feed 30 meters below them, the walrus are being forced to leave an area which is apparently one they like to be in, go to shore, rest on shore in concentrations that are not really normal for them in this area and then travel back and forth to the feeding area. We don't have answers as to what the implications of that will be, but it is an important part of the monitoring program.

QUESTIONS & ANSWERS

Q: Vera Metcalf, Eskimo Walrus Commission: We know that walrus rest in waters too. Maybe this is a USGS or FWS comment. Large males are known to swim faster and increase speed when they are disturbed and the lengths of their dive are different over young males, females and calves. Is that something that USGS could figure out for us?

A: Michael Macrander, Shell: I know they are tagging to look at diving and foraging behavior.

A: Jim McCracken, USFWS: The satellite tags are able to detect when they are diving and when they are near the surface and when they are resting. I don't know if the resolution is good enough to get the depth of a dive, and I'm not sure if the return are at a temporal scale where you could get very tight information on how long they are, but from what I've seen from Dave's work it looks like the acoustic stuff should actually get better information on dive length and dive depth than you might be able to get from the satellite tag.

C: Vera Metcalf, Eskimo Walrus Commission: There is a known walrus haul out northeast of Saint Lawrence Island. Based on ice comments from hunters, they are saying the ice is different than previous years, probably extending more. If there is late sea ice retreat, is that something perhaps you would deploy later or transit to drill?

A: Michael Macrander, Shell: We will be watching that closely. A couple of points to make is that although we have fully ice capable ice breakers in our fleet, they are not there necessarily to extend the season. They are there for a safety factor in case ice moves in unexpectedly while we are operating we would be able to respond to it. We will be staging, watching ice maps and won't transit until we think we can get to the prospect without a lot of ice breaking and ice management.

Q: Harry Brower, AEWC: I'm not sure if you are aware of that unusual mortality event. How far back is the data going?

A: Michael Macrander, Shell: 2007.

Q: Harry Brower, AEWC: I don't hear anything about this unusual mortality event or any observations in regards to your research being out there and seeing any animals that were being sickly or the animals being approachable other than the normal observations where they dive in right away. But these animals that have this ailment, people are basically able to walk right up to them because they are being unresponsive. Any comments on that?

A: Michael Macrander, Shell: I'm probably not a good person to ask that question to because we didn't have any operations this year. Whatever industry operations there were, were in the offshore fairly far off. I haven't heard any indications like that. We didn't do an aerial overflight program this year because Shell wasn't operating, so that's kind of a data lack in terms of this event.

C: George Edwardson, Inupiat Community of the Arctic Slope: Listening to all of you speak today and yesterday, you know what I realize? That the MMPA had been violated. The ESA had been violated. The migratory bird treaty had been violated. When I listen to all the knowledge everyone has acquired in the Chukchi Sea area. The marine mammals are going to be in the middle of the drilling area. The drilling mud is going to be dumped in the ocean and that violates MMPA. The ESA animals do use this area as a migratory path. This is just my observation from listening and watching what everybody is saying. It will affect the migratory bird path. Has anyone looked at that from the federal government side? I heard a comment earlier about the bowhead now feeds out in the Beaufort Sea. Has anyone taken a look to see why they left the bay on the south of Siberia? That bay is dead now, and the bowheads have to go out in to the open ocean to feed. Bowheads aren't on the endangered species list, but the Right Whale is and that whale is being chased out in to the open water. I'm wondering if anyone had observed this. I'd like to hear from the Feds.

C: Jim Lecky, NMFS: I'm not sure I fully understand the question. I would point out that your intervention is why we are here. I won't comment on your assertion that there's violations going on, but the Marine Mammal Protection Act does put in place a broad moratorium on the taking of animals in order to protect them, but it also includes exceptions. Those exceptions are what we are putting in place. They are conditional exceptions; they have to ensure there is a negligible impact on the marine mammal stock and negligible impact on the availability of those animals for subsistence use. These are monitoring programs that we're trying to put in place so we can understand what the impact of these activities are, so we have information to sustain those findings.

C: Jolie Harrison, NMFS: I want to voice a case of us being a bit remiss. Based on comments we've had in our last open water meetings and most recent peer review, when developing the agenda NMFS asked the companies if they could present some joint or coordinated results. By the time we asked them this, there wasn't a lot of time for them to coordinate with each other. We probably could've provided a little more guidance, but this is a new thing we're thinking about, and we may not have given them a really good idea of what we were looking for. That said, the agenda presents

the last session as an industry presentation suggesting that multiple companies put this all together. I want to say thanks to Shell for taking all this effort to take a comprehensive look at their own data and try to incorporate some of the results from other companies. I think the other companies, in not having enough time to coordinate together don't feel entirely representative of what they would have presented had they had enough time to do that. We'll try to do better next time to give them enough time and provide more direction.

C: Michael Macrander, Shell: Various programs conducted over last several years have generated a lot of data. As we've discussed, there are sometimes different views as to what the relevant questions are and frustrations as to whether the more relevant question to an individual was asked and/or answered. This program is constantly evolving. A lot of information is being gathered, and we have the ability to get the feedback so we can tweak these programs and focus it in particular ways. If questions have been answered, perhaps we should move on and recalibrate and work towards a common understanding of what the questions are and how we're going to do to answer them. There is value in all the different tools we have available to us to gather information. There are strengths to all of them. Acoustics can be deployed and make observations 24/7. Human observers can't be there that much of the time. Another advantage is they minimize observer impact. With vessel based observations, clearly there is the vessel presence impacting the behavior of the animal. Acoustics minimizes that to a certain extent. It is also like looking at the data through a straw, and until animals begin to self identify we won't know absolutely how many animals there are. How do we apply the strengths and minimize the weaknesses to get what we need?

C: Robert Suydam, NSB: Thank you NMFS for putting the evaluation of impacts on the agenda. Thank you Michael and the contractors with Shell for pulling together the presentation in a short period of time. I hope the agenda item remains for next year, maybe with one suggestion. I was struck in reading through the various EIS's that are on the table right now, on how little information was available on impacts from shallow hazards and site clearance work. Since there's been a lot of that work done in the last four years, maybe some emphasis can be placed on that, but not to the exclusion of impacts from seismic or impacts of drilling but trying to explicitly address shallow hazards and site clearance work.

C: John Isaacs, URS: These meetings are to look back and look forward. Beyond exploration the question is to what happens if you find something? How is development going to occur, what facilities will be there, and what are the long term implications? I think BP and Bill Streever have done a wonderful job reporting on Northstar, which is one of the examples out there of development. For future meetings, maybe taking a look at not only Northstar but Pioneer and other facilities offshore and think ahead a little bit about some of the experiences with those facilities and what can be learned from those.

C: Harry Brower, AEWC: I had a little different interpretation as to how things were being presented. I thought it might be something they had identified that was impacting the resources. We have different interpretations on how the English language is written. It's a bit frustrating when you first start reading information you are not familiar with and you've not had the opportunity to review to create questions appropriately. I always wished I could get the perspective of the resources that we depend on for subsistence. I have had conversations with others in regards to what do you think the animals are feeling? What do you think they would be saying? I've been out with researchers on small skiffs conducting research. I take, for example, the science that's been shared since the earliest USGS tagging walrus, and they would give them a shot with a crossbow and sedate them and putting tags on them to learn their movements and diving behavior. I kept telling the researchers, 'you need to cover their eyes because they're eyes are wide open and looking at

you.' The first time we gave the animal the reverse drug, it went through its quivering and it came back about and I told those guys, 'you'd better get back in the boat so we can get out of here,' and they didn't realize what that animal was probably wanting to do because of what they just did to it. When that animal came about it was jumping out of the water, diving and jumping. If we could share that impression you get from just observing the animal the way it's being treated, you get these serious vibes from the animal. These are the things in regards to evaluation of impacts to animals that was my interpretation of what we would be hearing. It was different than what I was thinking it would be. These are things I have to share with my constituents when I return home. I share the agenda, and they are going to question me as to what we discussed. I hope we get some information and reference we can use in writing a trip report. There were a lot of PowerPoint presentations, and John has been asking me if we were going to get something that we can reference and raise questions about. I think that would be very helpful. We have our different observations as hunters because of how we use the resources as food. Seal harvests, a long time ago, the seal hunters would set out their nets in the nighttime because they knew they would be hunting for fish at night. When they did catch a seal, they knew they would be having fresh fish along with that seal meat because of the stomach contents. These are the resources we depend on even today. This is traditional knowledge that has been passed on for generations, and we continue to share today. These resources are being used for food, and issues like this unusual mortality event on the seals and walrus we become more concerned about what is happening with oil and gas offshore activities and the influx of vessels coming in.

Parking Lot Issues

Issue/Goal	Sponsor	Next Step
A. Dedicated workshop to address these issues in an explicit way: 1) definition of small numbers, 2) definition of take, 3) estimating takes and understanding impacts	Harry Brower/Bill Streever/Robert Suydam	None identified
B. Plan of Cooperation discussion	Harry Brower/Johnny Aiken	None identified
C. How the Open Water Meeting recommendations can be voiced and utilized	Robert Suydam	

Parking Lot Issue A. Dedicated workshop to address these issues in an explicit way:

- 1) Definition of small numbers,
- 2) Definition of take,
- 3) Estimating takes and understanding impacts, i.e. what companies do to estimate how many marine mammals they may harass or expose to sound before the activity and how do you go about how many animals were actually exposed during the activity and, as Jim Lecky pointed out, really understanding the impacts is an important aspect as well. What is the biological significance of all this to the whale, to the population and to the hunters.

These concepts on the definition of small numbers and the definition of takes is a legal issue in large part and probably won't be completely solved until the MMPA is amended, but those two topics and estimating pre and post season takes and understanding impacts would benefit from having a

dedicated workshop that would hopefully be sponsored by NMFS and that would help provide guidance to all of us. Would a workshop be helpful, and what is NMFS feedback on whether this could be fit into the work schedule?

C: Jolie Harrison, NMFS: The first thing we want to take off the table is the small numbers issue. It is really more of a legal policy issue, and we are struggling internally on how to apply that more consistently and what it means. I think that's probably not something we would have in a discussion or workshop. I have four slides on how we further interpret take and what that written definition is.

C: Shannon Torence, USFWS: This may be a moot point but if we were, at some point, to have a discussion of take, because some marine mammals are also protected under the ESA, the conversation might also want to include definitions of take under the ESA and how that relates back to the MMPA and then how the small numbers relates to reaching conclusions such as jeopardy.

C: Jolie Harrison, NMFS: MMPA Take: The term "take" means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

The term "harassment" means any act of pursuit, torment, or annoyance

- (i) has the potential to injure a marine mammal or marine mammal stock in the [Level A Harassment]
- (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 [Level B Harassment].

ESA Take: The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

FWS further defined "harass" as an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt formal behavioral patterns, which include, but are not limited to, breeding, feeding, or sheltering.

A couple of points to make because we don't always go in to a lot of detail about how we interpret these things. Harassment is an act that results in a behavioral response right then. One thing we've addressed in MMPA authorizations before is that we've referred broadly to the behavior responses ranking in Southall et al (2007).

0-3: relatively minor or brief

4-6: higher potential to affect foraging, reproduction, or survival

7-9: those considered likely to affect vital rate

One thing we've said and is broadly applicable to how we look at what take is, is that those behaviors that are ranked 4-9 are more likely to be called a "take" and 0-3 may not. The expectation of a Level B Harassment is what sort of triggers the need for an MMPA authorization and then the enumeration of those takes is required by the application. This is only the first step. After that, there's more to be done; we have more analysis to do. These behavioral responses that we've called a take may or may not have any significant impact on the individuals and that is something we have to figure out in our subsequent analysis.

Population Consequences of Acoustic Disturbance. What this essentially illustrates is that there is a sound, then there is a behavioral response to the sound, and then you have to figure out what is the

likelihood that behavioral response will lead to some sort of impact on the animal's survival, reproduction, etc., and then the next step is to determine will there be an impact on the population from the impact to the individual. We have a lot of information about how animals respond to sound. There is a lot of information about population dynamics and how, if you understand the impact to individuals, you can determine impacts to population. What's missing is understanding exactly how important an observed behavioral response is to the individual. The point is that once we have a take estimate, that's the first step, and the steps following are primarily qualitative. When we have more regular access to the tools, we'll be able to do things a little more quantitatively. For now, when we say there are a certain number of takes, it does not mean there are that many significant impacts to marine mammals. Our work after that looks at contextual issues.

Q: Raphaela Stimmelmayer, NSB: You said there is quite a bit of data about behavior changes. I'm not a hunter, but after listening to them, one of the big issues is if there are behavioral changes, what if it is affecting harvest effort and success so there may not be an effect to the animal per se, but it could affect the hunt or harvest? Is that part of your definition of what you are going to evaluate?

A: Jolie Harrison, NMFS: I want to disarticulate a 'take' from an 'impact to a hunt' so we are evaluating two things: 1) is the impact to the marine mammal population themselves? And, 2) is the impact to the subsistence hunt? We independently assessed the impacts to subsistence hunters.

Q: Raphaela Stimmelmayer, NSB: (unable to hear, microphone not used)

A: Jolie Harrison, NMFS: They overlap. We don't quantify impacts to the subsistence hunt in the same way we say there are takes. For example, we acknowledge responses and say a take occurs at 160 dB levels for a bowhead but we acknowledge that they respond at levels lower than that, perhaps as low as 120 dB, in a way that causes them to move that could impact a subsistence hunt. We try to show and explain both the impacts to the animal and the subsistence hunt. Takes aren't quantified for subsistence impacts.

C: Jolie Harrison, NMFS: I was thinking we would have more discussion on the take estimates and the potential for a workshop for talking about those. I'm thinking that take estimates includes three things basically: 1) understanding of sound propagation, 2) understanding of the animal density and 3) some level or threshold or construct that the regulatory agency has established as the one above which things are a take or something in particular has to happen. I'm trying to understand which parts of that you want to discuss. We have some processes in place to look at the acoustic threshold piece of that that we are working on, but they're all open for discussion.

C: Robert Suydam, NSB: I think it would be helpful for the agency to be able to provide more guidance on the right way to do things, or the way the agency wants to see the companies do things. There can be inconsistencies. An example is that after a few years of pushing, looking at takes of bowheads relative to migration became a standard part of estimating takes. Before that it was based on densities of animals and it could be that densities of animals is the same day after day but they're different animals and that's only accounting for one day and then once migration was taken in to account and that movement of animals through an area that might be exposed to sound changed how folks estimated takes. That doesn't happen with belugas, seals, or other species. Talking about those kinds of issues, what data are appropriate to use, and for NMFS to provide some good standards. Having discussions among people that know the data, that know the issues and including the agencies making decisions, could help provide guidance so there's more consistency amongst applications and projects.

C: Jolie Harrison, NMFS: I think some discussion on that will be valuable. I will point out that one reason we...at least in the Arctic we are looking at sound sources and types of effects of things we

are familiar with. Across our program as a whole there are so many different types of projects, regional situations and species, we see a huge array of different ways to calculate takes, many of which are quite valuable. Generally, prescribing one method across so many take situations is like apples and oranges. There are some basic things such as which types of density estimates are preferentially used over another. I think having those sorts of conversations and setting some generalizations would be helpful.

C: Robert Suydam, NSB: Having more guidance and more discussion about maybe not the best way but good ways versus not so good ways to go with preseason estimates and then how do you use data collected during the season to come up with your final estimate of how many animals you actually took. Potential biases in the data and how they may be corrected or not. All those things are a part of the estimates, both preseason and postseason.

C: Harry Brower, AEWC: I mentioned earlier that I needed clarification on what was identified in the back pages of the agenda under the monitoring and mitigation requirements, and the taking of small numbers of marine mammals. I'm still struggling how that is being utilized in regards to information presented. We see research going on, activity happening, and large groups of whales going through. I need help in understanding what does that really mean to the federal government, and how do we mitigate for that. It's not a small group; these are large pulses of whales going through the area that are ensonified by seismic or post activity.

Jolie Harrison, NMFS: It is difficult to define exactly what that is. When we look back through the legislative history and how comments and responses on legislation about what those numbers are, we haven't made that entirely clear, nor has Congress. We are having internal struggles figuring out what that is. Meanwhile we still have to make the negligible impact finding and the unmitigable adverse impact finding. We also have to apply mitigation measures that are used to minimize both of those things. Those physical prescriptions of getting those numbers down are the things that we try to focus on. The small numbers is a challenge for us as well, and I don't think we are going to have something to hand you right now that's going to answer your questions, but know that we are working on it.

Parking Lot Issue B: Plan of cooperation.

Johnny Aiken, Executive Director AEWC: I want to reiterate what Harry said at beginning of meeting on Tuesday. I wanted to make sure this gets said again before this meeting ends. I want to thank you, Mr. Lecky and Mr. Kendall and your staff, for holding these meetings, and to oil industry for sharing their information. Although most of the oil companies have said or have committed to signing the Conflict Avoidance Agreement, the AEWC still has many concerns regarding the plan of cooperation. We respect the federal government for the suggested use of the plan of cooperation in place of the Conflict Avoidance Agreement. The plan of cooperation is being used by industry as back door to Conflict Avoidance Agreement. I believe that this was not the spirit of the suggested use of the plan of cooperation. It is our experience that the plan of cooperation is being interpreted by industry as merely a requirement to conduct a presentation to communities on the projects being proposed in their areas. It is simply a presentation and a one sided information sharing that does not address the true concerns voiced by community members. Where is the collaboration between the villages and oil industry which is at the heart of the CAA? In my opinion, it is nonexistent. Following minimal requirements of plan of cooperation, the oil industry reaches no agreements and makes no attempt to address the community concerns. The AEWC is left out of the conversation in most cases. We are not provided with the information the oil industry is reporting to the federal agencies regarding the plan of cooperation requirements, nor do we know the industry standards for meeting the requirements. With this kind of process we cannot help oil industry and the federal government to come up with mitigation measures to avoid impacts to our hunting and our

resources. It is a broken and exclusive process and divides communities and builds mistrust between whalers and industry, as it circumvents the necessity to sign the Conflict Avoidance Agreement. AEWC and whaling captains regard the Conflict Avoidance Agreement as the only tool that is a true collaboration between themselves and the oil industry. There is a very good reason, and we call it the Conflict Avoidance Agreement because it is the way for us and industry to avoid conflicts. It has historical significance, proven success, and provides a voice for the whaling communities that have existed for many years. We need your help in resolving this issue. The plan of cooperation as an alternative to the Conflict Avoidance Agreement has created, rather than resolved, problems. We have experienced the success of the Conflict Avoidance Agreement and believe it is the only solution as it includes mitigation measures that are agreeable to whaling captains and oil industry. AEWC has worked diligently and collaborated with the industry for decades to develop a process that promotes collaboration. The result of this was an annual agreement that allows everyone to get their work done in the ocean. Now we believe it is the time for the federal government to honor this effort and encourage industry leaders to keep working with us to develop and sign the Conflict Avoidance Agreement. After all the oil industry is just a visitor to the Arctic. Thank you.

C: Jolie Harrison, NMFS: Thank you for the comments. I really appreciate hearing them. I think I understand what you're saying, and I hope our ideas about moving forward and looking closer at the Conflict Avoidance Agreement and POC that I talked about earlier in the workshop that includes reaching out to both you and industry to figure out how we can make this go more smoothly and more importantly ensure that we get the measures in place to have unmitigable adverse impact. That is our goal. We need to look at the strengths and weaknesses of the two processes and what we can do to make these two processes make more sense. I hear what you're saying, and we're trying to act on that.

C: Jim Lecky, NMFS: Thank you for your statement. We have struggled with Conflict Avoidance Agreement issues in terms of its scope and what it addresses and whether the agency has the wherewithal to implement all of it or even part of it. Regulations were developed in a way that was meant to be more comprehensive in addressing issues of the communities along the North Slope. I take your comments to heart and will carry that message back with us so we can begin to look at ways to bring those processes closer together and address community concerns. I really do think it is important to engage in that dialogue and bring our sister agencies in to the discussion.

C: Robert Suydam, NSB: The Conflict Avoidance Agreement is, in my view, a phenomenal agreement. It is a private agreement between industry and the AEWC, and it really has led to everybody being able to do what they need to do. It works, and it's sharing the ocean for activities that may not otherwise be compatible. I think the AEWC and industry both deserve a lot of credit for setting a precedent to meet the obligations of the MMPA, and I think NMFS has benefitted from that agreement in many ways. Remember, there are other co-management organizations that haven't been covered in the past in the Conflict Avoidance Agreement, and it hasn't been a huge detriment, but as more and more activity is occurring in the Chukchi Sea that conflicts could arise with hunters of those other species.

Parking Lot Issue C: How can meeting recommendations be voiced and utilized.

C: Robert Suydam, NSB: In the mid 1990s and late 1990s the Open Water Meeting was much, much different. The meeting was 20-30 people sitting in a small conference room having quality discussion and reaching conclusions. In 2006, when the amount of interest in the seas expanded dramatically and the meeting grew to this size, it became a challenge. Trying to have productive

dialogue with 200 people is challenging. Over the last three years I think NMFS implementation of an official peer review panel has been a real help. Specific recommendations have come out of that peer review panel that I think everybody has benefitted from. Because there is a peer review panel, what is the point/purpose of this meeting? I'm not sure there are a lot of recommendations coming out of this meeting that are written down or that might be considered by NMFS or industry. If there aren't recommendations coming out of this public meeting, maybe that's not a bad thing because it is a phenomenal opportunity for anyone to come in and hear about what's happening in the Beaufort and Chukchi Seas. I think it is helpful to have presentations from all the companies at one time and in one place and have good discussion. But I worry that some recommendations that come from the room may be lost. Is there a way the Open Water Meeting might be modified somehow so that recommendation ideas for improving monitoring plans or doing things in different, better ways, might have a more formal process for transferring those ideas for NMFS, FWS and industry?

C: Jolie Harrison, NMFS: The two things that are different about the Arctic that started this meeting were the potential impacts of these activities to the native culture and our responsibility to make an unmitigable adverse impact, and the peer review. We've separated the peer review, and we have a meeting that's really focused on that. That has really allowed us to focus the input of the group, and we're getting more out of it. At the same time, I think our understanding of impacts to subsistence communities is the primary driver for this meeting and that's related to that POC and CAA discussion. And while I do think this meeting is very valuable, I agree with Robert that the subsistence recommendations related specifically to measures to reduce impacts are a little bit diluted in this particular structure. As we talk about figuring out how to deal with the POC and CAA we'll be intensifying, hopefully, input and getting it more directly from the community through that route. It does lead to the question of what do we do with this meeting? We have valuable information exchange and presentations, but I want to make sure we still get the focused input as well.

C: Lisa O'Brien, Facilitator: One of the things we do all the time when I work together with Professional Administrative Services is to make some suggestions for structuring organization. If you ever want to have that dialogue we'd be happy to do that. What we can do is pull out the recommendations from this meeting, if you want. If you want it flagged, it can be organized in that way.

C: Jolie Harrison, NMFS: Thank you for that, but it doesn't obviate the bigger concern though which is we are specifically looking for recommendations from subsistence communities, and there aren't as many individuals here as there would be if we held the meeting in a place where they didn't have to travel as far. We need to figure out a way to make sure we are getting that input and the purpose of this meeting is still what we thought it was.

C: Robert Suydam, NSB: One way to go about that might be that NMFS and USFWS have co-management partners, and maybe since the focus really is the availability of marine mammals for subsistence hunters that maybe it is worthwhile for the agency to get together with their co-management partners and say, here's what we're trying to do, how can we serve your needs better and make the Open Water Meeting work in a better way than it has been. From my perspective, having a list of recommendations that would be published on a website would be valuable. To have that record in an easily obtainable way would be beneficial.

Wrap-up and Closing

Harry Brower, AEWC: Thank you. I have a lot of constituents, and I have a lot of responsibility to provide information back to them. I have to put on my learning hat and learn things all over again. Being a hunter and being put in this administrative spot is a great learning task for me. I want to share my appreciation with you all, the oil industry, and the information you've provided. It is a pretty impressive set of information, sometimes overwhelming, and trying to create meaningful comments and questions without having all the material before you can be difficult and frustrating at times. I wanted to share my appreciation with you all though and thank you very much.

Mark Fesmire, BSEE: I, too, need to start by thanking the NOAA and BOEM staff. I've heard about the importance of this meeting ever since I got here five months ago. I was glad to have the opportunity to attend. I'm an engineer, I understand oil and gas operations. I understand oil and gas safety and how to do it correctly. I'm also a lawyer, and I understand regulations and the law but what I don't understand, at least three days ago, was Arctic marine ecosystems. Thank you for putting the meeting together and the presenters. It has been a heck of an education in three days. Thank you everybody.

Jim Kendall, BOEM: This is my third open water meeting. They only keep getting better. The first one I came to, I was awe struck. It's not the way things happen in D.C. Then when I came here acting last year for two to three months, I really enjoyed the meeting, and now I'm here permanently. I really enjoyed it and learned a lot and that's because of the great work that our friends at NOAA do. I know sometimes we get credit for this meeting, but NOAA carries the water and does a great job. The speakers do a great job. Lots of information. Everyone can come to participate. Thank you to the audience. The facilitators do a great job. Those groups (NOAA, the speakers, the audience and the facilitators) do a great job. Transparency depends on everyone having a seat at the table and coming forward, being honest and having good faith. I saw a lot of that in this meeting. We're going to go back to something Harry said the first day. I wrote it down: March 6, 2012, Harry Brower, "It's all about sharing." There was a lot of sharing at this meeting. This is a good example of how it should work. Thank you everyone.

Jim Lecky, NMFS: I particularly want to thank everyone for coming. It is one of the primary purposes is to gather comments and views so we can address our responsibilities. Harry, Vera, Johnny, George, it's good to have the Walrus Commission here and also John Goodwin. Thank you for spending this amount of time with us; I know time is precious. I want to thank my colleagues in other federal agencies for participating and being here; it's good to have you all here as well as we do have to administer our statutes in a way that meets the needs of the communities, and it requires collaboration, coordination and hearing some of the same comments and input. Lisa and Ron, thank you for coming and your work in these meetings. Finally, it has been a real privilege to work with you all over the years. Thank you.

"It's all about sharing."

---Harry Brower

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