National Marine Fisheries Service

Arctic Open Water Meeting

March 5 -7, 2013

Anchorage, Alaska

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Acronyms

ASAMM	Aerial Surveys of Arctic Marine Mammals
ABWC	Alaska Beluga Whale Committee
ADFG	Alaska Department of Fish and Game
AEWC	Alaskan Eskimo Whaling Commission
AFSC	Alaska Fisheries Science Center
ANC	Alaska Nanuuq Commission
ASRC	Arctic Slope Regional Corporation
AWBC	Alaska Beluga Whale Committee
BSEE	Bureau of Safety and Environmental Enforcement
BOEM	Bureau of Ocean Energy Management
BOP	Blow Out Preventer
BWASP	Bowhead Whale Aerial Survey Project
CAA	Conflict Avoidance Agreement
CSESP	Chukchi Sea Environmental Studies Program
COMIDA	Chukchi Sea Offshore Monitoring in Drilling Area
dB	Decibel
DASAR	Directional Autonomous Seafloor Acoustic Recorder
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EWC	Eskimo Walrus Commission
FLIR	Forward Looking Infrared
GPS	Global Positioning System
ICAS	Inupiat Community of the Arctic Slope
IHA	Incidental Harassment Authorization
ISC	Ice Seal Committee
kHz	Kilohertz
km	Km
LOA	Letter of Authorization
MMO	Marine Mammal Observer
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
NSB	North Slope Borough
OWM	Open Water Meeting
POC	Plan of Cooperation
PSO	Protected Species Observers
RMS	Root Mean Square
SEL	sound exposure levels
SPL	sound pressure levels
SSV	Sound Source Verification
TEK	Traditional Ecological Knowledge
TK	Traditional Knowledge

USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VSP	vertical seismic profiler

Note:

This report is a detailed summary of the March 5-7, 2013, Arctic Open Water Meeting held in Anchorage, Alaska. Attendees included those from the science community, industry, native organizations, community stakeholders, and local, state and federal agency representatives.

Presenters provided information on their respective activities, including a summary of 2012 monitoring results and harvest updates, 2013 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 presentations which can be viewed at http://www.nmfs.noaa.gov/pr/permits/openwater.htm. Documents from previous meetings are also available on this site. In addition, the peer review panel reports for the proposed programs discussed at the 2013 meeting are available at this same website.

Careful attempts were made to capture identified speakers, speeches, questions, answers and comments. However, it is not a verbatim transcript, and 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.

Day One – March 5, 2013

Welcoming Remarks

Jolie Harrison, on behalf of the Director National Marine Fisheries Service (NMFS), Office of Protected Resources

On behalf of Helen Golde, the Acting Director of Protected Resources, and Mike Payne, the Permits Division Chief, both of which are sorry they couldn't attend today. They wanted to be here and say thank you on their behalf. Good morning and thank you so much for coming. All of us at NMFS continue to be grateful for the active participation of such a diverse group of knowledgeable and committed people involved in both this meeting and the regulatory process. We are so glad to see you here; many of you have been here many years in a row, and it is very nice to have that consistent input. The opportunities at these meetings to hear more about and discuss both the industry activities themselves, as well as the subsistence and other environmental concerns related to these activities are critical to our ability to appropriately direct these activities under our National Oceanic and Atmospheric Administration (NOAA) authority. We continue to be grateful for that. Again, thank you so much for coming.

Jim Kendall, Alaska Regional Director, Bureau of Ocean Energy Management (BOEM)

This is one of my most favorite meetings. I really enjoy it every year. Not so much for the subject matter—the subject matter is great—but I would probably consider this as one of the gold standard for transparency based on the participants. We have the Alaska Native community, whaling captains, industry, federal and state agencies, non-governmental organizations, scientists and engineers, and last but not least, the public is welcome to come whenever they want. To me, this is a great meeting. I look forward to it; I always learn so much.

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

As most of you are aware, we learned a lot about drilling this summer in the Arctic. We learned a heck of a lot about how to get rigs up and back. One of the most important things that we learned was something that we appeared to do reasonably right and that was the importance of communication between stakeholder groups. This meeting is a very integral part of that communication, and I am very glad and very proud of being a part of it this morning.

Lisa Toussaint, Program Manager, Alaska Region, United States Fish and Wildlife Service

I recognize that the real focus of this meeting, with the exception of the Pacific Walrus, is mitigating impacts to the marine mammals under NOAA's jurisdiction, but I would like to say we are glad to be here this morning and very much appreciate the opportunity to participate in this important meeting. Our relationships with all of you, from the industry partners, our Alaska Native partners, our federal and state agencies partners and all the rest of you in the room, are very important to us. As many of you are probably familiar, we have at the United States Fish and Wildlife Service (USFWS) a long-standing and established process of engaging and working with Alaska Native communities

and industry to ensure that incidental takes of marine mammals from industry activity are minimized and that the availability of the mammals for subsistence use continues. Part of that process is issuing incidental take regulations and letters of authorization pursuant to those regulations and is a very significant component of that process is ensuring that industry applicants work early and engage with Alaska Native communities before we issue our letters of authorizations. In an ongoing process, the USFWS continues to work with the affected communities through meetings and visits to ensure that the important resources that we protect are conserved. We think the process has been effective over the years and continues to minimize impacts to these important subsistence resources. Just a word real briefly to our friend the Endangered Species Act (ESA) which one of my colleagues reminded me is celebrating its 40th anniversary this year. With the listing of the polar bear in 2008 and the proposed designation of the Pacific walrus as a candidate species in 2011 and with a final decision on the horizon in 2017 on whether or not to list the walrus, there are questions and concerns about what an ESA listing might mean for subsistence activities and industrial development in the Arctic. To better inform my agency's decision making under the ESA and our sister agencies decision making for their management and also to issue incidental take regulations, we have a number of different things going on at the USFWS. One project scheduled to commence this summer is a genetic mark-recapture project on walrus which will hopefully give us information on abundance and demographics. We don't know at this point whether or not the walrus will be listed in 2017, but would like to assure you that a listing of a species under the ESA does not affect the special exemption that exists for the take of marine mammals by Alaska Natives for subsistence use and making handicrafts. We would also like to assure our industry partners that we are committed to working closely and cooperatively with them to facilitate the likelihood that their activities can go forward, while we protect important resources. With that said, just a final quick note. I think we all share the goal of conserving marine mammals. With declining sea ice loss, this is going to be a greater challenge. It is certainly an ambitious goal, one that will require creativity and the commitment and the talents of everyone here. I have a faith in you with that regard and appreciate your efforts and with that wish you a productive and successful meeting.

Safety Moment

Courtnee Moss, Sales Manager, Anchorage Convention Centers

Welcomed participants and explained where the fire exits are. If in earthquake, please use only those exits as they are bunkers. She pointed out location of the fire extinguishers, AED and first aid availability next to security on the first level on the east side of the building. If the building must be vacated, the meeting station is Town Square.

Introductions and Housekeeping Items

Lisa O'Brien, Alaska Training & Consulting, and Ron Felde – Facilitators

Lisa O'Brien introduced herself and Ron Felde as the meeting chauffeurs who are tasked with the responsibility of keeping the meeting on time and on track. She also noted the record keepers and informed those attending that there is not a verbatim transcript. It was requested that if clarification is needed, that the original person asking the question restate the question or issue to ensure accuracy for the record. She then asked participants to introduce themselves by name and organization (See Appendix A). Lisa explained how participants will have an opportunity to ask

questions or make comments throughout the meeting via the "Air Traffic Control" process which assigned participants a number that will allow an opportunity to ask a question. Last, please put your name tags on, to help with the official meeting record.

Review of Agenda & Meeting Objectives

Candace Nachman, NMFS Office of Protected Resources

Thank you for being here and taking the time each spring to participate in this meeting. I want to say, and I hope people who have been here in the past remember this, that the agenda is fluid. It changes. It changes because you need it to change. We want this meeting to be useful to everyone and what people intend to get out of it. Just this morning, I found out that there will be quite a few changes on Thursday. We will probably be getting out quite a bit earlier than we previously thought and people will be talking about this throughout the day. For example, ION just informed me that they are not going to be pursuing a project in 2013 so that is coming off the agenda on Thursday, and we might be adding a couple of short things to fill up some of the time. I just want to remind everyone that we are all here to learn and discuss—please bear with us as these things happen. We started holding this meeting long before I joined this office. There are several people here who have been participating in what is known as the Open Water Meeting (OWM) for over 20 years now. It is a meeting that has grown. It is a meeting that as Jim Kendall put it, brings people together from all different facets of the industry, government and Alaska Native communities together. We are really here to talk about monitoring and mitigation and how these activities can be done in a way to ensure the availability of these marine mammals for the subsistence hunters that depend upon them for their culture and for their way of life. It is a meeting about sharing and exchanging information and that is really what the agenda is designed to do. This morning is meant to hear updates from the agencies and the Alaska Native marine mammal commissions. We will then move into what happened this past year; we have a chance to look at some data, ask questions and discuss issues. On Wednesday, our second day, we are doing things a bit differently. We have a strong line-up of NOAA scientists who will be speaking to you tomorrow morning about the work they have been doing that is meant to enhance the decision making of the regulatory process. It will be a great opportunity to exchange information and hear of the work that is going on. We close out the meeting with what is ahead and coming up and give people the opportunity to ask questions of industry who have proposed operations and activities and to hear what your concerns are. I look forward to a great meeting with all of you.

Ron Felde, Facilitator

Our primary purpose is to keep the meeting flowing and on-time, yet have participants make their presentations and others to ask questions and make comments. One of the tools to help guide the process is the ground rules which are in the agenda packet and outlined below:

Ground Rules

- Honor the agenda
- 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 with 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 texting and laptops

The most critical job is to get the group back together from breaks and lunch. When you see the fishing pole, please return to the room to resume the meeting.

For presenters, a "yellow light/red light" process will be used for timekeeping purposes. A yellow card represents five minutes remaining time; a red card represents the need to wrap up the presentation within one minute.

Parking Lot Process

The purpose of the parking lot is to move items that are outside the agenda to a "parking lot" for later discussion. We will document issues outside the topic at the time, yet important. On day three of the meeting, we will identify a small group that represents the audience and help sort through the items, review and prioritize and them as a whole-group, and discuss the top three to five issues.

For those who were here last year, we may ask you to be part of a small group to present all different perspectives. The small group's task is to break out from the larger group and determine if the parking lot topics fall into certain themes. Participants will then be able to vote on the laundry list of topical themes to identify the top three issues for discussion.

NMFS Incidental Take Program Updates

Jolie Harrison, NMFS Office of Protected Resources

As most of you probably know, last year NMFS put out a draft environmental impact statement (DEIS) on Arctic oil and gas exploration. After we did that, through public comments and other means, we identified a need to address the potential for a greater level of drilling activity than was put in the draft. We decided to do an update and issued a new draft that contained an alternative for a higher level of drilling activity and put it back out for public comment again. I think you are aware of this because we have had some public notices of our intent to do this. Working on this, we also decided to use the opportunity to update and revise based on some of the input we received from public commenters, our impact and mitigation analyses and also our description of the affected environment. You will be hearing more about these updates later on in the meeting. That said, I know many of you are probably interested in the timeline when you will be able to make comments on the second draft. Currently we think in two weeks we will make the next version, the supplemental DEIS available on our website March 21 for public comment, so please look out for it.

There is a 60-day comment period. Hopefully that will be enough time to get input from all of you that are interested.

I also wanted to mention—and we talked about this a bit more deeply last year—is we still have two priorities in incidental take program that we are working on. One is the development of a comprehensive monitoring plan to guide how folks do monitoring under their Incidental Harassment Authorization (IHA) for Arctic activities. Another one is our long, continuing goal to figure out the most efficient and best way to minimize subsistence impacts, considering both the Conflict Avoidance Agreement (CAA) process and the Plan of Cooperation (POC) process. Those continue to be priorities for us. Progress is probably slower than wished, but those are on our list of things to get done, and we welcome input from folks while we are here. Obviously those things involve a lot of input from a lot of different stakeholders. Last, I wanted to mention that Candace is in a leadership program and going on a detail a week from now and not returning until June. If there are things you usually address with her, please send them to me. I think that is all for now, and, like I said, we will be talking about these things throughout the meeting. Thanks.

Q&A | Comments:

Jessica Lefevre, Alaska Eskimo Whaling Commission (AEWC): Just a quick question. You said something about a comprehensive monitoring to provide direction. Could you elaborate a bit?

Jolie Harrison, NMFS: This is what we talked about a bit last year; I think I had a slide on it. As you know, our issuance of an IHA necessitates a monitoring plan by half of the applicants and there is a peer review that is required, and I think that we all know we've had some good monitoring done over the years and those plans have been submitted separately and without pre-guidance on what direction to go and thinking overarching what our target study might want to be. So, just getting on one-page of where we should be going, instead of the slightly more reactive way we might have dealt with in the past. Despite the fact that it has come up with great information, we want to make sure we are thinking coherently across the program instead of one plan at a time.

Jessica Lefevre, AEWC: Okay, thank you. I wasn't sure if you were introducing a new concept.

Interagency Compliance Monitoring Panel

Jeffrey Missal, Regional Environmental Officer, Environment and Enforcement Division, BSEE
Jim McCracken, Walrus Program Lead, Marine Mammal Office, USFWS
Bill Ingersoll, Chief of Plans Section, BOEM
Brad Smith, Alaska Region Protected Resources Division, NMFS
Hanh Shaw, EPA
Susan (Sudie) Hargis, US Coast Guard

The people participating in the presentation today are the primary points of contact for environmental compliance and monitoring. Basically, this group (and this is just a small representation of who gets together weekly during the drilling season) meets to discuss environmental and compliance monitoring issues that occur throughout the open water season. The group consists of 17 to 25 people, including industry in some cases, to discuss issues going on in the Arctic. The overall goals of the working group are:

1) Oversight of environmental monitoring and compliance (*ensure what is being done is what needs to be done as far as covering environmental concerns).*
2) Identify and respond to emerging issues during activities in federal waters (*basically as we go through the season, we discover new issues come up that we did not anticipate and this is a way for the regulatory agencies to get in front of that and discuss the problem and potential solutions).*
3) Provide situational awareness to de-conflict that information (*a way for us to all sit together and continue to discuss these issues and find solutions to them as we go through)*.

We definitely identified low hanging fruit this year. This next drilling season, we hope to have picked that fruit and found solutions to it. I'm sure more fruit will bear itself as we come to pass. This is mostly what we had and want to open it up to the group for questions you might have for us.

Q&A | Comments:

Robert Suydam, North Slope Borough (NSB): I'm curious if there is any way for folks outside of federal agencies to better understand and participate with what is happening with the panel? (*Asked to restate the question by Lisa O'Brien so that everyone could hear.)* Whether folks from outside of the federal government could either participate in the panel or whether there was a way that information from the panel could be distributed to other people on a regular basis so that other folks know what the issues are or what is being discussed?

Jeffrey Missal, BSEE: We actually had this discussion when we started putting this together back in June of last year. The decision was made to not invite the public or other governmental agencies including the tribes to this, mainly because we would be discussing proprietary information as associated with the industry. This year we hope to do more outreach as far as to the native organizations up on the slope and hopefully more outreach as far as the public is concerned. That is why primarily the meetings were not open to the public, because of that proprietary information.

Robert Suydam, NSB: I guess I don't understand what the proprietary information means. If it is talking about monitoring issues, all those issues seem to be discussed here and other places, so could you elaborate on what those proprietary issues are and why other folks either can't be involved or hear what the panel is discussing or at least a portion of it?

Jeffrey Missal, BSEE: Sure and maybe industry could help me out on that as well. There have been concerns about security up there. We didn't want to get into particular vessel locations, things like that as well. Plus some of the technology involved, we really didn't want to get that open to the public unless Shell wanted to make that public. Pauline, if you wanted to discuss that a little bit more?

Pauline Ruddy, Shell: Some of the concerns we had when we were in some of those meetings were in the well bowl. This year we only did top holes of course, but in the future we could be in more sensitive areas within the well and what technology and sand tools might be in that well which easily come up during those meetings. It didn't this year, but that is where we are at. Mostly what we went through Robert is the protected species observer (PSO) reports we had and, of

course, those go to you as well. They are made public anyway at some point. That is mostly what we went through and any type of mitigation that was taken as a result.

Robert Suydam, NSB: Thanks for that Pauline. One of the things that Jim Kendall said this morning that I thought was really helpful and appropriate is that this meeting is about transparency and the industry and the agencies and the public being able to understand what is happening and sharing information back and forth. Maybe there is a way for folks to listen into the panel if there are things that aren't proprietary. And if there are proprietary issues, then cut off the public's participation or can participate and when these issues come up, end their involvement or listening to the whole thing. Often times when folks say "proprietary", people think, "okay, what's being hidden?" Maybe there are some truly proprietary issues, but this year drilling top holes or talking about PSO reports or marine mammal observer (MMO) reports aren't really proprietary. We don't receive these reports regularly, we have asked in the past, and this would be great if these could be distributed more broadly and that may be a way to help deal with some things.

Jeffrey Missal, BSEE: And we are more than happy to release the after action report, which is a summary of what we discussed. And we will certainly work on posting this on our website as well.

George Edwardson, ICAS: I had the same question that Robert had. If they are monitoring our waters up there, why aren't we part of it? I would invite you to go up to Barrow and see the Inupiat Community of the Arctic Slope (ICAS). The question I had is enforcement – how do you enforce the self-monitoring? Is it industry or is there someone up there that will be monitoring with enforcement?

Jeffrey Missal, BSEE: We have several methods. First off, we have inspectors on the rigs 24 hours per day during drilling. In addition, we just hired an enforcement officer whose sole purpose will be to monitor and take control over any issues that come up. Unfortunately, due to the size of the environmental enforcement division, we are somewhat limited as far as logistics are concerned, and, as a result, we need to depend a lot on self-reporting from industry. We have worked tirelessly with industry to redefine that process, and it actually works very well.

Hanh Shaw, EPA: The Environmental Protection Agency (EPA) has two permits during the 2012 exploration activities – water discharge permits and also air emission permits – and we had both air and water inspectors on board both vessels during the exploration activities. We collect information, both self-monitoring reports and also on-the-ground inspections to make sure activities are in compliance with our permits.

Colleen Swan, Kivalina: I am not sure what year it was, but the Secretary of the Interior said that traditional knowledge needs to be incorporated into the work that is being done. I'm not sure if he's defined what traditional knowledge is or what it means, but we have meaning for it in the Inupiat community. I am wondering if any of the agencies are looking to incorporating this into their permitting and research processes? I'm from Kivalina, a whaling community. Every decision that is being made by everyone, everywhere, sitting up there affects us. There needs to be a process for people like me – a whaler, a hunter—that is how I put food on my table. Every decision affects me and my ability to put food on the table for my children and grandchildren. It bothers me when I don't see a discussion about traditional knowledge (TK) and how it's incorporated or who has oversight, and what is the process to get involved?

Jim Kendall, BOEM: Traditional Knowledge is incredibly important to BOEM. We take it very seriously. We are out looking for the information. We work with the community. With that, Michael Haller, if you could explain how we are working with traditional knowledge with BOEM?

Michael Haller, BOEM: Some of you know we do spend a lot time investing through our research and studies in traditional knowledge and try to engage elders and others in villages and appropriate levels of government and tribal leadership and look to those recommendations to engage them. Thank you very much for your point because we seemingly cannot bring it up enough in enough forums, and this is yet another example of that so thank you.

Hanh Shaw, EPA: EPA just issued two waste discharge permits for the Beaufort and Chukchi Seas for exploration activities and during the development of those permits, we collected traditional knowledge information from Barrow, Point Lay, Nuiqsut and Kaktovik. Based on the TK input, we revised a number of permit restrictions and requirements as a direct result of the input we received from the TK process.

Colleen Swan, Kivalina: Let me give you an example of what traditional knowledge is. A couple years ago, I attended an OWM and one presenter said in the work they are doing up north they were talking about the migration of the bowhead whale and how they would cross the route as the bowhead whales were moving, but wouldn't have much impact because it was at the beginning when there weren't many bowheads moving. Traditional knowledge, according to our elders, says—what they tell their young hunters—you never mess with the first migrating, no matter what animal it is—bowhead, caribou, beluga, whatever—you can't interrupt the first group because you are messing with the migration route. You are changing it. You are disrupting it because all the rest that follows, they follow the leaders. That is traditional knowledge. When I was tribal administrator, no one really used traditional knowledge or even recognized it for what it is. There is a difference between from what you get from hunters that are out there. That's local knowledge—it gives you "right now" information. But traditional knowledge in the sense that I just spoke about that comes from the elders is not just traditional knowledge, it is traditional law that our elders, our leaders, our omaliks, impose on us that we have to follow. I am curious and why I am asking about the process and your definition because this is what it is to us.

Richard Kuzuguk, Shishmaref: I like to do research on the internet and look after any information I could. With all due respect to the oil companies and our resources as far as our subsistence lifestyles, based on the internet information, the oil company when they design the oil rigs, the weight limits are so limited for their activities and hard for interagency compliance people to get on board to check whether or not they are in compliance with their discharge levels or their air quality emission levels. My question is: are there going to be any improvement to get better on-site access to reporting and monitoring of the oil companies' off shore? That information should be made public to any tribal or local entities especially concerning their immediate location or subsistence lifestyle needs to be protected and any access. I don't like the self-reporting of how the oil industry reporting their limitations.

Jeffrey Missal, BSEE: The Environmental Enforcement Officer's function is to travel to the area, be on the rigs and vessels to do exactly what you are commenting on. In the next drilling season, that issue will be greatly rectified compared to last year.

Art Ivanoff, BSA LLC: I have worked on fisheries issues on several occasions, and we see a real disconnect between what happens with the federal agencies and Alaska Native communities.

We are the most impacted, yet at the same time have no opportunity to voice our concerns. There needs to be inclusion with this body of the Alaska Native community. Not only at Barrow, but the Kotzebue and the Straits—there is a need for us to be at the table, to be a part of the process. We stated this to the gentleman who met with us in November who is providing a report to the White House. We have Executive Order No. 13175, and we need to use this to our advantage as a native community. We have been disenfranchised and left at the side line while federal agencies make decisions that impact our way of life. I highly recommend that you include the native community in the process from the Straights to Barrow.

Brad Smith, NMFS: Thank you for that, Art. I think that beginning with Robert's comments, we heard several suggestions that we look to expand the group to include and understand the local issues and to really embrace TK. It is not a closed subject, and we plan to discuss this in the group. I understand there is proprietary information that may be affected by it. I think the take home point, your point, is we need to understand the local issues and opinions and knowledge. One thing I will say about this group is we hope, and these are lessons learned from this past year, is to integrate more closely with communication centers so we have real-time feed to what is going on at the village and what the local perspective is on these oil and gas activities.

Susan Hargis, USCG: I wanted to speak to some of the comments people have made and to the topic that Robert has started. The Coast Guard joined the interagency working group toward the end of the season when we learned about it and my sense—Jeffrey can correct me if I am wrong—is that this group is not the permit issuers. They are the folks that are trying to serve in the compliance role and make sure things are being looked at adequately. They are taking in information from the subsistence providers, from self-reports, vessel observation reports. Some of those might lead to enforcement actions, and I think that is why the meetings have been more closed, but most information after the meetings have been releasable. I don't think it is been some big, dark secret that has had to be enforced upon, so I don't think it's been so much about being secret, but typically if any of us as agencies have been working that, the typical agency process would be that the agency finds the information, work it within themselves and then go to an enforcement action. In this particular case, the agencies are starting to come together. I don't think we started out with a full view of this, but to me this is a huge win for the communities because the agencies are starting to talk to each other and engaging tribal liaisons, and we are also saying let's reach out. For example, yesterday we had a meeting of over 20 tribal liaisons from the agencies, for the first time in over 15 years. We had a meeting to say how do we reach out together to tribes? How do we not go to Nuiqsut one week and someone else go the next? Or nobody go at all because no one showed up there? We are trying to figure out how to work together, and I think this panel is a starting group. One thing we talked about at one of our last meetings was that the group is still trying to find our way and what is the best way to do it. I agree with what Brad said. I think Art brought up the point of trying to find ways to engage with it. It isn't a big secret with people running behind closed doors to do things. They are trying to actually do the work to protect the people.

Harry Brower, AEWC: Listening to the discussion, I wanted to hear the agencies compliance monitoring activity that went on, but its reverted back to any questions being referred back to the panel. In regards to my concerns I have voiced several times. If you could provide examples besides what we have heard already. In terms of interagency compliance monitoring, I hear you are just in the beginning stages of communicating together. That is something we have been

asking for since I have been monitoring oil and gas activity offshore. And self-compliance seems to be just a slap on the hand in the sense that when there is a mistake that occurs, when an incident occurs in terms of compliance, it's just a slap on the hand. We take some of these things differently in terms of what is occurring and what is compliance within the program. There needs to be some examples given of how you are monitoring interagency compliance and conditions identified and what the ramifications are. It seems to be just a slap on the hand; don't do it again. Or, if they are going to continue, there is going to be some other issues to be dealt with. I am not sure if this is the appropriate time to make comments on some of the discussions that went on early in the summer through some of this activity. I am trying to identify when and where it would be in the agenda where it would be appropriate in the scope of the meeting. If there is an incident that occurs, that was mentioned early, having traditional knowledge and local knowledge incorporated into your plans and if there is an incident that occurs or the deflection of the animals, we can't go out there and stop those animals from coming back so they could be available to us. They are on the move. If there is a deflection of 50 miles, that is a big burden on the hunters. What do you learn at that time as an agency and what are you proposing to do? Because those resources aren't coming back. To go and try and understand your regulations you are placing on this activity. That is something that you need to keep in mind. We wait for the animals for subsistence; we wait for the annual migration so we can take the resources as food to feed our communities, our constituents. If there is a deflection 50 miles to the east of Barrow, we don't know the rate of return will occur or if it even will return. Those resources not returning puts a burden on the community. But yet you still look at regulations and self-compliance and again, from traditional knowledge and local knowledge about water, within the water column or the air and that we be very careful and try to keep it clean. I used to spring hunt for an example, we don't have our crew members urinate to the left of the boat. Everything is to the right because we don't want any scent or odor to be imposed in front of us so the whale detects it and dives away. Its keeping the area clean before the migration or animal comes to us. This is what has been taught to us and some of the things we have shared with you as agencies. I also understand there are transitions that occur within your organizations, and we have to go through relearning, retooling of the agencies that we are dealing with. I couldn't hold back in terms of compliance and self-compliance works. I've stated before, English is a hard language to learn and understand, but you as interagency compliance monitoring occurs need to be informed about what these interferences that occur deflect the animals. We try to work with the agencies to minimize the impacts for the availability of the resources, but we aren't being heard and other conditions are imposed, it makes it harder.

Robert Suydam, NSB: Thanks for that Harry. Susie, also thanks for your comments. They are right on. I think that it is really, really positive effort that the agencies are getting together and talking about the compliance issues and what is happening. This is a huge step forward. Candace mentioned this morning that this process we are in here today and the next couple of days is about protecting available marine mammals for subsistence hunters. So this compliance is really monitoring and partly that as so a couple of recommendations that the panel might think about: 1) to make the process more open so the subsistence community can participate, is maybe to have a call-in number so people can listen to the things that are listenable to that aren't proprietary, enforcement or whatever so the communities could hear more about what the discussions are. Another option is to have a list serve where a summary from each of the panel

meetings is distributed to whoever is on the list serve so the process is more transparent and open and the communities and the compliance and the monitoring are benefiting and understanding what the agencies are doing and how the efforts are proceeding.

Parking Lot Item: Invasive Species Mitigation (Art)

Alaska Eskimo Whaling Committee Subsistence Harvest Updates

George Noongwook, AEWC Chairman | Harry Brower, AEWC Vice-Chairman

Johnny Aiken, Executive Director of AEWC, presenting for George Noongwook

I will be presenting information for George Noongwook who wasn't able to make it due to weather on St. Lawrence Island. As most of you know, George is the chairman of the AEWC, and he is from the village of Savoonga. He has asked that I give his report to you.

"Good Morning, my name is George Noongwook. I am a whaling captain from the village of Savoonga on St. Lawrence Island and chairman of the AEWC. I appreciate this opportunity to tell everyone about our very successful 2012 bowhead whale subsistence hunt. I'd also like to tell you about our very successful work to renew the bowhead whale subsistence quota during the 2012 meeting of the International Whaling Commission. And I'd like to say a few words about the changes we are seeing including increased vessel traffic in the Arctic and concerns our hunters and residents have about that. And the ongoing changes we are seeing in our ice and weather patterns."

First, our very successful 2012 bowhead whale harvest under our quota from the IWC. We had 75 strikes available to us. We were able to use a total of 62 of those strikes and landed 47 whales with strikes used. In Savoonga, we landed eight whales. It's always a time of great celebration for us when we land the whale. This animal is so important to us. We depend so heavily on the whale and other marine mammals for our food. Anytime we feel there could be a threat to our whale or marine mammals for any reason—from the IWC, from offshore development and vessel traffic, or from climate change—it is frightening to us. When we have a successful harvest, everyone is happy, and we are very grateful. We also had a very successful meeting at the IWC in 2012. Our bowhead whale subsistence quota was renewed for six years at a level of 82 strikes per year to be shared between Alaska and Russia. We are grateful to those that help bring this about and the hard work that went into it. The quota gives us the opportunity to hunt the bowhead whale under law, but to be successful, we also have to be able to reach the whales and take them. With all the changes we are seeing in the Arctic, our hunting practices have to change as well. The changes in the spring ice means there is more of a focus on late season hunting than there used to be. On St. Lawrence Island, we are seeing more whales in late fall and winter, and we now are hunting in November and December on a regular basis. Late season hunting means that late season vessel traffic the oil and gas operators leave the Beaufort and Chukchi Seas could interfere with our hunting especially in November. We have worked with Shell on timing of their post-season transit through Bering Strait, and this has worked out well for all of us. Also, having the communication (comm) centers is really helpful. We encourage all to use them when transiting and helps keep us all safe on the water.

We also learned about the Automatic Identification System (AIS). I hope we can work with Ed Page to have some of this equipment installed in our communication centers in Gambell and Savoonga. Then our comm center operators can help keep track of other types of vessels like international traffic, cruise ships, and research vessels coming through our waters. *Showed slide from United States Coast Guard (USCG).* This slide gives you an idea of where we are seeing vessel traffic around St. Lawrence Island compared to the areas where we hunt. We want to make sure that all of you know about these important hunting areas in case any of your vessels operators might want to travel through here. To help us get a handle on the other types of vessel traffic, the AEWC is now working with the USCS through our new Arctic Marine Mammal Coalition. I am hopeful that with the initiative, we will get some measures in place to help all coastal communities to deal with expected increases in vessel in traffic in Arctic.

Harry Brower, AEWC Vice-Chairman

Good Morning Everyone. For the record, my name is Harry Brower, Jr. I am a whaling captain from Barrow. I am the vice-chair of the AEWC. Thank you for the opportunity to speak today. We did have an incident near Barrow this year, but we don't know what caused it. I am wondering if this peer review exercise and all of this monitoring that occurs is really doing what it is supposed to do. In 2011, our whales at Barrow were near shore as always unless they get disturbed, but this past fall the whales were about 50 miles offshore. I'd like to know how to use the tools we are talking about today to try to figure out what is happening when we see things like this. Did this happen because of Shell moving their rig onsite? We can't tell. If we can't tell, how do we mitigate things that are happening? We need to figure out how to use the tools to figure out what is happening when we see things like this. How do we use the monitoring that is being done as a mitigation tool? With things like this, I feel the OWM is not making progress. Here are the things I see:

First, there is no over-all strategy for how information is going to be used to address impacts. When I first starting attending these meetings, I thought that is what we would be doing, but I don't see that happening. Your agencies are permitting all of these activities and let industry do all this monitoring and you write environmental impact statement (EIS) documents that define impacts, but how are all the pieces being put together? What changes are being applied to the monitoring programs to help steer the mitigation? I don't see anything happening with this.

Second, there is no way to use the tools discussed here to address impacts that are happening. When we see something happening on the water, how do we use the tools to find out why that is happening? Everything is focused only on operating sites – what about areas affected by vessel transit? What about whales passing through the disturbed areas? We don't know if they return to their normal migration patterns. When the focus is only on the site, we have no information on what is occurring in the surrounding areas. I also have questions about some of the tools being used with the hydrophones. I am only seeing partial information on some of the marine mammals. For example, where is the information on beluga whales? We don't have the tools for monitoring impacts for night, during snow flurries or in the fog so how are we addressing these activities at these times?

Third, we are not addressing impacts that we know are happening. For example, we know there are impacts happening on bowhead whales during seismic operations at 120 dB, but NMFS just ignores this even in their latest DEIS. Why is this?

Finally, I don't see that we are looking at cumulative effects at all. The animals feel these effects and those that our hunters are going to have to deal with the cumulative effects as they mount up, but what are we doing here to help address that? I don't see anything.

Thank you for allowing me to speak, and I hope these thoughts are helpful, and we can work to address these issues through this meeting. Again, thank you and good morning.

Q&A | Comments:

Bill Streever, BP: Harry, I'm not sure if you are aware, but there will be a presentation later on about progress with cumulative effects.

Harry Brower, AEWC: Thank you Bill.

Colleen Swan, Kivalina: I have been spending a lot of time for many years looking at our own people, and I have found answers to my questions that I used to ask of the federal and state agencies from my own people. I know what needs to be done, but it is really hard to get the agencies to even consider it. It brings me back to the definition of traditional knowledge. I don't think that has ever been established. I was waiting for an opportunity and was happy to hear that the United States (U.S.) Secretary of the Interior thought traditional knowledge was important and needed to be merged, the scientists needed to work with the Inupiat people or indigenous people about these things and incorporating them into their processes, but that is not happening. It is really hard and I understand. I am not saying they can't do their job; they can, but I am beginning to think that maybe they don't know how. What is missing and the reason why it can't be done now, what is missing from the Inupiat community is about what traditional knowledge is. That would begin the process. The second part is getting the Inupiat community or indigenous people to recognize what knowledge needs to be written. It wasn't a problem – it is how we hand down knowledge, it's not written. Because of the importance of the work that is being done and potential impacts it has on the indigenous people, it needs to be done. We need to begin to document these things. I don't want to create a problem between us and the agencies. It is a sensitive issue, but there needs to be a definition. If that can't be done, then we need to do it ourselves, make a proposal and submit it to the agencies. This is what needs to be done, and we will do it because they can't—really. They don't have that knowledge, it's not recognized. Even in the National Environmental Policy Act (NEPA) process, traditional knowledge—and I have heard federal agencies say this—it doesn't carry much water. That is only because they don't recognize it for what it is. The majority of our people don't recognize it for what it is. For example, I used to think our ways were dying, and I didn't realize we were still practicing it. I looked at our people through a different culture's eyes, and I saw poor people. I thought my parents were poor because they didn't have cash. It took a really sensitive incident for me to realize they aren't poor; it is how they make a living. It is a matter of getting those definitions you have for your culture and comparing them to ours. They are so

different, you have different definitions. My parents live a complete subsistence lifestyle with some help to support their western adoption of things. My dad is a whaling captain—he's umialik in our family—and he is very rich. His freezers are always full. He's considered poor, economically disadvantaged and uneducated but if you used his knowledge, it would be very protective of things you are studying. AEWC has a very important role because remember they almost made us stop whaling because of declining population, and now we are doing things that are threatening the whale population again. We have to do better. We have to take charge as indigenous people. We know. We have the knowledge, and it is a matter of taking their process and applying it to our ways. It can be done.

Harry Brower, AEWC: Thank you for your comments.

Parking Lot Item: Definition of Traditional Knowledge

Robert Suydam, NSB: Harry, thanks for your presentation. Your three points at the end were very important. 1) What is the overall strategy for how all this information is going to be used? What's the strategy for making decisions? To take that information that industry has spent money collecting, how will that information be used to help make important decisions? 2) How will the tools be used to address the impacts? What mitigation measures are going to be used to reduce impacts not only from oil and gas activity, but from shipping? 3) There are impacts we know about, but they aren't being addressed. We know bowheads are sensitive to low level of sounds. We know that yet, the agencies level they are using to assess Level B takes are quite a bit higher. The sound levels are quite a bit higher than traditional knowledge or science has been telling us. Those points were valuable, and I am interested in what NMFS' responses are to those questions and points.

Jolie Harrison, NMFS: I will start with the one that seems a bit easier and this is the level of which bowhead whales might respond some way. In the past, certainly we have used 160 dB criteria for the Marine Mammal Protection Act (MMPA) defined take. We've also mentioned qualitatively in our analyses of the fact that bowhead can respond at lower levels and that this can be a concern for subsistence hunters. Moving forward, and we will discuss this later in the meeting, where we are currently in the process in revising our MMPA acoustic criteria where we say 160 dB, 180 dB, that sort of thing, and part of that is because of the recognition that bowhead whales may be responding in a way lower than 160 dB sometimes. We will be hearing more about that specifically later in the meeting. We have some presentations that are addressing that, and you will see that type of material starting to emerge in our documents in the upcoming months. Regarding our specific strategy on how monitoring information can be used to affect our decisions, I think this is part of what we struggle with as regulators and part of why we have this meeting, peer review meetings and why we'd like to have a comprehensive monitoring plan versus the way we are doing things now. Without getting into a super long detailed discussion now, I'd like to say this is one of our hardest jobs and why we rely on input from the subsistence community, scientists, industry and everyone else. I guess that seems like a deferment of the discussion and is in a way, but I would be happy to talk in detail with folks about it. This is one of the main things we struggle with. It is obviously our goal as an agency to most efficiently, to say here is the monitoring that would be best to answer the questions that we have, to get it done and that people spend a lot of resources on to make sure good

information that is obtained. Industry does a very good job, and our goal is to target that more efficiently. But we struggle with the same questions you guys do and figuring out how best to do that and part of the reason we have these meetings.

Bill Streever, BP: As I was waiting, a follow-up question to Robert's came to mind. I guess it's sort of a legal question. I want to be very careful how I pose it, but it seems to me that sometimes we get really hung up on what is a Level A and a Level B take. The MMPA, if I understand it right, protects the whales and identifies Level A and Level B takes, but also protects the hunt and it seems to me that you could do things that are a clear violation of the act that doesn't impact whale behavior at all but can impact the hunt. Like if you get in the way of a vessel or something like that. But it also seems to me that it could be possible—and this is a question for you—can you have behavioral impacts on a whale that don't meet the Level B take definition, but yet still have an impact on the hunt and therefore illegal?

Jolie Harrison, NMFS: Bill, yes, that is what I was eluding to before and why, when we have talked about 120 dB before, and about potential deflections of whales at lower levels than 160 dB because you are absolutely right. The definition of subsistence impacts is not strictly limiting your impacts to the whales. I think you had a second part to that, but I have forgotten it.

Bill Streever, BP: The main part was could you have a change in behavior of a whale that does not reach a Level B take, but still be illegal because it interferes with the hunt?

Jolie Harrison, NMFS: We would still have to address it through the responsibilities of the subsistence part of our act, and I think actually why the DEIS that currently went out, we still drew a 120 dB isopleth around, in our pictures or examples of what might happen because of the recognition through text that there were impacts happening at levels below 160 dB.

Bill Streever, BP: My further comment to that would be that exposure is not a good predictor of change of behavior. Sound exposure is not a good predictor of change in behavior. In fact, some whales respond at levels well below 120 dB in some circumstances. They respond to levels well below ambient in some cases. It doesn't sound responsible, but humans do it too. It's quite possible, but my point is you can't predict that response based only on exposure. It's kind of a question that fell into a comment, but...and I don't know if you want to follow-up on that comment or not.

Jolie Harrison, NMFS: Right now? About the importance of context in evaluating impacts to whales.

Bill Streever, BP: If you'd like to comment on it.

Jolie Harrison, NMFS: I think we have a presentation that will talk about this tomorrow, but you are totally right. Received level alone is not; you can't use that alone and expect to understand how whales are going to respond. Especially your point that whales aren't the only subsistence equation, so we have to pay attention to other things as well.

Bill Streever, BP: Okay, thanks. And why I had my hand up originally was a follow-up to the question that has been tabled, but only to suggest that this report that BSSE or BOEM prepared on subsistence hunting, I think there are enough copies to make available to everybody in the room. It is a very short report. It's almost a magazine. I had nothing to do with writing it, but it is one of the better things I've seen since coming to Alaska. It does a good, concise job in the western sense of trying to figure this stuff out. I think that someone has a bunch of copies that could be circulated.

Jim Ayers: Like some others, my question is prefaced by a statement, and I mean it as an observation, not a criticism. It is kind of a unique, perfect storm happening to exclude native

Alaskans from having a voice in nature resource opportunity decisions. It is going to be incumbent upon people in this room that to realize what has happened over the last few years is that the State of Alaska has (and I have worked many years for the State of Alaska, love the state, been here 40 years), but in the last five years the State of Alaska has maneuvered the rural communities from decision making processes by eliminating the coastal zone management program. And for those of you here that have contributed large sums of money that make sure it happened, let me say that consistency determination that was provided by law for rural communities to actively participate in decision making federal activities like offshore oil and gas development. It is what allowed the communities to actually have a voice that meant something at the table. That is now excluded because of the actions by the state. So a lot of the frustration and the things you are hearing today are because there isn't a pathway in. The NEPA process does not provide that Harry Brower will be sitting at the table as the AEWC and helping the writer mitigate measures. They get the comments and all the other things the state says, but they are comments they send in and the person that left whose name is escaping me and there were several that left, but they said they couldn't include their enforcement so they don't have people sitting at table with them. My question is really what I think other people are asking: what are you going to do to bring people that actually live in those communities to the table to help you look at the decisions you are making? Not send in their comments—I've heard that lecture before. We all have played that game many times, but what are you going to do to bring them to the table to look at what are those measures? What is a slap on the hand versus an appropriate enforcement measure? That's the question that's really being asked. There's something that could be done, and I am very curious otherwise this conversation will probably go on for quite a while—simply commenting and not being at the table.

Jolie Harrison, NMFS: From a federal standpoint, and I think you were asking for some input there too, we completely agree that it is very important to have subsistence communities represented at the table where the decisions are being made and in the past, that was part of the rationale for building this meeting. But I think in its current construction, it doesn't always get the job done. We also have co-management agreements like with the AWEC that are meant that do this as well. We may interact more directly with folks on NEPA documents, but you are talking about what I said earlier, and I realize that I said very quickly and last year may have expanded on it a bit more, but we have a responsibility to understand the impacts on the subsistence communities where we are authorizing and part of what has been accomplished through the hard work of the AEWC and others have done on conflict avoidance agreements (CAA) in the past is trying to get some of that information together. Similarly, we have a process called a Plan of Cooperation (POC) under the MMA that is meant to do that as well. What I mentioned earlier is our recognition of the need to make the process better because the people that have the information we need to know are spread out over a large area and have limited resources because they are asked to meet, as folks bring up often, with multiple state and federal agencies and industry to provide their information. But I think part of what you are saying is part of what our focus is on now—to figure out the best way to get that compiled and the most pieces of information to the decision makers that need to use it in the best way. We don't think we have the best solution yet, but agree with you that that is what we need to work towards.

Jessica Lefevre, AEWC: Jolie and Candace, I want to come back to one of the themes in Harry's comment having to do with monitoring plans and the interplay between monitoring and mitigation. Perhaps you will address these issues tomorrow in Amy's report, but I wanted to emphasize the comment coming from Harry because this is something that NMFS has been hearing from our section of the table for many, many years. I understand the way the statute is written and the need for site specific monitoring plans. I can define site specific for you in many different ways depending upon how you need it defined, but what Harry is trying to say, an activity has impacts beyond the specific site where it is occurring. Moving equipment on site has impacts. Even once the equipment is on site, there are impacts occurring to the east. We know this from what the hunters tell us, and we don't know what happens to the west. I have been coming to these meetings for a very long time and every year and every meeting we ask when do the whales come back? The whales get deflected; when do the whales come back? Many, many years that question has been asked, and I am hopeful as you work through your monitoring approach, you will start to think more broadly about what site specific means. I would encourage you, and perhaps you are already planning on doing this, but I would encourage you to make use of these meetings. Make this an agenda item. You have the experts in the room. How can we best do monitoring to make the most effective and efficient use of industry's investment because they are spending an awful lot of money to gather this data to respond to the concerns being raised by the hunters in the room?

George Edwardson, ICAS: What Harry was saying earlier about you don't dirty to the left of where you are whaling. He said that for a reason and the federal committee in front have totally avoided the issue he was trying to bring out. When a contaminant, it doesn't matter if it is crude oil or gray water, goes into the water a good portion of it goes into solution. That is the contamination that the whales and the marine mammals get affected by. To not have the hunters and our associations that protect the ecosystem and our animals be part of the committee you are with, you are totally avoiding one of the biggest pollutants going into the Arctic Ocean. The pollutant is—whether it is crude oil, grey water, chips being extracted and dumped, or lighter ends of minerals in the soil. When you don't look at contaminants that affect the food chain of the animals we are trying to protect, then you have not done your job. You have violated the MMPA, the migratory bird treaties if you do not take care of the food of the animals. Having the people that depend on the animals as part of your group would be more than in line, would make you comply with the federal regulations and international treaties you are supposed to follow. You cannot leave our AEWC, Walrus Commission, Beluga Commission just because they haven't come up with the right answers you are looking for. We need to be there to protect the ecosystem. Because when you look at contaminants that go into solution, you are looking at the ocean being 24-29 degrees Fahrenheit, when that is the case the lighter ends of the contaminants, whether they be crude or gray, don't evaporate out. And when you look at the currents going around the Arctic Ocean, they come back to the same spot every ten years.

Jim Kendall, BOEM: I am relatively new to Alaska and have been here about two years. During that time, I have been incredibly fortunate that certain individuals have taken me under their wings: Harry Brower, Edward Itta, George Edwardson, Fenton Rexford and recently retired Jeffrey

Loman, my deputy, who was a tribal member in the upper peninsula of Michigan, and he has since left and gone back to the tribe. One thing I've learned from these mentors is that it is not always the definition. The proof is in the pudding, that is the actions taken. The document you can pick up at lunch is a special issue on BOEM science on traditional knowledge. It was my idea; I came up with this. I drove my staff crazy because they said do you realize what you are getting into? I said no, I don't know what I am getting into. I just know that it is really, really important, and if we can't work to understand what traditional knowledge is, we aren't doing our job. Here we are in Alaska, and I just came from D.C. where they are so far away from it, maybe we need to educate them. So going to our website, it's not really a definition, but it puts things in perspective: *Traditional knowledge or indigenous knowledge, uses the information, advice and wisdom that has evolved over centuries of living as part of the environment.* The bottom line is native hunters in the Arctic, hundreds and thousands of years, are the original observational scientists. They have data that are invaluable. We need to use it. As our director, Tommy Beaudreau said when he wrote the first page in this document, he says, "Over the past 20 years, traditional knowledge has become increasingly integrated with social, biological and physical scientific disciplines. Listening to indigenous perspectives and taking local knowledge into account is vital to achieving informed decision making in ocean resource management. Although traditional and scientific knowledge may arise from different cultural differences, they are compatible and allows for powerful synergy when integrated appropriately." It is something we have to do. Western scientific data and science is very compatible with traditional knowledge and on more than one occasion, traditional knowledge where western science got it right. They are sort of like the teachers – they say you got a good report, you got an A. You got a B-. They are sort of grading the western scientists. Furthermore, Tommy Beaudreau says, "Understanding and respecting traditional cultures and using traditional knowledge is vital to fulfilling our stewardship role. For this reason, BOEM (as well as other agencies here at the table) have strived to institutionalize the use of traditional knowledge in our ongoing ocean research and NEPA process." Well how do you do that? There are three things, a, b, and c:

a) Communication. Communication doesn't mean talking. Communication means listening. I myself am over 50% deaf. I have a very bad hearing problem so active listening is very hard. We have to listen. That is part of communication.
b) Respect. You may have a PhD in physical oceanography, but our hunters in the Arctic have a PhD in life, and they are using data from thousands of years and the information they see when they go out to survive. Incredibly important.
c) Sharing. This is something I learned from you Harry last year to make all this work—sharing. This is something the western folks aren't always good at, but the indigenous people of the Arctic are good at this because their lives depend on it.

I know that wasn't the nice little definition that Lisa wanted, but traditional knowledge is very important. The definition isn't really important. What is important is the proof in the pudding and how we use the information that we can acquire from our indigenous stakeholders on the Arctic slope so that better decisions for ocean management and stewardship can be made.

Alaska Beluga Whale Committee (ABWC) Subsistence Harvest Updates

Harry Brower, ABWC Vice-Chairman | Robert Suydam, North Slope Borough, Department of Wildlife Management

Robert Suydam, North Slope Borough, Department of Wildlife Management

Keeping with Johnny's approach, Willie Goodwin asked Harry and I to talk a little bit about the Beluga Committee and what happened in 2012 and what is planned in 2013. Willie sends his apologizes for not being here, but he is the chair of the Beluga Committee and lives in Kotzebue. I am going to go over a couple of things that we have talked about the last couple of years because people need the reinforcement to really understand what the whale committee is and what it does. For years, the OWM has been about bowheads primarily and other species are certainly important, but primarily about the bowhead, so as activity increases in the Chukchi Sea, that paying attention to the beluga is becoming more and more important as well.

The goals of the ABWC are to:

1. Maintain healthy populations of beluga whales in northern and western Alaska waters. The reason for maintaining healthy populations or one of the more important reasons is providing an adequate opportunity for subsistence harvest.
2. Provide for adequate subsistence harvest of beluga whales and protect hunting privileges for Alaskan subsistence hunters.

The beluga committee is not dealing with Cook Inlet belugas, but just belugas in the Bering Straits, Chukchi and Beaufort seas. The beluga committee is a little different than most of the resource management organizations. It's not better, it's not worse, it's just different. But it has worked really well, I think, for the hunters, the regional representatives and the agencies so far. One of the ways the beluga committee is different, is that there is not only hunters and regional representatives sitting on the committee, but there also agency managers and scientists that are voting members of the committee. So everybody sits down together, says here's what we want to do in terms of research on belugas or if there are issues that come up, we jointly address them. If there are issues about hunting, it's just the hunters that make the decision, but it is a co-management organization that is comprised of a variety of different people and it's worked very well. The management plan was adopted in 1995 and accepted by tribal organizations in 1996 and 1997 and last, a cooperative agreement for the co-management of the western Alaska beluga whales signed with NMFS in 1999.

Funding for the committee comes from different sources. NOAA/NMFS recently is providing co-management funding. In the early years of the committee, Bureau of Land Management provided some funding as did the NSB. There is a list of other organizations that have provided funding either directly and indirectly for some of the goals of the beluga committee. On the list is BOEM who has been funding aerial surveys under the Aerial Surveys of Arctic Marine Mammals (ASAMM) program, the new designation of the Bowhead Whale Aerial Survey Project (BWASP) surveys. Data that are being collected through the BOEM funding is helpful for the beluga committee, but the funds don't go directly to the beluga committee. There are other pots of money including NFWF [National Fish and Wildlife Foundation], ADFG, and Shell Baseline Studies Program who is providing funding for

some of the beluga research as well. Probably one of the most important funding sources for the success of the beluga committee is coming from the hunters, numerous village representatives who are working closely with the scientists.

In the past we have talked about the different science that the beluga committee is approaching. Back in the late 1980s when they were formed, one of the reasons why is because the International Whaling Commission (IWC) was expressing great interest in managing belugas. With the experience of managing bowheads with the IWC, the beluga hunters said we don't want that. We don't want people coming from around the world telling us how we need to manage belugas and beluga hunting. The committee decided that they needed to gather information that would be helpful for making management decisions, i.e., looking at stock structure, harvest and health of the animals, population status and a whole lot of other factors. The beluga committee continues to do that, and last fall they held a workshop on the biology of beluga whales that was well attended. Some exciting and new information was talked about.

In Alaska, there are five defined stocks: Beaufort Sea stock that spends the summer in the Mackenzie River Delta primarily and overwinters in the Beaufort Sea, and Chukchi Sea stock, Eastern Bering Sea stock, Bristol Bay stock in western Alaska. The belugas in Kotzebue, the data suggest, that they are a different stock as well, but no decisions have been made about that specifically yet and Cook Inlet stock but they are not part of the consideration of the committee.

Average harvests for past five years:

STOCK	WHALES/ PR YEAR	COMMUNITIES
Beaufort Sea Stock	54	Little Diomede, Point Hope, Barrow and Kaktovik; sometimes Nuiqsut
Eastern Chukchi Sea	56	Kotzebue Sound, Point Lay, Wainwright
Eastern Bering Sea	159	Norton Sounds, Yukon-Kuskokwim Delta Villages
Bristol Bay	22	
Total	299	

This gives you an idea of what the average harvests are and the importance of belugas for villages in western Alaska. The numbers do not include "struck and lost". The committee has struggled a bit to get that information and are working to get some of those information needs. These figures do not include harvests in Russia or Canada.

Specifically for the harvest in 2012, it was kind of a mixed bag. Some villages had successes and others didn't land as many as they would have liked to:

Kotzebue – 3	Kivalina – 3	Point Hope – 84	Point Lay - 14
Wainwright – 34	Barrow – 5	Kaktovik / Nuiqsut – 0	

There is a lot of bio-sampling occurring with the goal of understanding health especially related to climate change but also to increasing industrial activity in the Arctic. We are looking at body condition, exposure to disease, immune functions, hearing apparatus, basic hearing anatomy and possible hearing loss, and contaminants. Age, growth and reproduction, diet: stomach contents and FA and SA, and forage fish sampling that has occurred the last few years to understand diets of belugas. The forage fish sampling is one of the projects the beluga committee is taking advantage of but not necessarily funding.

Regular updates on stock status are needed. There hasn't been a good aerial survey for the Chukchi Sea done since the early 1990's. The beluga committee has been concerned about this for a long time and in 2012, the committee, working with Janet and Megan, were able to provide funding to do aerial surveys in June. BOEM funding continued the surveys into July and August and into the fall.

Showed map of survey track lines and sightings. The surveys in June were marginally successful; however the July and August surveys were wildly successful. There were 429 sightings of 3,998 belugas during the period of June 30 through August 31, 2012, over a 74,400 km survey effort. This is a spectacular improvement on the data set for Chukchi Sea belugas. The sightings from June through August are likely all from the Chukchi Sea. The previous estimate from 1992 for the minimal population size was 3,700 animals. Of course, more than that was seen this last year so the population estimate will be vastly improved for that stock of belugas. This is really important because in probably every IHA application I have seen since the late 90s, the population estimate for Chukchi belugas were about 3,700 animals. Hardly do applications say that that number was the minimal population estimate, but the problem is that it gave the impression that there weren't that many belugas in the Chukchi Sea population. As Harry mentioned, where is the data? Where is the information about belugas as they are moving through the Beaufort and Chukchi Seas? The aerial survey has provided a lot of information. Satellite tagging has provided a lot of information, but the acoustic monitoring surprisingly has provided few records of beluga calls. We are in a really good position to come up with new population estimates in the Chukchi Sea. Our Canadian partners are working on new population estimates for the Beaufort Sea as well.

Showed slide of belugas in Elson Lagoon. About 1,000 belugas moved into the lagoon a few years ago. The photos are from NMFS.

Quite a few belugas have been tagged in a few different stocks. *Showed slide of belugas tagged in Point Lay.* Before we started tagging, we knew where these stocks of belugas were for about one month out of the year. We now have much better information of where they go and the areas in the Arctic that they use. They use a lot—a lot more than we expected. Some of the animals moved up to 81 degrees north—what are they doing so far north? Why are they so deep into the ice where the water is 3-4,000 meters deep out there—what are they doing? Why would they go there? These are Chukchi Sea stock. There haven't been whales tagged in Beaufort stock since early 2000. Belugas tagged out of Point Lay are mostly collecting information on how deep they dive. *Showed slide showing maximum dive data.* This figure is the maximum depth of dive that these belugas are experiencing. We have had a few that have gone down to about 1,000 meters. Typically they are not

going that deep, but belugas can dive deeply and dive a long ways down. That information is in press and should come out in the not too distance future.

Slides showing male and female whales in the Beaufort and Chukchi. There is no overlap, or very little overlap, in July and August but by September, they overlap as migration is beginning. The belugas committee provided the information to the people doing the work.

Synthesis of Arctic Research (SOAR) Project, another project BOEM is funding through NMFS. There will be a paper on belugas and Arctic cod in the Beaufort Sea. There is a whole different series of data being used to get a better understanding of beluga use of the Beaufort Sea and developing a hypothesis of why belugas are using specific areas therein.

In 2012, there were some successes in tagging belugas. Hunters out of Nome and Hooper Bay were able to tag without the help of scientists. *Showed pictures of tagged belugas and movements of the whales.* The number of belugas tagged was one for Point Lay, four for the Eastern Bering Sea and ten in Bristol Bay. The slide on the right shows info on three different stocks of belugas but looks like they segregate in the winter as well as the summer by stock. This is new information that has been surprising.

The beluga committee now has a website; if you want that information, contact Robert Suydam. It's on the North Slope Borough's website.

The committee has some concerns about belugas and industrial activity:

- Point Lay hunters continually express concerns about the possible interference of industrial activity, human activities with their hunt. As someone mentioned earlier, hunters are told to not mess with the first group of belugas that come past. The concern is at Point Lay is that if industry goes out in the Chukchi Sea before the hunts happen, which is in early July, if the belugas are diverted, their hunt may not be successful because of diversion or their behaviour has been changed, it will make it hard for the hunters to get out there.
- Wainwright hunters are also concerned about possible impacts to their hunt which usually occurs in late July or early August.
- The information we have on how belugas respond to industry sound is very limited. This is one of the big data gaps that is needed for the Chukchi Sea. It appears that belugas may be even more sensitive to bowheads to industry sound, at least those belugas in the Arctic, and so we need additional data there.
- Lots of hunters have expressed concern about possible impacts on beluga health or the prey items they depend upon.

Q&A | Comments:

Bill Streever, BP: I was wondering if you could give a briefing on how the beluga hunt works? I think it is quite different than the bowhead hunt, but I don't really understand it.

Harry Brower, AEWC: In Point Lay, there is migration that occurs in that area from the south, and they wait until the movement of the whales come closer to shore. Once in range, they conduct a drive

hunt to move them closer to shore and minimize struck and loss. Wainwright is very similar. When they move into the lagoon where it is shallow and they are able to retrieve the animals rather easily compared to being in open water where they are in deeper water and they are susceptible to losing the animals. They drive them into the lagoon and take the numbers to meet the community needs.

Bill Streever, BP: How far off shore are they before they start to drive?

Harry Brower, AEWC: It varies year to year. There have been some down in the ten mile range. Most of them are right up into the beach area.

Colleen Swan, Kivalina: I was just talking with someone from Point Lay, and she said by traditional law they leave the first two pods alone and allow them to pass before they start hunting. I just wanted to make that point before I get into my question about mitigation. Obviously migration is very easily changed by any kind of activity. We used to be able to hunt like Point Lay does—herding them into the lagoon and doing our hunt—but ever since the Red Dog Port was installed, the beluga that migrate from the south along the shore, as soon as they hit the point they head straight out. Kivalina is 18 miles up the coast from the port. We have never been able to hunt the way we used to since the port got it. There has been no mitigation efforts taken, ever. We raise these issues about interfering with migration because of that and because the road itself interfered with the migration of the caribou. They used to migrate in the lagoon right across from us, and we would fall harvest and collected our winter supply. The migration of the caribou has been permanently changed, and every year we wait and look for a different route that they might be taking, and it changes from year-to-year. They have never recovered. It is a permanent change. The migration of the beluga is also a permanent change. I wonder what type of measures would be taken if the migration pattern is changed because that is what is missing here? It is going to change. It doesn't matter if it doesn't affect the Point Lay people. It doesn't matter if the activity is here or there because whatever activity that is related to off-shore oil exploration is going to go from whatever the migration begins to where it ends, not just in a specific area. If you affect it down here, it's going to affect it up there too. Obviously there isn't enough information, and it will affect the communities. Where is that information? What are you going to do for the communities if they lose their tribal resources? It has never been done for us.

Robert Suydam, NSB: I think that is a response for Jolie or Candace, but one thing the beluga committee might be able to do is follow the example of the AEWC and how they have taken information, traditional knowledge and science and said this is how bowhead whales respond to activity. They have then developed mitigation measures through the CAA. The beluga committee has expressed interest in doing something like that to address these problems. Colleen, you are right that there have been problems there with belugas related to Red Dog Mine that folks haven't tackled. That's something that maybe should be remedied, but NMFS responding to that question would be worthwhile too.

Jolie Harrisson, NMFS: I would second what Robert has said, and I applaud the work of AEWC and their compiling of information that has been gathered from multiple communities and whaling captains and helping us so much by putting it in a format we can understand and help us use in our decisions has been helpful. If other resource commissions could help in that way, it would be very valuable to us. We need that information but struggle with the same challenges that the subsistence communities do which are limited resources. We only have so many people to get out

and engage, and we try to do this the best we can. We would certainly be supportive of an effort by the beluga commission following a pattern of how the AEWC gets information to us on what you think works and how to minimize impacts to your hunts.

Earl Kingik, AWC: I am a beluga hunter. I back up Colleen. We haven't seen any beluga in the summer since the port has been built. The AEWC and Beluga commission understands that. I was in a commission to and asked how come the beluga are not going to Point Hope during the summer? Once animals are disturbed, they are disturbed. Take a look at your Beaufort stock when you look at your map where activities are going on. I wish I could ask the beluga how they feel about the activity going on. We are worried – any activity in the ocean is disturbing. We have MMOs on the ships, but has the Beluga commission received reports on the beluga in the activity area? When you see where the belugas are on the maps, we know the activities go out in August, September and October. There were no belugas there? There were no fish for belugas to eat? These are our MMOs and the reports from the oil companies about belugas in their areas? When I look at the Chukchi tagged bowhead whale, it hung around for 3-4 days. Why didn't it want to leave the area? Maybe it was saying don't let activity happen in the Arctic. Maybe the beluga will tell us the same thing too. I am disturbed because once you mess up the migration of an animal, we will lose the whole village. We will starve. We will become diabetic. MMOs, we need to find out if there was any beluga activity in the activity area? Same with the Beaufort and Chukchi. They are hired to observe animals and when they see animals, they are supposed to stop activity. We need to understand that when you mess up the migration of the bowhead whale, it is messed up. I grew up watching bowhead whales before Prudhoe Bay was built. As soon as they made the man-made island or built Prudhoe Bay, the noise drove the bowhead out. We all know that. I don't see any bowheads in the fall in Point Hope any more since Prudhoe Bay started – they aren't there. We have to understand the migration of the animal. We need to protect the migration of the animal. If we lose the animal, we lose the whole community.

Harry Brower, AEWC: Thank you Earl for your comments. In regards to interaction with the beluga committee and oil industry operators, there have been recent communications and sharing of information from their hydrophone research to the committee. I can acknowledge that in terms of communication from industry operators and the Alaska Beluga Whale Committee.

Megan Ferguson, NOAA: The comment I would like to add is that because belugas are migratory, we need to also be considering potential effects be concerned in the Eastern Beaufort Sea, i.e., also in Canada. So in regards to the beluga migration, it could be a factor of potentially anthropogenic industrial activities going on in the eastern Beaufort or the prey resources there. It there is a lot of good food over there, it could delay the migration. When we are talking about what kind of spatial scale our observations should be, when we are talking about bowhead and beluga whales, we can't just limit it to the Alaskan Arctic waters.

Robert Suydam, NSB: Thanks for that Megan. That's absolutely true. We need to remember that things are going on to the west and in Russia and don't know enough about what is going on there and potential impacts on all of the different resources.

Darren Ireland, LGL: Going back to the harvest numbers. A lot of comments have been made about disturbing the migration and the numbers caught me off guard. I guess the Point Lay numbers are

usually much larger than the Point Hope numbers. I wonder if traditional knowledge tells us anything about the harvest in Point Hope impact the migration as it goes up to Point Lay?

Robert Suydam, NSB: The Point Hope hunt in 2012 was in April and May as the bowheads migrate along the ice edge. What Earl was talking about earlier was summer time beluga hunts. Beaufort stock comes through in April and May, and the Chukchi Sea stock migrates up later on in the summer time in June, early July.

Ice Seal Committee (ISC) Subsistence Harvest Updates

John Goodwin, ISC Chairman

The Ice Seal Committee consists of five coastal regions: the North Slope Borough, Northwest Arctic, Yukon-Kuskokwim Delta, Kawerak and Bristol Bay. It is difficult to get a count for harvest data. Seals are very hard to get a count on because each village hunts year round and each geographical area takes a certain amount. One clue is that when I was a young man, me and my brother were hunting seals in September and my mom, on a piece of paper, was keeping track of every seal we brought home. Just before freeze up she said, 'you guys need 11 more to make 100' and so we went out but it was cold and we only got 10 more for a total of 99 for the season. So that's just to let you know how much is harvested by each family. It so happened that same year, my two cousins did the same thing. The harvest data on seal is going to be humongous, and when they start declining we will be very interested in that. Ice seals are listed right now because of habitat loss. We are losing the ice. As far as this year there has been no incident with industry. That concludes my short presentation.

Q&A | Comments:

Enoch Shiedt, Maniilaq: I wanted to update you with the incident with industry and our seals. There were different ways that Kotzebue was being impacted, not only in springtime but also on the return migration when they're coming back from north to south. The one we had impacted, and I feel it real hard, was years ago when Shishmaref is calling me and I'm in Kotzebue and they're with Kawerak. At that time, when they were trying to get ships to the port at Red Dog and due to the study you guys are doing, I could hear ships hitting the ice, and the seal we were going to shoot got scared and got the jitters and yet I could not see the ship. At Kotzebue and Shishmaref, due to the ice conditions, sometimes the ice will be solid in the middle and Shishmaref will hunt on this side, and we will hunt on our side. They were trying to break a trail to go to the port, and we felt it. I was getting calls from Kivalina that they were being impacted. When I was a youngster my grandfather said when the beluga get scared they will run, as much as 30 miles. John Burns did a study on beluga, and he said they would run as much as 32 miles. So just to say that with traditional knowledge, the Eskimos know what they're talking about. What I'm scared of is industry impacting fall time (mainly cruise ships) with the sewage water and the black water, they might dump out in the bay. The reason I'm mentioning this is that in Kotzebue, when our city was dumping sewage in the bay, within less than a week my people were getting fish that smelled like sewage when they were eating it. The summer time is the beginning of the rearing of beluga whales young. If they eat the sewage they'll pass it on, and the impact will happen. And who are they going to blame first? You guys and then the natives next. We need to be careful where the sewage and wastewater is being dumped. Last summer

when the cruise ships went to Kotzebue and there were belugas out there, we were waiting and they made the noise and we never saw the beluga again. That was in late fall. If the ships are out there, the sonars are going to impact the food chain. That's what I'm scared of. It's going to hurt us in the long run.

Darren Ireland, LGL: Did the hunters see many of the infections on seals harvested this year that had been present over the past couple of years?

Harry Brower, AEWC: There were much lower numbers in the 2012 season. 2011 there were larger numbers that were identified with the sick conditions on animals nearshore. In 2012 there were much fewer; two, maybe three, at the most.

Johnson Eningowuk, Native Village of Shismaref: I appreciate what Enoch was saying. Shishmaref is a subsistence community. There are not many jobs in the community. Everyone is a subsistence hunter and that's what they do every spring. Our main catch is the bearded seal and the seals that go through our village. Many years ago we were whale hunters, but we no longer whale hunt. We had beluga many years ago; we no longer have beluga. Our main subsistence is the seal. Shishmaref is known for seal oil and what we call black meat. The increased amount of traffic going through is going to have some kind of effect on the population. I'm not sure what's going to happen. I'm afraid it is going to go the wrong direction for our people. We are thankful that caribou are coming back, but we still hunt in the ocean every spring. Sometimes we run in to a big boat in the fog, and we wonder why we haven't seen any game for a while and then we'll come across a tugboat in the fog. They're pretty loud. I'm afraid to know what kind of affects the increased traffic will have on our village in the future.

Enoch Shiedt, Maniilaq: Regarding wastewater in Kotzebue, I wanted to add that when the city was dumping the waste out in the bay, I made holes in the ice with an 8" auger three miles away, and the fish were dead. I counted 63 tomcod, flounder, bullheads and smelts in that one hole.

Bill Streever, BP: Can you give us a quick description of the seal hunt and how it works to make sure everyone understands that?

Harry Brower, AEWC: The hunt normally starts in the spring right out in front of the shore fast ice that we use as a platform during the winter months. We take small dinghys out there to hunt for seals. Several hunters work together at times; some of them work individually to take one or two seals. They can take up to 10-15 seals off the ice edge in winter. In the summer the ice recedes but is still nearshore. We take aluminium boats with motorized units to hunt for bearded or ringed seals for our sustenance in the summertime. It occurs differently in different locations in terms of the type of hunting. There are some that hunt as the ice recedes and there is open water hunting that occurs as well using gill nets sometimes, or rifles to take them in the ocean. The animal floats after its shot for a few seconds to give the hunters time to harpoon it; some will sink if we can't be fast enough or some right when they're shot depending on what state they're in and the water conditions.

Eskimo Walrus Commission (EWC)

Vera Metcalf, EWC Director

I was born and raised in Savoonga. I've been with EWC for a number of years, starting in 2002. I want to thank NOAA for inviting the EWC. I think this is my third meeting. I also want to thank the whaling commission because they all said the EWC needs to be at this, and I thank them for including us. I know the walrus is not included in the NOAA/NMFS but it is good to be here.

This picture shows the whaling captains from St. Lawrence islands. We are using Lund boats. This picture was taken south of St. Lawrence Island during bowhead whaling last spring. They are all getting together to harvest the bowhead or tow it back to a safe place to butcher. This activity takes many hours. Our hunters are out there for a long time, and safety is on their minds all the time. This is open water, and at this time of the year they don't like to see large boats getting in their way.

The EWC has been around since 1978. It currently represents 19 coastal communities from Bristol Bay to Barrow. The commission has five regions. Our office is located in Nome, and the funding comes primarily from the MMPA, Section 119. We have an agreement with USFWS to manage this resource, and it is a shared resource between Alaska and Russia. We have a really good program going with our Chukotka neighbors. They have walrus hunters there, and they have the same concerns we do. Their federal government is a lot different than ours; they're very restricted. They look to us for support and advice. We work closely with not only Alaska but also with our Russian colleagues.

It is a challenging time. We have an agreement that has been extended, but we don't have a budget yet because of what is happening in Washington DC. It really affects us, and we're not certain what is going to happen in the future. We had a meeting in Anchorage in December. Our commissioners are dedicated. Charlie Brower is the chair. These people represent their communities. They are appointed by the tribal organizations, IRAs or communities; we don't select them, the community selects the representatives. We do hold hunter meetings, primarily on St. Lawrence Island because that is where the largest hunting communities are. Last month we held a meeting and had 45-50 hunters that came. The neat thing about these meetings is we hear hunters' concerns. In Gambell we have a whole bunch of high school students that come, and they will be the next emerging leaders and hunters. We have a dedicated group of representatives on our commission, and they work hard. Charlie is a very good chair, and we're proud he's working with us.

We formed the Arctic Marine Mammal Coalition a couple of months ago. Representatives include AEWC, EWC, ISC, Alaska Nanuuq Commission, ABWC. We primarily formed the coalition to address shipping. Bering Straits is an international strait, and, over the years, each commission has been needing to address increased shipping in the Bering Strait. The Coast Guard and other agencies have said you need to come up with a unified voice to address shipping, and we are primarily addressing increased shipping in the Bering Strait. We met for a couple of days, and we're very excited about the Coalition. We are still working through addressing the issues that were raised at this meeting but we're unified, and it's exciting to see this moving forward.

At Kawerak we have a natural resources department. One of the things we are doing is ice seal and walrus mapping. Last week we had a two day workshop in Nome. Lily Ray**,** the primary investigator for the project, brought in subsistence hunters from communities to review maps that were developed a couple of years ago and to verify, based on traditional knowledge from the hunters, and update the mapping. This information will be useful for shipping. It covers subsistence use areas for walrus and ice seals. It is a really unique project, working directly with the hunters. Someone mentioned that traditional knowledge is very important, and this is one thing we are doing to map ice seal and walrus use areas. It is still in progress. The final product will be reviewed by the hunters before it is printed. Oceana will be developing the maps for us once everything is agreed upon.

Over the years, the EWC has worked with USFWS collecting bio samples from walrus targeting Gambell and Savoonga because that is where the largest subsistence harvest is taken. We are not really interested in numbers because that's what the USFWS does but more on the health and status of the walrus. We collect teeth and blubber. This information shows you the number of walrus harvested last year and 2010 but we don't have updated information from the Russian partners on the 2012 walrus information. We work closely with USFWS on collecting the samples. We are hoping it will get funded so we can have some of our own hunters helping biologists and others working on genetics. We try to encourage our hunters to be part of the discussions and projects. They provide the samples and environmental information as well because they are out there in the environment and know the areas well. We are concerned about diet and disease. Someone mentioned the unusual mortality event that has been happening with walrus and ice seals. We have not detected any new diseased animals over the past couple of years, but at this point we still have not determined what caused that disease. The NSB has been very dedicated to finding out what caused that disease, and hopefully we'll have some answers soon. The other thing is the oiled wildlife on St. Lawrence Island. We still don't know what's causing that, and I think the Coast Guard has been working diligently with the island folks to find the source and hopefully not have that incident happen again.

We work closely with our hunters. If it takes 80 miles or 90 miles to find game, that's what we'll do. Marine mammals are our subsistence resources, and we are very reliant on them. I want to end with a quote from Earl Comstock who is a legal advisor for AEWC. "The Alaska native voice is essential and is the only effective mechanism for the protection of Alaska native marine subsistence resources and native culture." This is the reality of many of us that work in the marine mammal commissions. It is a very political reality of Alaska native communities because of what we are facing and living with. I thought this quote very adequate and important to note.

Q&A | Comments:

George Olemaun (ICAS): Thank you for the Arctic Marine Mammal Coalition. I think this is a step forward. It should be commissioned or whatever needs to be done so they can be sitting here.

BP 2012 Monitoring Results for Northstar and 2013 Operations and Monitoring Plans (Beaufort)

Bill Streever, BP Exploration (Alaska) Inc.

The basic premise of the presentation is captured in this illustration (shown). During the fall migration, the bowheads swim past Northstar to the north, and we have recorders out near the migration corridor to record the bowheads coming by. Some years we triangulate their locations; some years we just get the general direction.

This presentation is a summary of 2012. There is not much new going on, although we did bring a new personnel module on to the island. We had typical numbers and call counts. There was some vessel noise captured by the array.

First oil was in October 2001. Oil peaked out at 80,000 barrels per day (bpd), declining since then down to 11,600 bpd now. There has been a long regulatory history with Northstar. For a long time we have been in contact with NMFS and AEWC and other interested parties as we developed Northstar. (displayed) a timeline here of the Northstar Marine Mammal project and the communities we work with to ensure everyone is on board with what we're doing to the largest extent possible. Most of the effort and focus is on the fall migration of the bowhead and mostly the effects of noise from this production island. It's not a seismic vessel and it's not a ship; it's a production island, it's a gravel island. After doing four years of intensive work, we got in to the routine monitoring mode. 2012 was another year of routine monitoring. We have published quite a few papers thanks to Susanna Blackwell and various others, and we are now up to 14 peer reviewed papers from the work done at Northstar with the most recent one coming out this year with the first author being Trent McDonald and the usual group after that. It's the first peer reviewed paper that talks about the deflection of the bowhead call distribution around Northstar.

Northstar Activities 2012. We always track vessel activity around the island. It's a gravel island, so most of the sounds from the island are not finding their way directly into the water. The island does put some sound in the water, but the most direct sound and what seems to be the loudest sound comes from vessels. We track vessel traffic pretty closely. 2012 vessel traffic was within the range of past years. Tugs/barges and Alaska Clean Seas boats all were within the range of past years as well. The crew boats were not applicable because the hovercraft is back online and at least for now have retired the crew boat.
The two big changes on the island: the drill rig is gone (taken off the island about two years ago) and a new personnel module came in late 2011.

Seal Monitoring. We watch for basking seals in the spring. We have personnel based on the island, and they look around and count how many seals they see. The total number of seals varies quite a bit from year to year, but 2012 is within the range of what we've seen in the past. This makes sense since our level of variability ranges from 3 seals in 2007 to 811 seals in 2009. We also look at seal numbers at different periods of the basking seasons as well.

Acoustics and Bowhead Study. There is one location to record Northstar using three recorders for redundancy. There is one location used to count calls using two recorders. There are extra locations this year that give us the ability (sort of) to triangulate whale calls, and there is one overwinter recorder.

For the near island recorder: the recorder goes out for the month of September. (Displayed slide of recording levels). The spikes displayed are mostly boat traffic. The larger scale up and downs are mostly weather (storm days). The red line displayed is a filter out of noises that didn't last very long, i.e. boat noise. In 2012, there appear to be fewer boat spikes in 2012. This is due to retiring of the crew boat. (Displayed slide of maximum sound levels for each year) One thing you can see in this data is the range is a little higher than normal in 2012. The minimum is within range of what we've seen before, but the 95th percentile turns out to be the highest one we've seen in the 12 years we've been doing this (highest) and maximum, 144th percentile, is also the highest we've ever seen. So what happened at Northstar this year? These are levels at Recorder C. We look at the plot of Recorder C, and it shows the high levels occurred out in the array offshore of Northstar, but they didn't occur closer to the island. The most obvious interpretation is there were boats offshore on top of the array.

Whale Calls: 31,200 recorded. 943 calls per hour on September 19th. There was nothing really unusual in the whale call pattern this year. Compared across years it is similar between 2011 and 2012. Shell and Fairweather helped when picking up the recorders this year, and we appreciated their help. We did leave one recorder behind for overwinter data.

It isn't easy to classify bowhead whale call types, but we compare simple and complex whale calls. We don't see any real patterns from one year to the next. (Graph displayed)

Call directionality (displayed plots) shows that most of the calls come from just to the southeast on a particular recorder. It shows that not many calls at all come from the west of that recorder. If that's all you knew you would say 'what's Northstar doing to our whale calls?' We've looked at it for years, and it is almost a standard pattern that there are fewer calls once the animals get to the recorder and then head on past it. So what's happening? We think what is happening, and we got at it in a paper that came out in 2012 showing to our surprise that bowhead whale calls are directional, which is surprising for an animal calling at such low frequencies that they can generate a directional call. So it could be that the directionality of calls is all that is needed to explain the pattern we are seeing. We don't actually know that, but we speculated about it in the paper. This is something we might want to take a closer look at when we have some time on our hands to figure out what's going on with this. These recorders are in relatively rather shallow water and because of the depth of the water the lowest frequencies the whales are calling at are omnidirectional, going in all directions at about the same strength, and they're being filtered out because the water is so shallow. That may be why it shows such a strong pattern more to the east than the west since the shallow water filters out the directionality.

Cross Island Hunt 2012. Michael Galginitis spends time with the hunters at Cross Island and puts trackers on the boats. This helps us to better understand the hunters concerns about Northstar's

activity. The 2012 hunt year was a successful year. Four whales struck, four were taken. No concerns expressed by the hunters about Northstar itself by the people Michael talked to. I think there were overall concerns about vessel traffic, but that's not surprising given what we've talked about earlier today.

2013 plans:

- Hope to receive Letter of Authorization (LOA) for Northstar
- Continue standard ongoing monitoring
- Hope to retrieve overwintered recorder
- Consider possible processing of overwinter recorder data (budget dependent)
- 2013 hunt
- Hope to submit a second paper on deflection
- Hope to submit summary acoustics paper
- Hope to submit cumulative effects paper
- Look at call distribution pattern

In summary, this is our fourteenth year of Northstar. The ongoing reservoir is depleting. 2012 was a year of typical activities, typical sound levels, typical seal counts, typical bowhead call count and a successful Cross Island hunt.

Q&A | Comments:

Bob Day, ABR: In hearing you talk about the movements and distribution it raises an issue in my mind and that is after a meeting last week with a guy named Bob [*unable to hear last name*], a physical oceanographer from Woods Hole, and one of the things he was talking about is that because there is more open water along the Beaufort Sea shelf there is a tendency for increased upwelling occurring at the shelf break now compared to what they suspect used to occur. Have you looked at the movement of whales with respect to easterly winds which will recreate this upwelling along the shelf break?

Bill Streever, BP: We've looked at a whole lot of variables, but I can't recall if we have wind direction in any of the earlier models. This study wasn't designed for that kind of thing, but if someone wanted to look at our data and see if they can relate it somehow, we'd be happy to share it. Would you add anything to that Susanna?

Susanna Blackwell, Greeneridge: We were using the Northstar weather station data in the early years, and it was placed in a way that when the wind came from a certain direction it didn't record it accurately.

Bill Streever, BP: So then we switched to the Deadhorse weather data, which we know isn't accurate either.

Susanna Blackwell, Greeneridge: I think you said when you showed the radio plots that you pointed to the ring in the middle and said it was Northstar and it is actually the recorder C north of the island.

Bill Streever, BP: I hope I said it was a point north of Northstar. That's what I meant to say.

George Edwardson, ICAS: When you're done with exploration and development do you have any studies on whales and seals from before your exploration and development? A baseline study … was it ever done by your company or the federal government?

Bill Streever, BP: It depends on what you consider baseline. Prudhoe has been under development since oil was struck in 1969 and came online in 1977 so Prudhoe Bay itself was a source of noise; and then stuff starting going offshore with Endicott. If you count all that as baseline and certainly while that was going on Minerals Management Service (MMS) /BOEM was doing the BWASP work, so there was data on bowhead location.

George Edwardson, ICAS: When you look at Prudhoe Bay and Cross Island there is over a 30 mile difference so a baseline study would be a baseline study north of Prudhoe.

Bill Streever, BP: I personally think you can hear Prudhoe Bay quite clearly from Cross Island. When we started developing Northstar, before we put Northstar in the water did we do a baseline? Partly the answer is yes and part is no. The part of the answer that's no is we acquired an existing island out there called Seal Island that BP acquired, and then we built on top of it so there had been activity out there already. Before we built Northstar we did studies offshore for one or two seasons, but it wasn't the same kind of studies you see here, but I would not personally call it a baseline study. I would call it a study that you typically get when you have a relatively short planning window. I might pass some of that over to MMS/BOEM because they've been studying stuff in the Beaufort for a long time. Do you know how long they've been going on?

(Unidentified): I don't have the data here but they've been going for about 20 years; since 1979, so a long time.

Jessica Lefevre, AEWC: I have two questions: do we know what the vessels were?

Bill Streever, BP: I'd be speculating. No disrespect, but does it matter? I guess there are people in the room who could guess at which vessels.

Jessica Lefevre, AEWC: I'm not trying to cause trouble, I'm just curious if you had the information.

Bill Streever, BP: I'd be speculating. I don't have the information. You can see the dates; it was end of September and first part of October, but there was probably more than one vessel out there.

Jessica Lefevre, AEWC: That's one of the things we're just trying to get on top of, as you know. My other question and thought is that you've spent quite a bit of time on the Northstar project and this monitoring plan in addition to working on the cumulative effects workshop. I'm curious, maybe for discussion tomorrow, if you have thoughts on, given the long term effort BP has put in here at Northstar, if looking at it from a cumulative effects perspective, if you could go back and tweak it, I'd be interested in your thoughts on how you would tweak it to give us a better picture from the cumulative effects perspective.

Bill Streever, BP: That's a good question. I think I would ask two questions: 1) how would I have tweaked it differently? If we were just looking from a perspective of Northstar would we do it exactly the same way again? I don't think we would. I think we would take a different approach. And secondly the cumulative effects question, which is a completely different question, and a good one. I think I would say, though, about boats and cumulative effects, Bob [*unable to hear last name*] who works with Robert and Craig went to great lengths to try to get a better understanding of vessel traffic in 2008. The main thing he discovered is just how difficult it is to know what vessels are out there and what they are doing even though you have things like AIS

and apparently even with the AIS data it is not necessarily that clear. Does that sound right Robert?

Robert Suydam, NSB: I think that was true for 2008. I'm not sure that it is still true because the number of receiving stations on the North Slope has increased dramatically in the last few years. In 2008 it was hard to interpret, there were a lot of holes in the data, but I think more recently it's improved dramatically.

Robert Suydam, NSB: I have a follow up to Jessica's questions and the non-cagey response as to whose vessels they were. We can probably all guess whose vessels they were. But to me the question is, the issue is a really important one because it relates to cumulative effects and also points out the need for the companies to work together to share data, to share monitoring ideas, and if we're really going to tackle this issue of what are the effects of multiple activities on bowhead whales that we really do need people to play together. I want to compliment you Bill and Michael and Shell for working together to get the Northstar (Directional Autonomous Seafloor Acoustic Recorders (DASAR) back this year and just hope that type of interaction continues, and I encourage that it continue. My first question is: BP just moved out new quarters, which suggests that Northstar will likely continue to produce oil for quite a while. Any idea how long Northstar will continue? Second question: what is BP's plan for monitoring in the coming years?

Bill Streever, BP: The question I heard first was, will we continue operating for a long time? We are down 25% from 2011 and 2012. This is the extent of my knowledge. I did ask around before I came here because I anticipated that question. I've asked questions about do we have a DNR plan in place. No one at this time is speculating as to when Northstar's life will be in jeopardy. The second part of your question was about continued monitoring. I hope, and we plan, next year to do what we did last year and my hope is that we continue to do that through the operating life of Northstar. I don't have the final word on that. The government has to weigh in, we don't know what they're going to want us to do in addition to what we've done; and of course BP has to weigh in and as production falls and the money flows less freely.

Robert Suydam, NSB: Thank you for that. A follow up then related to what George was saying. Obviously there's not good baseline data for before Northstar was constructed, but something that would be valuable to start thinking about now would be to collect enough data so that we can understand the potential impacts of when Northstar is deconstructed and removed. Presumably much of that will occur in the ice covered season, but I could easily see a lot occurring in the open water season too. If there's a way to collect data now, maybe more than what's going on for typical monitoring from year to year, but collecting additional data that will be helpful in understanding potential impacts from deconstruction of the island is something to think about.

Bill Streever, BP: That makes perfect sense to me. You probably know that during the onshore portion of my job, I spend a lot of time thinking about exactly that kind of thing. For Northstar, it's far enough in the future I would like to think we would have at least several years warning if we started getting to a stand down situation, but we can at least start thinking about that internally.

Colleen Swan, Kivalina: With all the traffic that's happening right now and the effects that noise has on sea mammals, and I know there's an effect because we have hunters who go out there and as soon as they show up the seals disappear. My question is how long does it take for the population of species to recover and adjust to the noise that is out there? And since someone said they've been studying these things for 20 years there should be an answer out there somewhere. This speaks to the importance of having baseline information.

Bill Streever, BP: Nobody knows how long it takes for these animals to recover from chronic exposures to sound like what they've experienced from Northstar. And that would be a very difficult question to get at for lots of different reasons. One reason is that there are other pressures on the bowheads, so whatever expression they might have of the impact from Northstar is confounded by other impacts. I don't think we'll ever know. I do hope you understand that we do accept that animals respond to the presence of Northstar and related activities; that's what studies show and that's what we've shared with you guys for years. We've documented that effect to the extent that we can. But I do think I think it would be difficult to definitively predict or document how that response diminishes or how those animals recover in terms of their behaviors.

Colleen Swan, Kivalina: The hunters can tell you. For years we go without seeing caribou because the migration changes. There are hunters that can tell you that information about the recovery period. (unable to hear)

Bill Streever, BP: I keep hearing people say we don't have a baseline in the Beaufort Sea and to some degree I agree with that, but in comparison to other parts of the world where oil and gas is developed we have one hell of a baseline thanks to MMS and to some degree to the companies as well.

BP 2012 Monitoring Results for Beaufort Sea Seismic Survey Operations

Bill Streever, BP Exploration (Alaska) Inc.

The purpose of the Simpson Lagoon operation was to look at the area north of existing oil fields, shallow water, to look at existing reservoirs to better understand how the oil and gas has migrated since production started so that we can effectively optimize the remaining production. The general description is that of an ocean bottom cable shoot. These shoots that BP has been undertaking utilize a smaller boat and a smaller array of airguns, but there are no streamer arrays behind the airguns. The receivers that typically would be in those streamer arrays lay on the seabed and can be attached together with a cable or can be independent units called nodes that receive, collect and record the data. It's a bit different than an offshore shoot. They are called OBC shoots.

In this case we had two boats each pulling 640 cubic inch airgun arrays and then a third boat carrying a 320 cubic inch airgun array operating inside the Barrier Islands up until the shallowest water we could reach and outside the Barrier Islands to a depth of approximately 40 feet. We covered about 70 square miles of marine habitat, 42 square miles inside and 28 square miles outside, and some habitat on island and on shore. We started acquisition on July 29th. Acquisition outside the Barrier

Islands was completed on the 25th of August and of course that was planned around the agreement with the whalers, and then we completed the acquisition on the inside of the Barrier Islands on September 7th. We staged this in such a way that we could get what we needed on the outside earlier and on the inside of the islands later because the Barrier Islands, to a large degree, block the sound propagation from inside the islands going out into the offshore.

Two MMOs were on duty on each source boat. Standard ramp up and shut down procedures were used. MMOs were paired, one local and one science based on each ship. There was 1,500 hours of MMO on-duty time. There were 45 seal sightings of 47 individuals. No cetacean sightings. There were five shutdowns; four for seals within 190 dB and one for a seal approaching. There were three power downs and five delayed ramp ups. There were approximately 21 seals exposed to 160 dB. Fish monitoring has been conducted just east of this for years. We check that fish monitoring data to see if we see any effects. The effects would have to be really dramatic for us to see.

Q&A | Comments:

Sue Banet, BOEM: I have a question on the sound source distances. When you look at the outside barrier island you say your first array volume is 40 cubic inches. Is that right? Should it be 640?

Bill Streever, BP: Yes, that's a typo; there should be a 6 in front.

Brettny Hardy, Earth Justice: I was curious how you do the fish monitoring? Is that from catch landings?

Bill Streever, BP: No, and I really want to emphasize that this fish data is a long term monitoring project related to a causeway that was finished in 1977. Every year but one since 1977 we've had at least four fixed nets like fishing weirs. They sit in shallow water, the fish swim by, and they are sort of corralled into these nets and they're checked daily, and we count them and release them. It's not related to seismic. For us to see something related to a seismic shoot it would have to be absolutely devastating to the fish.

James Patkotak, Barrow: On your seismic activities have there been any results or have you noticed any krill or other food the sea mammals may eat be disrupted with their travels and so forth?

Bill Streever, BP: Yes, so, impacts on invertebrates from sound ... we wouldn't be likely to see it in a shoot like this just because of the visibility, the water and we're close to shore, etc. BP did support a study that's underway right now in the UK where we are looking at low frequency chronic sound effects on three species of invertebrates. It's a start, but we don't know the answer right now.

Vicki Cornish, Marine Mammal Commission: I have a question about estimated down time associated with poor visibility or fog. How much down time do you have associated with not being able to see?

Bill Streever, BP: It's all in the 90 day report. The report is posted online.

Richard Kuzuguk, Shishmaref: During the seismic activities that's going on where would the whales be since they are not close by, and what distance would they be at as far as the majority of the pods?

Bill Streever, BP: Bowheads or bowheads and belugas?

Richard Kuzuguk, Shishmaref: The reason that I'm asking is that where the whales normally would be from April 29 to September 7...

Bill Streever, BP: August 25th is when we stopped shooting outside the barrier islands and September 7th is when we wrapped up the job.

Richard Kuzuguk, Shishmaref: The reason I asked is because of the airguns that are being shot. And another question is what were the levels from 0 to full power last, and how much time frame did the marine mammals have to scoot out of the area. When there was shut down time how fast was it restarted?

Bill Streever, BP: Okay, I think I heard three questions: 1) where are the whales relative to this operation. So if we are talking about bowheads, most are to the east and much further offshore than this operation during the time period when we were outside the barrier islands. During the time we were shooting inside the barrier islands, at least as we understand the bowheads, they were approaching the area and beginning to migrate through, most of the sounds from our guns would be intercepted by the barrier islands. Belugas, I would turn to others to answer. I think they are mostly offshore, out by the shelf break, but we do occasionally see them in shallow water. BWASP doesn't see them in shallow water usually. Nelson Lagoon in 2011 was an exception. The second question was ramp up. So, the way it works is you start out with your smallest airgun, and in this case all the airguns were the same size, and you double it, you double it, you double it until you're up to the full array. So 15 minutes for the small array, the 320 inch array, then 20 minutes for the 640. If we did have a shut down, I believe it was a half hour before ramping up again. Do I remember the numbers right? If we had a shut down for a seal in the area, it was a half hour clearance followed by ramp up.

Richard Kuzuguk, Shishmaref: I have a follow up question on that. According to the internet, I think the full power is something like 220 decibels and the impact that it has as far as the whales, belugas, and other mammals that have a bladder system or floatation system ... one of the concerns is how much impact does that have because the airguns are said to have an impact to whales up to 1,000 miles and one of the concerns that we need the public to be made aware of is that air blasts due cause haemorrhaging in the brain and destroy the eggs. Those sea mammals have not enough time to scoot out when the sound starts. I don't know how much the benign take level would be, what is acceptable and how those decisions would be made. That needs to be included with every community or every subsistence village like Barrow, Shishmaref, Kivalina, etc.

Bill Streever, BP: I'm glad you brought that up because there's one thing the MMPA has been successful at in Alaska is preventing direct physical harm. I agree with most of what you just said. The levels of these guns are very loud sounds. You would not want to be next to one of these guns in the water when it goes off. That's why we have these mitigation criteria. In this case we're operating in very shallow water, and it would be extremely unlikely for an animal to be in the area without us knowing it. By the times the animals are a relatively short distance from the array, the direct physical harm chances has diminished. I think you are right to be concerned, but technically it is not a realistic concern to think there will be direct physical damage from the energy of these sound sources unless you are quite close to the sound source. When you said animals could be affected 1,000 miles away, you are right. Some animals can hear airgun shots and various other things 1,000 miles away; there's no doubt about that. It's not normal though. In a situation like this I think it would have been, with this particular seismic

shoot, virtually impossible for anything to hear this thing 1,000 miles away. I'll turn to Dave Hannay in this case to confirm that. Do you think that's probably true in this case?

ACOUSTICS

These data I'm going to share actually came from the Simpson Lagoon operation but in looking at this I talked to Lisanne Aerts and Caryn Rea and then the three of us as part of the Alaska Marine Science Symposium held a brief workshop on comparing modelled sound levels to measured sound levels and that is where this comes from. The first message I want to give you is that you have to stop thinking of acoustic and received levels in black and white terms. You'll never know exactly what the animal hears. Number two, we go to great pains to try our best to figure out what these animals are exposed to. I want to zoom in and show you just one case study of that.

In this particular case we're looking at the 120 dB radius using different methods relating to this 320 cubin inch array that we had. We did preseason models to measure the distance out to the 120 dB radius and we get 5.7 miles in this case. We do an end fire measurement. We have recorders here (shown). We have a boat steaming along for about 10 km firing every eight seconds or so, and the level that's received at that location is recorded, and we do a regression analysis and it shows you how the sound changes as the distance changes. Then we do a broad side measurement over the side of the boat. We've got three recorders, and we measure sound over the side of the boat. We got a 16.5 kilometer estimate, way more than anyone thought. We also had dipping hydrophones. We sent a boat out to this area, drop a hydrophone and listen. We couldn't hear pulses out at that distance between 4.5 and 14 km distance. Then we have long duration records at three locations which said there was about a 3 kilometer distance out to the 120 dB. It is not that easy to figure out what these animals are hearing. We know the 16.5 was clearly wrong. But we know they were hearing 120 roughly between 6 km to maybe 2.5 km.

Q&A | Comments:

Dave Hannay, JASCO: I wanted to clarify ... I think when you said that the measure distance was 16 km to 120, I understand the measurement was only made at about 3 km...

Bill Streever, BP: I know where you're going with this. So, I expressed it as 16 km as a measured distance because it was measured across these three recorders but then it was extrapolated out to 16 km. Obviously, a physicist or scientist would first of all scratch their head about extrapolation which is one of the reasons this was a suspect measurement to us and so likewise, the 10 km measurement, if we measured to 10 km but were extrapolating out to 100 km we'd be very curious as to the meaning of that extrapolation. Does that answer what you were getting at Dave?

Dave Hannay, JASCO: It would have been good to have a recorder somewhere outside the island at the same time.

Bill Streever, BP: We did. We had the long term recorder outside the island. So we had long duration recorders that were indicating we were at the 120 at about 3 kms which is reasonably consistent with some of the other stuff.

Craig George, NSB: Is it safe to say that because there is a shoal between the islands, that most of the acoustic energy is contained within Simpson Lagoon based on your experimental results?

Dave Hannay, JASCO: Yes. Having the barrier islands there really is a barrier also to the sound propagation outside the items. There may be some small sound corridors where sound could escape out, but I think the measurements BP made characterize that quite well that it really is a barrier to sound

Bill Streever, BP: There's more than one thing going on here. Yes, the bathymetry is important but so is the subsurface especially for these longer wavelengths. So the long wavelengths we produce with the airguns are going to travel through the subsurface and back in to the water column under some conditions, and they will penetrate the barrier islands that way. There is some blockage, but the other thing I wanted to add is that whether or not you add a shoal or barrier islands out there, this very shallow water, in and of itself, can act as a blockage and the shoal certainly doesn't have to break the surface to act as a blockage.

Shell 2012 Monitoring Results for Beaufort and Chukchi Seas Exploratory Drilling Programs

Michael Macrander, Shell Alaska Venture

REVIEW OF 2012 OPERATIONS

Michael Macrander

In 2012 we initiated drilling at one well site, Burger A, in the Chukchi Sea, and one site in the Beaufort Sea, Sivulliq. If you attended last year's meeting you know we aspired to drill at least one, and in some cases two or three, wells to hydrocarbon depth. We did not achieve that in 2012. There were a host of reasons why including it being a late ice year in the Chukchi Sea, some regulatory issues, etc. but we successfully drilled what we call top holes.

Some of the key dates include:

In Chukchi Sea anchor setting was conducted from August 8-10. The drill ship did not come on to location at Burger A until September 7, the first time. It got on location and anchored up, and we began drilling on September 9, drilled for four hours and then, in a precautionary move because our ice forecasting showed ice was headed our direction, we went off location. The ice didn't show up for about seven to ten days; eventually it did and then melted, and we came back on prospect on September 21 and started drilling September 23. Another significant event in the drilling of a well is the mud line cellar. This occurred October 2-4. We ended drilling October 26 and left the prospect on October 28.

In the Beaufort Sea anchor setting occurred August 18-22 before the blackout period. The drillship came on location on September 25. Anchor hook up occurred September 25-27 and drilling started October 3. The mud line cellar was worked on from October 13-23. We ended drilling October 27.

Safeguards were implemented including the whaling blackout starting August 25. The village of Nuiqsut completed their hunting relatively quickly. The village of Kaktovik had some challenges (some people passed away in the community and there were some weather challenges). They finally got their last whale taken on October 3. There were many conversations with AEWC and Shell, and we want to express our appreciation for the willingness to talk and work together to make things work for everyone. That is why we went on location on September 25 while the hunt was still going on, but we didn't start drilling until after the hunt had been completed. We funded communication centers in all the coastal villages, which were activated during vessel activity. Shell also has a subsistence advisors program where we have people embedded in the communities (local people/hunters) to keep their finger on the pulse of hunting activities and animal movements so we can attempt to avoid impacts to hunting by adjusting our program. Doris Hugo Shavings runs the Subsistence Advisors Program for Shell. We conduct twice daily teleconferences with subsistence advisors in communities. We also disseminate information through other Shell teleconferences. There were Protected Species Observers on all Shell assets including over flights. In addition to the Subsistence Advisors in each village, we had community liaisons in most of the villages. It is their job to understand what Shell is doing and to provide people within the community updates as to Shell's activities. We operate a real time tracking program called ADAM (Advanced Data Acquisition Manager) that keeps track of all vessels offshore and aviation assets as well as weather data points. In addition, we collaborated and communicated with AEWC, Beluga and Seal Committees, Walrus and Nanuuq Commissions and hunters.

We drilled two top holes, one in the Beaufort and one in the Chukchi. Most of the wells we're trying to drill are in the range of 7,000 to 9,000 feet deep. What we accomplished in 2012 is the first 1,500 feet of that, which is why it is called a top hole. The first thing we do is drill an 8 1/2" pilot hole. This is to ensure our understanding of stratigraphy in the first 1,500 feet. Then we drill the mud line cellar, which is about 20' in diameter and 40' deep. It is a large specially built bit 20' in diameter. The reason for this is when we start to drill towards a reservoir, we are able to put a blowout preventer down in to that hole in the event we had to abandon the well for a crisis reason. Once that is completed we drill a 36" hole down to 1,000 feet and line it with a 30" casing and then finish out the top hole with a 26" hole with a 20" casing. This is what we accomplished in 2012.

MONITORING PROGRAM OVERVIEW

Michael Macrander, Shell

A key part of our studies program in 2012 was participation in the Chukchi Sea Environmental Studies Program. This program is jointly funded with ConocoPhillips and Statoil and operated by the Olgoonik Fairweather Corporation, and is an interdisciplinary and integrated program having been worked on since 2008, and it is yielding significant results.

There were three aspects to our monitoring program:

- Vessel based monitoring program with PSOs on all vessels and integrated biologist/local knowledge staff.
- Aerial monitoring program with PSOs in aircraft looking for marine mammals and logging observations.

- Acoustics program operated during open water season since 2006 in both Chukchi and Beaufort and year round since 2007 in the Chukchi Sea.

The acoustics program (displayed deployment pattern of acoustic recorders in the Chukchi). One of the parts of the acoustic program is the sound source characterization. All of the vessels participating in our 2012 program had a sound source characterization conducted on them. If the vessel operated in both theaters, it was measured in both theaters. Where possible we did the sound source characterization at the initiation of activities. It makes a lot of sense when doing seismic operations because you do have sound energy put in to the water that rises to the level of at least concern about physical harm or temporary threshold shift. The vessels and the drilling operations do not generate that much sound to get to those levels, so we're not actually assigning shut down or power down distances to these criteria, so it is good to do them as early as you can so you have a good understanding, but not sure that it has to be done very, very first thing. We tried a real time sound source characterization for the drilling program. We had mixed results. That was to have one of those recorders that gets sent down to the sea floor cabled back to a buoy and then able to radio communicate with the rig. We did have some deployment, logistics and weather problems. We got it out in the Beaufort Sea at the Sivulliq Prospect for about ten days and then a storm came through and killed the buoy.

The acoustic arrays have slightly different goals in Chukchi and Beaufort seas, which is why the deployment patterns look different. The acoustics program in the Chukchi is more multi species in terms of its focused and broadly spaced across a larger area. It is jointly funded with ConocoPhillips and Statoil going back to 2006, GXT, now ION participated in it, so there have been various partners for the past seven years. In the Beaufort Sea the arrays are specifically designed to localize bowhead whale calls as they pass through on their fall migration and evaluate possible ways they may or may not be reacting to our presence.

In addition to our regional arrays and our sound source characterization arrays, we had very localized (1,000, 2,000, 4,000 and 8,000 meters from the drill sites) a transect of acoustic recorders to get a better understanding of what drilling activities produce what types of sounds and the levels of those sounds. We did that same array in the Beaufort Sea.

The aerial program differences: In the Beaufort there were a series of transects with PSOs on-board. We added aerial photography capabilities. In the Chukchi we worked on nearshore transects some in 2012 but it was not our priority because we really wanted to fly out over the Burger prospect while we were drilling. Because of safety constraints we flew the aircraft out there, but we did not have the PSOs on-board, cameras only. In one sea we had observers and cameras, in the other sea we had cameras only, for the nearshore we had cameras and observers, so we can get an idea of how the cameras perform as compared to observers.

Q&A | Comments:

James (unidentified last name): Are there any drilling programs on your agenda this summer?
Michael Macrander, Shell: Shell announced last week we will not be drilling in 2013.

Bill Streever, BP: What bandwidth are you recording your drilling sounds at?

Dave Hannay, JASCO: 32 Kilohertz (khz) acoustic bandwidth down to 10 hertz.

Bill Streever, BP: 10 hertz down to 32 khz then? The other question, and it doesn't just apply to you but to all of us, I see these measurements of vessels and it kind of worries me because we do these measurements and we run these vessels under certain conditions (speed, etc.) and really these vessels all have a range of sounds, and I wondered if you guys thought about that and if people thought about taking an approach similar to what Susanna did in terms of reporting sounds. We were calling them acoustic flashcards for a while. So anyway, a better way to capture the full characterization of the sound and the range of operating conditions that the vessels have.

Michael Macrander, Shell: I think there are a lot of things we can do. We have all of these regional arrays and lots of recorders. We also put out the recorders, and Bill, you did a great job of describing how we do the sound source characterization for the vessels, so we have a whole lot of places where we can gather information from. I think it is important to look at the variability, not only the sound source characterization we do, but all the recorders and Global Positioning System (GPS) locations and vessel activities and really tease as much information out as we can. It is a universe of sound propagations and interface between what the vessel is doing, what the weather conditions are, etc.

Jessica Lefevre, AEWC: When you're ready to go down into formation, how long will that take?

Michael Macrander, Shell: We've talked about that. We've done the majority of it. You probably have the answer Pauline?

Pauline Ruddy, Shell: It should take maybe a week, two plus in order to reach total depth but it will really depend on what we encounter as we go.

Bill Streever, BP: (unable to hear)

Pauline Ruddy, Shell: I believe it is all automated.

Jessica Lefevre, AEWC: So, thank you, but is there an estimate of beginning to end total time starting where you are now?

Pauline Ruddy, Shell: I don't have the total number of days because it will vary. The total number of days in the exploration plan was 30-38 depending on which site.

Michael Macrander, Shell: In talking to the drillers, prior to the season we anticipated 30-38 days but we worked 20 to 28 days on those wells and we only got the top hole in. In talking to the drillers, they say about 60% is done at this point. Again, though, we are drilling in the Arctic for the first time in 30 years. We're not going to rush these early wells.

VESSEL-BASED PROTECTED SPECIES OBSERVER PROGRAMS

Craig Riser, LGL

This presentation is on the PSO results from the Chukchi and Beaufort seas. We are trying to maximize the amount of time we have trained eyes on the water to monitor and mitigate the activities associated with the drilling operations. All of these results can be found in the 90 day report. One of the primary objectives is to implement mitigation during operations as required by various permits and authorizations.

The high level overview of the program from this past year. PSOs were teams comprised of biologists from LGL and Alaska natives from Arctic Slope Regional Corporation (ASRC) and NANA regions. This was our first year working with NANA. PSOs were deployed aboard 17 vessels. There were anywhere from one to five PSOs per vessel. Each rig and each primary ice-management vessel had five. At any given time there were 57 vessel PSOs deployed at full operations with 25,905 PSO watch hours: 14,888 in Chukchi Sea and 11,017 in Beaufort. There were six vessels with "Big Eyes" binoculars; high powered 25x150, aboard each rig, ice management vessel and anchor handler in both seas.

There were two PSOs on watch during all daylight drilling and ice management activities. One PSO stayed on watch during all night time drilling operations. At least one PSO was on watch during all other active vessel operations whenever possible and safe to do so.

One of the changes in 2012 was in data collection. We moved from paper data collection to entering directly in to computer software designed specifically for this. This stemmed from a recommendation from the NMFS Peer Review Panel from a few years back. It increases the efficiency of the data collection process and the accuracy of the data collected. With one click the PSO can enter the date, time, the position of the vessel or the position of the animal sighted. There's a series of validation steps built in to the process that increases the accuracy of the data. There is a series of drop down fields for ease of use. This program has a generated log of all edits made, behind the scenes in an admin account that is unavailable to PSOs. The file is written and saved and can be tracked. This program also reminds the PSOs of the important things to keep in mind, including scenarios requiring mitigation and flagging of incomplete data fields.

As for the data, the results and the mitigation efforts in Chukchi Sea, this map (displayed) shows the distribution of the monitoring effort when PSO's were on watch. In the center of drilling at the Burger drill site there is a 25 mile buffer that represents various things associated with the EPA air permit. This area was limited as to what activities could and could not take place and how much based on various emissions quotas so it set up an area outside where vessels were staged for vessels that weren't allowed to operate or release their emissions within this permit zone. This is important to note as you look at the monitoring results.

I'm going to provide a high level summary of species sightings without going through all of the numbers. You can find the numbers in the 90 day report or obtain a copy from me after the presentation. For cetaceans in Chukchi Sea, as you would expect, the most commonly identified species was gray whale followed by bowhead whale consistent with the fall migration. You will notice a large number of unidentified whales. Another comment received from the NMFS Peer Review Panel was the importance of identifying a marine mammal as unidentified when diagnostic features were not observed. This was stressed to PSOs; don't go assuming based on what you don't see. You'll see that for cetaceans and seals. This year the proportion of unidentified went up as this more conservative approach was taken.

For seals there was more or less the expected distribution for the Chukchi Sea. Bearded and ringed seals were the most commonly identified species. Again, there were many unidentified seals. From my experience it is challenging to identify a seal species from a distance.

Pacific walrus sightings were rather large at almost 9,000 individuals. What this is saying (on the slide displayed) is that there were 338 sightings of 8,678 individuals. Many of these may have been double and triple counted as PSOs on different vessels transited through the area on the same day and also by different vessels on different days. Definitely an overestimate of what we saw but we just assumed each day as a new day. The main thing to keep in mind is that the walrus carry with them some of the more explicit mitigation measures that need to be implemented. Vessels need to maintain a distance of at least 1/2 mile from a walrus sighting on ice, and a vessel needs to reduce its speed for all walrus in the water so these results explain the extensive mitigation that took place out in the Chukchi Sea.

With regards to polar bears, we encountered ice until mid-September when it finally moved off the shelf, but until then we did see a fair number of polar bears, again, probably an overestimate. With big eye binoculars PSOs were able to detect these animals sometimes 8+ km away. At that time, the vessel does everything it can to maximize that distance between it and the animals.

Mitigation measures in Chukchi Sea included: almost 200 occurrences of speed reductions, most for walruses observed in the water; 73 course alterations and 26 other mitigation measures. Other mitigation measure may involve delay of equipment deployment, delay of tow transfers, and relocation of vessels with helicopter decks used for crew changes away from ice due to presence of marine mammals in the operational area.

We try to estimate the number of animals present during operations that may have been exposed to various received levels of sound from these activities. We were interested in drilling and ice management in the Chukchi Sea. NMFS has established the disturbance threshold for continuous sounds as 120 dB, so we'll focus on those activities. The 120 dB isopleth for drilling of pilot hole extended to about 1.5 km, 8 km for drilling of mud line and 9.6 km for ice management.

Sightings that may have been exposed to greater than 120 dB drilling sounds were:

Species or Species Group	Number of Individuals Observed during Drilling Periods	Number of Individuals in Areas with RLs of ≥120 dB (rms)
Cetaceans	107	2
Seals	396	10
Pacific Walruses*	574	480*
Polar Bears	0	0

*474 of the 480 walruses observed in areas with RSLs in the water >120 dB (rms) were hauled out on ice and would not have been exposed to the same RSLs as those in the water

Sightings that may have been exposed to greater than 120 dB during ice management were:

Species or Species Group	Number of Individuals Observed during Ice Management	Number of Individuals in Areas with RLs of ≥120 dB (rms)
Cetaceans	27	3
Seals*	34	10*
Pacific Walruses*	985	329*
Polar Bears*	30	24*

*3 of the 10 seals, 250 of the 329 walruses, and 19 of the 24 polar bears observed in areas with RSLs in the water >120 dB (rms) were hauled out on ice and would not have been exposed to the same RSLs as those in the water

These estimates are based on the number of animals observed during the activity; that's one way we can estimate the number of animals that may have been exposed to these activities. The second method we use is based on the area we know to be ensonified times the estimated density of animals in the area. This assumes there is no avoidance behavior shown by the animal. In many ways we think it may overestimate.

- Basal Area ensonified to ≥120 dB (rms) by Drilling and Ice Management Sounds

X (times)

- Estimated Density of Marine Mammals

= Estimated number of marine mammals exposed assuming no avoidance behavior

Species	Estimated No. Individuals Exposed to ≥120 dB (rms) from Drilling and Ice Management Sounds		
	Jul-Aug	Sep-Oct	Estimated Totals
Cetaceans			
Beluga	2	2	***4***
Narwhal	0	0	***0***
Killer whale	0	0	***0***
Harbor porpoise	0	1	***1***
Bowhead whale	1	23	***24***
Fin whale	0	0	***0***
Gray whale	11	7	***18***
Humpback whale	0	0	***0***
Minke whale	0	0	***0***
Total Cetaceans	***14***	***33***	***47***
Seals			
Bearded seal	6	10	***16***
Ribbon seal	0	1	***1***
Ringed seal	216	224	***440***
Spotted seal	4	5	***9***
Total Seals	***226***	***240***	***466***
Pacific Walrus	***272***	***131***	***403***
Polar Bear	***3***	***1***	***4***

In the Beaufort Sea, the PSO monitoring effort, here even more so than in the Chukchi, you can see the influence of this 25 mile buffer around the drilling area. Shell's vessels did not arrive until August, so there was very little monitoring effort from July to August. Most of the monitoring occurred in September to early November. The most commonly identified species was bowhead

whale, followed by quite a few unidentified animals that we assume are bowhead, but, without definitive evidence to identify them, they were classified as unidentified seals, much of what you would expect. Mostly bearded and ringed seals, a lesser number of spotted, and again, quite a few unidentified seals. Walrus, more so than in past seasons, but there was a continuous ice ridge that extended from north of Barrow into the Beaufort Sea early in the operating season, so there were about 20 individuals observed in August and another four before the ice moved out. There were 29 sightings of 104 individuals sighted. That may strike you as a rather large group but most of these bears were actually associated with Cross Island either immediately before or after the Nuiqsut whaling activities so really very few bears encountered near the drilling operation.

In summary, the mitigation measures included 16 speed reductions, 11 course alterations and 7 other mitigation. The majority of mitigation measures were for bowhead whales and polar bears. Other mitigation measures include delay of equipment deployments, tow transfers, and other active vessel operations.

The measured sound radii from drilling activities were just over 1/2 km during the drilling of the pilot hole and 6 km during the drilling of the mud-line cellar. Sightings that may have been exposed to greater than 120 dB during drilling periods were:

Species or Species Group	Number of Individuals Observed during Drilling Periods	Number of Individuals in Areas with RLs of ≥120 dB (rms)
Cetaceans	4	3
Seals	123	81
Pacific Walruses	0	0
Polar Bears	15	0

Density based exposure estimates:

■ Basal Area ensonified to ≥120 dB (rms) by Drilling Sounds

X (times)

■ Estimated Density of Marine Mammals

= Estimated number of marine mammals exposed assuming no avoidance behavior

	Estimated No. Individuals Exposed to ≥120 dB (rms) from Drilling and Ice Management Sounds		
Species	Jul-Aug	Sep-Oct	Estimated Totals
Cetaceans			
Beluga	0	1	***1***
Narwhal	0	0	***0***
Harbor porpoise	0	0	***0***
Gray whale	0	0	***0***
Bowhead whale	0	9	***9***
Total Cetaceans	***0***	***10***	***10***
Seals			
Bearded seal	0	2	***2***
Ribbon seal	0	0	***0***
Ringed seal	0	40	***40***
Spotted seal	0	1	***1***
Total Seals	***0***	***43***	***43***

Pacific Walrus	***0***	***0***	***0***
Polar Bear	***0***	***0***	***0***

*All drilling occurred in Oct. thus no marine mammals were exposed to this activity in Jul-Aug

Q&A | Comments:

Candace Nachman, NMFS: These results are posted on the NMFS website and a link was sent out with the agenda.

George (unidentified last name): Will you continue monitoring despite not drilling in 2013?

Michael Macrander, Shell: Yes, we will. We've been doing this same or similar monitoring program since 2006. Our activity levels have varied, but we've implemented the same or similar monitoring programs for the past six or seven years.

Mari Smultea, SES-Smultea Env. Sci: What data was used for density estimates?

Craig Riser, LGL: We used what we felt was the best available density estimates out there; primarily peer reviewed results in literature. For cetaceans and seals they were similar to those used in Shell's IHA applications and those density estimates are reported in Appendix E of the 90 day report.

Mari Smultea, SES-Smultea Env. Sci: Was it while there was no operations? You used densities when there was no operations or ... ?

Craig Riser, LGL: For ice management estimates, for example, we used exclusively ice margin densities. Drilling in the Beaufort Sea occurred in open water for about three weeks and in ice margin conditions for an additional week so we blended 75% open water density with 25% ice margin densities.

Megan Blees, ASRC Energy Services: Regarding your polar bear sightings in water, did you have sightings or any interactions with vessels or were they primary with the ice management vessels? I'm curious because I think I heard some discussion about close interactions, lingering polar bears swimming around in water with no ice, and I just wanted to confirm those sightings.

Craig Riser, LGL: In the Chukchi Sea there was a scenario encountered where there was a lot of standby time so vessels would go in to a stationary mode and it was primarily in those time periods when they were staged near the ice, five to ten km away, when they would wake up in the morning and a polar bear had swam up to the vessel. So, almost all polar bears in the water were a result of that scenario.

Bill Streever, BP: When measuring drilling noises, did you drive casings on these wells?

Michael Macrander, Shell: We'll get in to more detail on that later. We put casing in, but we didn't really drive casing.

Bill Streever, BP: 120 dB or whichever number you want, and this is really directed at NMFS or AEWC, I keep hearing the numbers and clearly that 120, particularly for an operation such as this, is constantly moving. It would be worthwhile to have a discussion about what all that means and whether or not we're perhaps coming down a rat hole in terms of conservation and

in terms of science in focusing perhaps too much on these radii. **Maybe for the parking lot: discussion of the relevance of sound isopleths.**

Michael Macrander, Shell: We'll support that activity/discussion as well.

Chris Krenz, Oceana: In regards to the density estimate. Was that just an average density estimate for the entire Chukchi Sea or does it account for spatial variability that's out there for marine mammal densities, in particular it looks like your vessels were more in an area where walrus are known to be in fairly high densities? You said you expect that is a high estimate, but if you are using densities across the region one might expect actually low estimates.

Craig Riser, LGL: We tried to consider the seasonal period and best available data for that seasonal period and the best available data site specific. So, for polar bears and walruses, both of those densities used were from aerial surveys of the area in ice conditions where they were actually some of the highest density estimates available.

George Edwardson, ICAS: Did anyone look at the fish and the shell fish in the ocean while you were doing your operation?

Michael Macrander, Shell: My first slide in my presentation about the science we've been doing ... again, it was a joint studies program funded by Statoil, ConocoPhillips and Shell going on since 2008 looking pretty carefully and closely at our drilling locations out there, looking at the benthos, looking at fishes, looking at bird and mammal distribution, etc. We've taken a pretty strong look over five years. We initiated a program this year in the Chukchi that we're referring to as drilling monitoring, looking at discharge streams, etc. The next time we drill, which we estimate to be in 2014 we'll be under a new EPA discharge permit, and it will be required by that permit.

SOUND SOURCE CHARACTERIZATION

David Hannay, JASCO

There will be two parts to this presentation. The first part will be the drilling program sound characterization and that includes measurements from sounds of drilling activities as well as vessels.

Drilling Measurements. The drilling measurements were performed at both sites: Burger in the Chukchi Sea and the Sivulliq site in the Beaufort Sea. We had a dedicated program where we deployed recorders close to the drill sites at both of the locations, and the primary recorder locations were at 1, 2, 4 and 8 km from each of the drill site. Those recorders operated through all the activities. They were deployed before drilling started and retrieved at the time when the vessels were being pulled off the drill sites. At Sivulliq in the Beaufort Sea we also had a real time measurement using a telemetry buoy that also recorded at 64 kHz as all of the recorders operated at, and also at Sivulliq we had a recorder at 1 1/2 km, and we put that recorder down ahead of time because the anchor lay activities happened before the drill ships came in to position.

When making these measurements of drilling activity, we found that there were so many vessels present that the vessel noise contributed to the measurements and actually contaminated the measurements. We had to identify time periods of a few hours each, at least, within each of the

activities (anchor laying, ice management, mud line cellar drilling, pilot hole drilling and main hole drilling), where there were few vessels nearby allowing us to capture very accurate and very high resolution measurements of just the activity of importance. These measurements that I'll show today are from the dedicated recorders. But in both theatres we had very large arrays of recorders from the area wide monitoring program.

The measurements of several of the activities at Sivulliq are displayed here. The top table far right column shows the 120 dB. You can see the anchor laying has by far the largest radii to 120 dB, 12 km up to 29 km. By contrast the pilot hole drilling had only a 660 meter radius. It is a very quiet operation in comparison, and the drilling of the mud line cellar was one of the moderately high level operations. The bottom table is a comparison with pre-season modeling efforts.

Drill Site Activity	rms SPL Threshold Radii (m)			
	190 dB re 1 µPa	180 dB re 1 µPa	160 dB re 1 µPa	120 dB re 1 µPa
Anchor laying	< 10	< 12	63–120	12,000–29,000
Drilling of pilot hole	< 10	< 10	< 10	660
Drilling of MLC	< 10	20	140	6200

	Burger-A		Sivulliq-N*	
Received SPL (dB re 1 µPa)	2011 Model—Estimate (m)	2012 Measurement—Drilling 26 in hole (m)	2011 Model—Estimate (m)	2012 Measurement—Drilling 26 in hole (m)
140	71	100	112	30
130	260	390	427	150
120	1310	1500	2200	660

* *Noble Discoverer* used as noise source in model, *Kulluk* was measured noise source.

These are the corresponding measurements at Burger for the 26 inch hold, mud line cellar and ice management activities. If you focus on the bottom row, the 120 dB, you can see that the 26 inch hole had a 1 1/2 km distance to 120, the mud line cellar was just over 8 km and ice management, which is a measurement of the Fennica ice breaker pushing and handling ice, was just over 9 1/2 km.

	26 in hole	MLC	Ice Management
SPL (dB re 1 µPa)	Range (m)	Range (m)	Range (m)
190	< 10	< 10	< 10
180	< 10	20	< 10
170	< 10	40	20
160	< 10	130	60
150	30	350	200
140	100	1000	730
130	390	2800	2600
120	1500	8100	9600*

Vessel Sound Measurements. We made measurements of all vessels operating in both drilling areas in 2012. At each site we deployed several configurations of recorders using a relative layout by defining 15 km sail track with 5 km approach to a set of three recorders, and then the vessel continued 10 km past. This was designed to capture sound emission levels in front of the vessel as it approached the recorders, and then as it passed we would get sound emission levels to the side, and, as it departed, we would get the sound emission levels behind or after the vessel. For each vessel we plotted the sound measurements in one second increments as a function of distance from each of the recorders. We then fit smooth curves, and finally we shifted up those curves to create a 90% fit.

Chukchi Sea Vessel Sound Characterization Results to 120 dB. Ranges for most vessels were typically ranging from 1-5 km in approximate terms except for one at 19 km from the tug towing the Kulluk. We did measure some vessels at differing transit speeds, although, we usually measure them when transiting at nominal transit speeds.

Here are the sound characterization results from the Chukchi Sea. Focusing on the right hand column, you can see the ranges for most vessels were typically less than 5 km. They range from 1-5 kms typically, except for one that stands out at 19 kms and that's from the Aiviq, a large tug, that was towing the Kulluk, and, as it was towing, it was under quite a bit of high power setting so we would expect a higher level. If we look at different transit speeds, in some cases we did measure at more than one speed, for example the Fennica. We generally asked the vessels to transit at their nominal transit speed for these measurements.

Vessel Name	rms SPL Threshold Radii (m)		
	180 dB re 1 µPa	160 dB re 1 µPa	120 dB re 1 µPa
Affinity–8.8 kts	0	< 10	1300
Affinity–9.0 kts	0	< 10	1400
Aiviq (towing the Kulluk)	< 10	110	19,000
Fennica–8.0 kts	< 10	11	2000
Fennica–12.0 kts	< 10	26	5000
Guardsman (towing the *Klamath*)	< 10	70	4700
Harvey Explorer	< 10	16	2000
Harvey Spirit	0	< 10	2600
Nanuq–9.1 kts	< 10	42	5200
Nanuq–10.8 kts	< 10	60	6900
Noble Discoverer (towed by *Tor Viking II*)	0	< 10	740
Nordica	< 10	40	4600
Tor Viking II (towing the *Noble Discoverer*)	< 10	25	4800

Here are the corresponding measurements for the vessels in the Beaufort Sea. Similar distances. The Aiviq was measured in both theatres. The other vessel that had a high sound level was the Tor Viking, another large tug.

Vessel Name	*rms SPL Threshold Radii (m)*			
	190 dB re 1 µPa	180 dB re 1 µPa	160 dB re 1 µPa	120 dB re 1 µPa
Affinity	*0*	< 10	< 10	3000
Aiviq	*0*	< 10	67	11,000
Arctic Seal	*0*	0	< 10	510
Lauren Foss (towing the *Tuuq*)	0	< 10	< 10	1500
Nordica	< 10	< 10	24	4200
Pt Oliktok	0	< 10	< 10	830
Sisuaq	< 10	< 10	25	3000
Tor Viking II	0	< 10	30	12,000
Warrior	< 10	< 10	42	4400

Displayed a video that showed sound level footprints for each vessel out to the 110 dB level. Darkest at high levels (160 is the highest) and the 110 shows a light shade of gray.

Q&A | Comments:

Brettny Hardy, Earth Justice: When you were measuring the distance at which sounds radiate out, you measured the individual vessels in the individual drilling operations, did you look at a cumulative? The effects of having the vessels with the drilling operation or having more than one vessel and if that affected the distance that the sound travelled?

David Hannay, JASCO: The measurements were dedicated at characterizing specific activities. We identified time periods where we did not have the cumulative effects of multiple activities. However, we've monitored, as part of our overall program, in a regional way, the sound footprint of all of the operations together. That analysis is ongoing. Susanna Blackwell is going to give a presentation following this that will speak more to that.

Brettny Hardy, Earth Justice: In terms of marine mammal exposures to sounds greater than 120 dB, you averaged the exposures for the drilling and ice breaking sounds. Did you average exposures for the vessel sounds as well?

David Hannay, JASCO: We looked at one second levels mapped as a function of distance from the vessels. They can be used in a variety of ways. One of the ways would be the type of mapping or videos like the one I just showed but I'm not sure exactly what your question...

Brettny Hardy, Earth Justice: It's related to the presentation before in terms of the number of marine mammals exposed to sounds greater than 120 dB. In the presentation it sounds like you were estimating the number of marine mammals exposed to sound from drilling operations and ice breaking operations, but I wondered if you estimated the number of marine mammals exposed to sound from the vessels themselves.

Craig Riser, LGL: Those exposure estimates only considered drilling and ice management sounds. The main reason for that was consistency with the IHA application, to parallel preseason exposure estimates and those were the explicit activities authorized within those authorizations.

Dave Steckler, Entiat River Technologies: Did I misread that or did some of those tugs approach seismic levels in their sound propagation?

David Hannay JASCO: The source levels of the tugs are high relative to the other vessels. The sound levels from any source are dependent on how far away you are from that source. If you are very close to a quieter source you'll receive a level that is relatively high, and if you're far from a seismic source, you could receive a level that was lower than a vessel level. Even close to those vessels, those sound levels are below the thresholds we're using right now for assessment of an injury or auditory injury to animals.

Robert Suydam, NSB: Is it Brettny? A follow up to her question. Craig, you responded that the estimated number of animals exposed was just to drilling sounds. Given that we are concerned about cumulative impacts from sounds, not just drilling sounds, is there an intent to actually try to measure how many marine mammals were exposed to sounds regardless of whether it came from a ship, a drilling operation, airgun array or whatever?

Michael Macrander, Shell: Our first effort was to be respondent to the permit, the IHA. We will be doing additional work in terms of the comprehensive report that will come out in June sometime, so I'll say that information will be evaluated and incorporated into that report.

Daniel (unidentified last name): Not that Shell's ever had a successful spill response drill, but how would that factor in to this acoustically? Do you guys have any data on that? I mean we've never seen a successful spill response ... but acoustically, are there any studies on that?

Michael Macrander, Shell: In that the vessels that would be primarily involved in a spill response were among the vessels that were... one important point to make is that we do and we are required by BOEM to deploy the spill response assets that we would use in the face of a spill response as a part of our fleet ... We had approximately 17 vessels; close to 20-30% of those are actually spill response vessels, so some of the sound source characterizations on the vessels that you've seen us talk about are among the ones that would be used for that.

Bill Streever, BP: There are, of course, acoustic signature data for spill responses, not necessarily in the Arctic but other places. A question I had was... you presented a lot of great acoustic data and you presented mostly levels. I was thinking about the anchor handling and what it sounds like when you're in the water and on the surface versus something like drilling. Drilling tends to be a steady machinery sound, and even if they were at the same level, they are qualitatively very different with one coming and going with irregular rapid changes in frequency and amplitude and the other is a steady whine. Have you thought of any ways to characterize that or how that might impact animal responses?

Susanna Blackwell, Greeneridge Sciences: I'm not going to talk a lot about that today because we are not actually done with the analysis that we are supposed to do with all of this data to assess the effects of the whole drilling operation on the distribution of whale calls. But we have given

some thought to how we are going to characterize the (*unable to understand*) of sound, the industrial sound. There are, as I know you know, several things you can look at like the presence of tones and so on, and I think that's what it's going to boil down to.

Bill Streever, BP: Do you think you'll look at the variability over short time windows like we did at Northstar?

Susanna Blackwell, Greeneridge Sciences: It is a good way because rarely you do have natural sound levels like storms that just start up instantly, so I think we will end up using several indices and combining them with the detection of calls at different areas.

David Hannay, JASCO: One of the things we noticed in these measurements is that drilling sounds have very different characteristics to vessel sounds. Vessel sounds are often produced by propellers. They include tone sounds, but they also have a lot of background, we call it broad band noise. While the drilling sounds are very tonal because they don't have the propellers to create that broad band background.

REGIONAL ACOUSTIC ARRAYS

David Hannay, JASCO

I'm going to discuss next the measurements we made using a regional approach with recorders deployed over a large part of the Chukchi Sea, and Susanna will follow up with a regional program in the Beaufort Sea.

The regional program is part of the Chukchi Sea Environmental Studies Program, sponsored by Statoil and jointly funded with ConocoPhillips and Shell and managed by Olgoonik Fairweather. There were 30 recorders deployed in 2012 between August 8-14 and retrieved October 5-13, 2012. This was the sixth year of this program for us. I am only going to discuss the summer results from this program, but we do run it in the winter as well with approximately 10 recorders deployed in the winter. For each site we deploy AMAR recorders right on the seabed and run a rope about 100 meters to a small anchor ring, and, at the end of the season, we pull it up so nothing is left on the seabed. The purpose of the program is two-fold: to measure noise levels, both anthropogenic (man-made) and we also use it to detect marine mammals to find out what the extent of their habitat is and the timing of migrations and use of different areas within the study region.

We get long term recordings out of these measurements. *Displayed a graph of sound levels between Burger and Devils Paw (otherwise known as Klondike) from early August to mid to late October.* Even on a large scale we can see some contributions to the overall sound field that are produced by the drilling activities. At this range we can see increased levels from the mud-line cellar drilling.

We use the data in several ways for noise analysis. We wanted to find out how much these activities would increase sound levels from average ambient background levels. We determined time periods at each recorder where there were vessels present and when they were absent. For each of the present and absent time periods we calculated the median sound levels over the entire periods, and then we looked at the difference. This plot (displayed) shows that sound levels were increased over ambient, as expected, in the areas where activities took place. These recorders are at 16 km from the drill ship Discoverer. The median difference in sound levels was about 12 1/2 to 13 dB at 16 km

from the drill ship. We see increased sound levels off of Wainwright. The reason for that is that due to Shell's air permits, they were required to keep their vessels out of a 25 mile zone, so what happened is the vessels were all here south of the drill site, and this recorder was picking up the sounds.

The other way we use these data are to look for marine mammal vocalizations. I'm going to show two movies displaying walrus and bowhead detections. You will see the daily detections from August 5 through October 14. In most years we see walrus detections mostly up here on the south side of Hanna Shoal early in the season and late in the season, in low ice years, we will often see more activity close to shore. In 2011 we saw a lot of activity by Point Lay associated with a haul out. 2012 was much different than the last six years, due largely in part to ice presence this year. The other interesting fact is that even though there was no haul out at Point Lay, there was a lot of walrus calling activity on the recorder just offshore. Similar call counts even to when the haul outs were there.

This one is for bowheads (video displayed). We see a few bowhead detections early in August, but very few in late August and early September. You will see some near Barrow associated with the fall migration, and this appears to have started about a week earlier than usual. Then the major migration comes through in October as it normally does.

Q&A | Comments:

Betsy Beardsley, Alaska Wilderness League: Could you show on a map where the Chukchi fleet was when the ice moved in and you weren't able to drill over your leases?

David Hannay, JASCO: The ice was present in to early September in 2012 closer to the drilling site. The fleet at that time was standing by south of the drill site by approximately 25 miles.

Betsy Beardsley, Alaska Wilderness League: Can you just point to that?

David Hannay, JASCO: When the map comes up I can.

Mari Smultea, SES: Did you hear belugas?

David Hannay, JASCO: Yes. Every year we detect multiple species. Interestingly, we detect very few belugas in the central Chukchi Sea in the summer. We think that is likely due to low numbers of belugas being present in that area. We do detect larger numbers of beluga calls in Barrow Canyon, and that's expected because we know belugas are there. In the springtime, while ice is still present, we detect the spring migration, and a lot of that happens close to shore, but there are some belugas that travel quite far from shore in late April and May.

Mari Smultea, SES: What about the fall?

David Hannay, JASCO: In the fall we detect very few. That is likely because they are travelling closer to shore, and, in the fall, we have our acoustic recorders further offshore because we can't tow them in the shallow water closer to shore from worrying about ice scraping them.

Robert Suydam, NSB: Just a quick clarification. The belugas aren't travelling close to shore in the fall, they're offshore quite a ways and that's why the conundrum why aren't belugas being detected on the offshore recorders during the late summer and fall.

David Hannay, JASCO: It's a question we are still looking at. It may also be some of those belugas are going very far north around our recorders. We have a limit of our study region, and we may try to get some of our recorders further north to see if we're missing some of that migration.

Chris Krenz, Oceana: It sounds like because of the air permits you are avoiding the 25 mile area around the drill ships. Are we, through these regulations, moving vessels around and increasing the area that is being impacted by sound and is the pollution actually greater because now you are moving to and from the drill sites? I think I know the answer but I think it is something for us to think about. How do we reduce emissions and yet keep impacts low?

David Hannay, JASCO: That's a good question and it feeds in to how do we mitigate sounds from multiple vessels. If you wanted to calculate the overall sound footprint, it is typically optimal to keep all the vessels together. If you spread them out you get a larger overall footprint to any given sound level threshold. We also want to keep them out of migration paths and that's what the data we are collecting is being used for ... to try to position vessels so that we avoid as much as possible the interactions with marine mammals.

Melania Guerra, Cornell University: How far apart are these periods with and without vessels when you were estimating the contribution over ambient noise because the underlying assumption you are making is that the conditions/weather was staying constant?

David Hannay, JASCO: They weren't always continuous or contiguous sound periods. There were periods of time when vessels were present and some when they were not present. We summed up all the time vessels were present and summed up all of the times they were not present and calculated the median levels in both of those categories so it would have averaged it out to some extent. We were using median levels as opposed to average so it would have provided more uniform representation of the sound level during those periods.

Mari Smultea, SES: How high of a frequency can the AMARs record? In other words, could you be missing belugas because you're not recording that high?

David Hannay, JASCO: These regional recorders sampled at 16 kHz, so they could record to 8 kHz, which is generally high enough to get the whistle type calls from belugas. Some whistle calls go up to 11 kHz, but the majority are 4-7 kHz, so we do think we're getting most of those. We will probably not get their click sounds and that's an important aspect of it.

REGIONAL ACOUSTIC ARRAYS

Susanna Blackwell, Greeneridge Sciences

I feel we need to apologize a bit. We are further behind this year in the analysis in part because of a variety of problems. There are new types of data we need to learn to deal with, but I do have some results to show you. Here is the deployment map in 2012 with five sites (displayed). In the past we've put seven recorders at each site. In 2012 it was a little different. We removed four recorders from site one, and we made some changes at site three and site four. Sites three and four are on each side of the Sivulliq location. Four of the DASARS have been there in the past. We moved them over because we were afraid they were too close to the activities, and we were afraid we would have a hard time hearing the whale calls. We removed the four DASARS from site one because we

figured that if the whales actually deflected northward maybe we would get more calls out in this area. We added a triplet of DASARS that are closer together than normal, and they are downstream in the whale migration corridor. Also shown here are the AMARS that JASCO deployed (displayed).

We got over 200,500 call localizations in 2012 season. One thing that was interesting is that if we look at the number of detected calls and localized calls, for all of the years of the study, you can see the number of localized calls in 2012 is higher than it has been in the past, and the number of detected calls is also higher in 2012 than in the past. You will also notice that the difference between localized and detected is pretty large, and that's probably because overall the environment was noisier which means that more often than not we had calls that were recorded only on one DASAR, and we can't localize it.

We had an extra problem with the automated call detector mistaking some types of vessel sounds as whale calls. Aaron is working on filtering those false calls out. As we have in the past, we did nine days of manual localizations. This is a map of where those calls ended up (displayed). The most striking thing that looks different from previous years is the presence of a wedge. If you compare that to the automated localizations on the same days you get something that looks similar from a satellite viewpoint. We are still working on doing a more accurate comparison. You'll also notice there are 26% fewer call localizations with the automated analysis, which is consistent with previous years. We don't want to have false detections, so we turn down the severity of the automated detector which means it misses a certain proportion of true whale calls.

This plot (displayed) is the call detection rate at the entire site four array. You can see on the bar plot that shows call detections over the entire season that over the entire season there was not an increase in call detection at the northernmost DASARs. There is a big section during the month of September in which Shell was not in the area at all.

There are two DASARs (H & I at site four) that were added in 2010 close to the Sivulliq location to get a couple of years of non-drilling activity data. In the 2010, 2011, 2012 plots you can see the presence of natural events like storms, and it shows 2011 was the quietest year. In 2010 there was some vibracore activity that was taking place. The 5th, 50th and 95th percentile is shown. In 2010 there was a moderate difference of about 6 dB from 2011. In 2012, with much more activity there was an increase of about 9 dB in the 5th and 50th percentile and by about 34 dB in the 95th percentile.

One surprise to us is that site 5 north of Kaktovik which has been our wildest site or where there was the least amount of activity by Shell in past years, however, in 2012, every single DASAR had a lot of this kind of stripes which correspond to activities that were not part of our study. When we looked at the number of airgun pulses detected at 5G in 2008-2012, you can see 2012 had more airgun pulses detected than any other year despite Shell was not working in that area at all. Those of you that know DASARs know that we can get bearings to sounds of interest, and if we plot the bearing of airgun pulses, we can get an idea of where these activities came from. From the moment the DASAR was in the water through early October there was an activity at about 80 degrees approximately to the east. Turns out there was a Canadian operation about 160 km to the east of site 5. We know

that airgun pulses affect the behavior of bowhead whales. This year we're trying to assess how drilling operations and the vessel sounds and everything are affecting bowhead whales, but unfortunately we do have to deal with noise in our data to do that.

Displayed several graphs showing anchor hook up sounds - some of the highest recorded levels. Displayed movie of automated call detector.

Q&A | Comments:

Bill Streever, BP: Did you hear the Simpson Lagoon shoot?
Susanna Blackwell, Greeneridge Sciences: It's possible close by, but I'd have to go back to look.

Dave Steckler, Entiat River Technologies: I'm noticing a real fidelity in your localizations with certain radio lines going away. Do you want to speak to that a little bit?
Susanna Blackwell, Greeneridge Sciences: We call those the spokes. We had many more earlier in the season and ran a filter to get rid of them because we know those are airgun pulses. Aaron's code uses the very predictable airgun pulse as one way of weeding out what is and what isn't an airgun pulse. It appears the operation had a sputtering airgun which would fire, and it kept getting detected, and we would get a lot of those spokes. It is a work in progress. When we look at the data, they are distant airguns.

Robert Suydam, NSB: Your comment about Aaron's auto detect program identifying ship sounds as whale sounds is a bit disconcerting. Talk more about that. How big a problem is it? How much effort is going in to looking at more data?
Susanna Blackwell, Greeneridge Sciences: It was particularly striking because we had the vessel superimposed. At some point the Nordica crosses the screen, and you see a trail of black dots as if there were a bunch of whales following. It will happen now and then, like there are certain situations when it mistakes something for a whale. Aaron is working on it and is reasonably confident he can get rid of it. The sounds made by the vessels this year was a whole new set of sounds that Aaron's code is not used to.
Robert Suydam, NSB: The auto detect program has potential, but if the data is biased there is a huge concern. Last year there was a problem separating walrus and bowhead calls, and the auto detect program had problems separating the two. There are some downsides to using that auto detect program, and it causes me great concern.
Susanna Blackwell, Greeneridge Sciences: I've also been concerned about that, but it is just another problem we have to deal with.
Michael Macrander, Shell: As these problems arise, we work on solutions to them. Identifying it as an issue and then coming up with an answer is a work in progress, but we're working on them.

Robert Suydam, NSB: Michael, since you are there at the microphone, I've asked this question to you before, are the anchors on seafloor at Sivulliq?
Michael Macrander, Shell: They are still there, but no buoys.

Robert Suydam, NSB: This question is for NMFS. Do you guys know if seismic surveys are going off northwest of 5G and who it might have been?

NMFS: (unable to hear any response; several people responded without the microphone)

Susanna Blackwell, Greeneridge Sciences: No that's the one to the east.

Robert Suydam, NSB: There were two directions for seismic, and I was looking at one up towards the Arctic Basin.

Bill Streever, BP: I want to make a short comment about the detector because I fear it'll get a bum rap. When we did repeated efforts of humans listening to the same sound track, we didn't get the same answer. With the detector you get the same answers. The detectors are definitely the way to go ultimately in my opinion

Susanna Blackwell, Greeneridge Sciences: We're still doing manual analysis every year even though it may not be the gold standard, it is the standard that we're used to, and the analysts are very careful at only picking calls that they feel sure are calls.

Day Two – March 6, 2013

Day 1 Recap

Lisa O'Brien | Ron Felde

The day began with a safety minute from Andre Williams, Anchorage Convention Center, who reviewed several features of the building:

- Building and alarm lights will strobe and then directions will be announced.
- Exits in the building: east end goes to E Street; west goes to F Street. First floor exits were explained as well.
- Meet at Town Square across the street in case of evacuation. Walk, do not run. When the situation is corrected, you will be re-admitted to the building.
- The defibrillator is located by the security office; first aid kit is at security as well on the 1st floor on the east end of lobby. All management is CPR certified.
- In earthquake, do not exit on the south side due to glass. Exit out of the north of the building. Contact anyone with red shirts in lobby with name tags.

Impacts of Seismic Surveys on Marine Mammals

Amy Scholik-Schlomer, NMFS Office of Protected Resources

Thanks for having me this morning. This is my first OWM, and I am excited to be here. My first presentation is on the behavioral and physical effects of seismic on marine mammals. I am not focusing on just the Arctic but a more general approach; however, data we do have is from the Arctic. I will have three presentations this morning. My first talk will be about understanding the impact of seismic; second, I will talk about updated acoustic criteria for marine mammals, and finally have a short talk on monitoring. The monitoring presentation is more personal observations that I've used to form criteria. It is not the larger monitoring talk we will have later this afternoon.

Sound and Marine life – we know that the ocean is inherently noisy, more than just navy sonar, due to both natural sources such as wind, earthquake, biological, the animals themselves as well as manmade sounds. Some sound is produced intentionally for a particular purpose, i.e., sonar and seismic and other sounds are produced as a by-product or are incidental in terms of construction and shipping. Sound is important to marine species for a variety of reasons: communication, navigation, predator/prey detection. There are a lot of outstanding questions with marine life and public interest. The concerns we deal with in our office is when sound is a threat to marine life and what can be done to mitigate these effects this while letting activities vital to national security and the economy to occur.

Showed slide depicting special zone of sound and its influence on marine life. As a mammal gets closer to the source, there is a higher potential for injury and hearing loss. As you get further away, there are other effects: masking and behavioral disturbances. Masking is when sound interferes with communication. For example, if you are talking and an airplane flies over, that has the

potential to mask communication. At NMFS, we have acoustic criteria in the areas of injury, mortality, hearing loss, masking, and behavioral disturbances from seismic.

In general, what we know about sound is that there have been issues with mortality, specifically mid-frequency sonar and beached whales in some situations. Also, explosives have the potential to cause mortality in marine mammals. What we know about hearing loss in marine mammals—we actually don't know a lot about hearing especially with the large baleen whales, but we have information from laboratory studies. In terms of masking, we know the effects of noise and that some mammals have the ability to adjust their vocalizations to deal with masking. There is a lot of variability in terms of behavioral disturbances and depends on more than just the received level of the animal. It also depends on the context—whether the animal is feeding, migrating, etc.,--whether the sound source is approaching or moving away from the animal. We see a variety of responses ranging from no response up to avoidance, changes in vocalization, respiration, foraging, or distribution. There is also stress and other effects that we don't know that much about. Just because an animal doesn't behaviorally or physically move in a certain direction does not mean that they are not experiencing stress responses.

Specifically with seismic and the potential physical effects of these activities, there has been concerns about mortality and the potential for stranding events. There has not been a definitive tie between stranding events and seismic to date. As far injury, i.e., permanent threshold shift in hearing where there is a loss in hearing that does not fully recover; there are particular concerns about impulsive sounds. Seismic is an impulsive sound. It has high peak pressure and rapid rise time. Those types of sounds are more injurious than non-impulsive sounds. We have no direct data on marine mammals in terms of permanent threshold shifts. We have to use basic estimates from terrestrial mammal data, i.e., data from humans, chinchillas and mice. We know a bit about temporary threshold shift where there is a temporary hearing loss but full recovery. We have data from three laboratory studies: seismic water gun with bottlenose dolphins and beluga whales, single airgun for exposure for harbor porpoise, and an arc-gap transducer based on two California sea lions. We have data on these areas, but they are very limited in sampling.

<u>Seismic Watergun</u>: It is a broadband source that has higher frequency components than an airgun. This study looked at two species: bottlenose dolphins and beluga whales. With the bottlenose dolphin, they exposed the animal and found no temporary threshold shift, with beluga there was a shift at a level of 186 cumulative sound exposure level and 224 dB peak. Peak pressure is often used to describe impulsive sound because they have a fast rise time and high peak pressure and the cumulative sound exposure levels (SEL) metric takes into account the level and duration of exposure. They were able to get temporary threshold shift in the beluga whale in this particular study.

<u>Single Airgun</u>: This study was done on a harbor porpoise and did get temporary threshold shift in the species. There are different ranges of cetaceans: high frequency cetaceans are porpoises, mid frequency would be beluga and bottlenose dolphins. The finding is significant and indicates that high frequency cetaceans have a lower Temporary Threshold Shift (TTS) onset than mid-frequency cetaceans. We aren't sure why and data is only on a single porpoise. Would we see the same trend in other types of porpoises? We don't have the data, but there have been other studies that show

with different sound sources, not seismic, that show the same trend. There is something happening here that shows for some reason, harbor porpoises have a lower TTS onset so at a lower level causes hearing loss compared to other species.

Arc-Gap Transducer: In this study, two California sea lions were exposed, and there was no incident of TTS.

This is what we know in regards to temporary threshold shifts in marine mammals exposed to impulsive sounds similar to those related to seismic activities. There is current research being done on bottlenose dolphins being exposed to multiple shots. A lot of these studies were single shots and not realistic to real-world situations, but there are studies looking at the effect of multiple shots.

GENERAL TRENDS | TEMPORARY THRESHOLD SHIFTS

We see a lot of these general trends in marine mammals. Two things to consider are the duration and frequency of the exposure; the frequency is the pitch of the sound.

Duration: Intermittent exposure is when there are spaces or pauses between exposures like we see with airguns. Recovery is typically faster than if when there is continuous exposure of the same duration. The idea is if there are pauses or breaks between exposures, the animal can recover. Obviously it depends on how long those breaks are, but that is the general trend. Exposures with longer duration and lower levels usually results in more TTS where the onset is at a lower level and the threshold shift is typically higher compared to exposure with higher levels and shorter durations with the energy. When I talk about the energy metric, it takes into account the level and duration of exposure, and you can get to that in a lot of different ways. An exposure could be really loud and short or a lower level exposure for a longer duration. The trend is if it is a lower level exposure over a long duration it results in more TTS. It also takes more time for the animal recovery from a longer duration compared to shorter durations.

Frequency: What we know with the frequency component, and we have seen some of these trends with marine mammals, is that regions of highest hearing sensitivity is where the animal is most sensitive to exposure from noise in terms of TTS. For example, mid-frequency cetaceans like bottlenose dolphins hear best between 30-40 kHz. If you have sound in that range and expose them to noise, TTS occurs at a lower threshold compared to exposure to noise outside their best hearing range. With seismic, most of the energy is low frequency and outside the best hearing range of those mid-frequency and high-frequency cetaceans, but from what we know it is right in the best hearing range of the larger whales.

Potential Behavioral Effects: Generally, as you get further from the source, impulsive sounds lose their impulsive characteristics. They are less injurious as you get further from the source. Depending on the environment and how the sound propagates, even though they are short close to the source, they start stretching out further from the source due to reverberation. Here is what we know about seismic and potential behavior effects for specific species:

- Baleen Whale: This is where we have the most data. There is a lot of variability in terms of behavior when animals are exposed to noise because there are a lot of factors that come into play. Based on the data we have, we have seen changes in vocalization, distribution, respiration and foraging. There are incidents when animals avoid the sound, and, sometimes, they are attracted to it. We've seen incidents of aberrant behavior, i.e., increased breaching in the grey whale off Sakhalin Island being exposed to noise. Most of the data we have is on bowhead whales and other species in a variety of context—how they respond when they are feeding, migrating, resting—which is useful to us to help us understand the variability we see with behavior.
- Odontocetes: These are the toothed whales. We actually have fewer data, especially with received levels; the decibel at the animal. Again, we see a variety of responses: changes in vocalization, distribution and foraging; avoidance and attraction; aberrant behavior with a single, pantropical dolphin. When it was near a seismic vessel, it displayed erratic locomotion and unusual posture. Note this is with a single individual, and usually they are with large groups. Another recent paper showed that ice entrapment was causally linked to seismic exposure in three instances with narwhals off Greenland. Most of the data collected is from sperm whales and delphinids.
- Pinnipeds: There are even fewer data than odontocetes, especially with received levels. What we have seen in the data we have are changes, changes in density and localized avoidance. In laboratory studies, alteration in behavior was observed in lab setting. Most of the data on pinnipeds is from Arctic seals.

In many situations, there were no dramatic effects observed in terms of responses of animals. With mysticetes, in terms of vocalizing, we see more or less vocalization, avoidance—short term, localized or an entire group leaving the area, changes in distribution. We also see sensitive periods, context or habitats. For example, the data we have on humpback whales shows they seem to be particularly sensitive when resting. Again, there could be sensitive periods, context and habitats that could be affected as well. With odontocetes, there are even fewer data. Subtle behavior effects in terms of foraging in sperm whales in the Gulf of Mexico. When they were exposed to seismic, they had a lower buzz rate, which correlates to foraging so there could be subtle effects from seismic. With changes in distribution, there are laboratory studies on changes in hearing loss in some of these particular species.

MASKING AND EFFECTS ON ACOUSTIC HABITATS

Ocean noise, especially commercial shipping, is a growing global problem for marine ecosystems. We talked about acute effects of noise and how it can have adverse physical and behavior impacts on health and fitness. But we are also concerned with chronic effects of noise, particularly rising background noise, that could limit animals' ability to communicate or sense their environment. These chronic effects could have effects over broad, temporal and spatial scales especially for mysticetes because those animals are able to communicate over long distances at low received levels.

Showed movie depicting masking using commercial shipping in Stellwagen Bank National Marine Sanctuary outside of Boston. The tiny dots are north Atlantic right whales vocalizing and the moving larger dots are commercial ships, demonstrating the potential of masking, and the acoustic space they take up is quite large and has potential of interfering with communication between whales.

Showed graph of the effects of masking on whales calling. Showed one-month period shows the percentage of masking. With no shipping occurring, there is no masking, but, when commercial ships moved through, the animals were masked 50-80 percent of the time.

Seismic Activities and Impacts on Vocalization: Blue whales vocalize more when exposed to sparker activity. Data from bowhead whales showed fewer detected calls when animals were near seismic activity. It is not clear if the animals are ceasing vocalizing or if they are actually moving away and vocalization cannot be detected. There is also data on fin whales that ceased vocalizing through an entire seismic operation. It is believed that the animals moved out of the area when seismic occurred which lasted for weeks. Sounds from airguns have been recorded up to 4,000 km from a vessel in the Mid-Atlantic. Although this was an extreme situation and not recorded in the Arctic, it does demonstrate the potential for these sounds in some situations and depending upon the propagation conditions, to travel to far ranges. It can be considered seismic sources in some areas. For example, in the Gulf of Mexico there is a lot of seismic activity occurring and can be considered a chronic source. This illustrates the spatial and temporal range from airguns. So we see these animals are able to adjust their vocalization between different types of noise, but we don't know the consequences of these adjustments. Are there energetic consequences? Are there consequences of missed opportunities? We just don't know.

Behavioral Effects and Bigger Picture Issues: Most significant issues are when behavioral effects have the potential effects on fitness consequences, on:

- Reproduction—mating behavior
- Survival—stranding or separation of calf/mother
- Growth—feeding and energetics

Also, there is concern with cumulative impacts and the effect of multiple sound sources and the effect of sound with other stressors. Ultimately, we are concerned with population-level impacts. What I talked about previously were individual effects, but how do those effects translate to population effects?

I've been focusing on the receivers that were placed on the animals, but there are obviously source considerations as well. So, what is the typical soundscape associated with a seismic survey? Each one is slightly different, and there are a lot of things that need to be considered. There are different techniques, multiple vessels are involved. We often focus on the airguns because it is the loudest source, but there are other sound sources associated with seismic activity that could have effects, and animals could respond to. Other sources beyond airguns include boomers, sparker sites, side scan sonars and echo sounders. The animals hear the whole acoustic soundscape associated with these activities. There are also spatial, temporal and spectral considerations associated with the source. Are sounds traveling horizontally? Most of the sounds are directed downward, but

sometimes the sound can travel horizontally. Are there issues with long-distance propagation? Spectral refers to frequency or pitch of the sound. For industry purposes, seismic is often focused on the lower frequency sounds, but sometimes there are higher frequency components produced that other animals might hear. What are the considerations of the other sources associated with seismic beyond airguns?

Q&A | Comments:

Harry Brower, AEWC: Thanks for your presentation. I am going to have to learn a whole bunch of new information. This is informational and educational for me. Not being a researcher in the field and trying to understand all the tools you use to try to understand the impacts are and more about what the effects of the sound being generated into the water column and how the sounds impact the resources. Again it is educational for me; learning the new words—threshold shift, etc., these types of terms are hard to identify with. I am trying to get a picture in my mind in terms of being a hunter and looking for some of the effects that may have caused abnormality of the marine mammals as hunters out on the ice. We see some things that are a bit different from your observations and the research you are doing. In terms of what I should be looking for as a hunter in the event that there is something abnormal about the animal. Some of that would be helpful. I was taking notes during your presentation and thank you for providing paper materials. It is very helpful, and I can look back on what notes I was taking. The other part I was really trying to identify with what you said was the notable behavioral effects. I would like to read through this, work with the NSB and get more education on what observations I can make as a hunter to help identify what is happening out in the ocean. As a hunter, I use different areas of the ocean and see different things as we conduct our hunting activities.

James Patkotak, AES: First of all, there was a concern by one of the surrounding communities that we met with on the North Slope. Their concern was the impact on the food that whales and other sea mammals eat in the Beaufort and Chukchi seas. Would it disrupt the seismic operations of industry to begin studies on the krill and other sea life especially during the slowing down on the drilling program in the north? Could you answer that first?

Amy Scholik-Schlomer, NMFS: We do have a little information on the effect of seismic on fish for example.

James Patkotak, AES: Not on the krill. There have not been any studies on the krill and all that other life.

Amy Scholik-Schlomer, NMFS: Exactly. There are some studies on fish and some on invertebrates, but not specifically krill which is an important animal that people should be looking at.

James Patkotak, AES: I am asking if it would be possible to do a study on sea life other than whales and seals?

Amy Scholik-Schlomer, NMFS: Yes, it's definitely possible. My background is in fish, and I exposed fish to noise and did hearing tests on fish, so there is definitely capability to do studies on other species. I just focused on marine mammals here, but we do have a little data on other species as well.

James Patkotak, AES: Can you inform us on that note please? Inform the North Slope? At a later date?

Amy Scholik-Schlomer, NMFS: I couldn't do it right this second, but absolutely. Yes.

James Patkotak, AES: Also, I am concerned about the whales being dead and lamed. I'm sure the oil industry has not collided with sea mammals or whales killing them and leaving them maimed on the shore of the North Slope. I am thinking about having some protected species observers (PSO) on commercial shipping vessels as well. Not today, but we are thinking about that, and I just wanted to bring that up.

Richard Kuzuguk, Shishmaref: I have a question about the different variations of seismic activities that occur with offshore drilling. I counted six based on your presentation. My question is that as far as off shore drilling, even in the mud recipes alone there can be up to 1,000 different chemicals that are used and that information is privileged with the oil companies. Is it safe for the seismic variations that are used for seismic activities for research?

Amy Scholik-Schlomer, NMFS: When I listed the different types of variations of seismic activities, it has to do with different configurations of the arrays of the airguns that produce noise or how the vessels are driven when they do their surveys. That is what I meant. The specific configurations I listed were most often seen in the Gulf of Mexico. I am not as familiar with what happens in the Arctic, but my point was that every seismic survey activity can be slightly different and the sounds that are produced. That makes it more complicated to understand effects because the source varies, and they aren't doing things the exact same way. I don't know if I answered your question or not.

Bill Streever, BP: Great presentation. Thanks for that. It was the best summary I have seen on this, but I have a lot of questions. I will only ask two for now. In one of your slides, you talked about behavioral effects and at the very top it said something like "many cases no dramatic effects observed". Would another way to phrase that be no observable effects or were there truly no dramatic effects?

Amy Scholik-Schlomer, NMFS: No observable effects, and I will talk a little bit about that in my next presentation when I talk about our acoustic criteria.

Bill Streever, BP: Okay, then maybe my other questions are better for then as well, but I will ask now and you can decide. A follow-up to my first question is what percentage of observations that have been made at exposures of around 120 led to no observable effects or do you know that?

Amy Scholik-Schlomer, NMFS: I don't know off the top of my head, but when I get into our acoustic criteria we are trying to develop dose response curves. Those curves, and I am using logistic regression which makes thing binary, so it takes into account when something happens and when something doesn't. I can't tell you the percent off the top of my head, but we do have the information. A lot of time we don't see anything happen.

Bill Streever, BP: Okay. I guess that is what I am getting at. It seems to me that most of the time at lower levels nothing happens, but sometimes at even lower levels sometimes…

Amy Scholik-Schlomer, NMFS: Exactly, and I will get into that in my next talk.

Bill Streever, BP: My other question is—maybe for others in the group I'm going to be very careful how I phrase this so you know what is coming—I want to separate for a moment biological takes from violation of the hunts, from the right for people to have access to the hunt. Just looking at biological or behavioral effects that might have a biological impact, does NMFS have an idea of

when one of these observed behavioral effects reaches the hurdle of being a take? And maybe even defining that in a sense that at what point does something happen that you issue an NOV is someone doesn't have a permit? Did I word that diplomatically enough?

Jolie Harrison, NMFS: Yes, we do have an idea of that, and, as Amy said, there is a continuum of potential responses to a sound from minor, insignificant and discountable to severe. We have a place in that continuum where we think that something rises to the level of a take and one of the things that I am not sure we have articulated that as well as we want to. As Amy talks about next, is as we move the criteria forward will be a place where we attempt to do this. One thing I will say is that in Federal Register notices before, when we referred to Southall et al., there is a severity index ranking behavioral responses from 0-9. For example, we have said there are three groups: 0-3, 4-6, and 7-9 and used words again like insignificant and discountable, minor, etc. The 7-9 is likely to have an effect on livelihood or reproduction. The middle ones were more likely to potentially have an effect on some individual fitness and that sort of thing. What we have said is while the 7-9 are obviously a take, the 0-3 probably aren't in most cases and the 4-6 probably are, but there are other things besides received level which you know have other variables on how an animal responds. I'm not sure we've done a terrific job in articulating that, it is something we are working towards with the revamping of the acoustic criteria and something that we've pointed to as specific examples as the Southall criteria lays them out. I know that is not exactly what you are probably looking.

Bill Streever, BP: I guess to extend the question further, if someone was out operating a commercial ship which they would not typically do with an IHA and had a 7-9 level interaction with a marine mammal which I suspect happens fairly often, should they look forward to a NOV in the future?

Jolie Harrison, NMFS: Are you asking if someone doing a particular activity explicitly saw something that very clearly rose to a level of a take, should they…I'm not sure what you are asking.

Bill Streever, BP: Say ship activities, say a vessel, say a freighter carrying cargo/containers; what's the 7? What's the behavioral change that would equate to 7 on the Southall criteria?

Jolie Harrison, NMFS: Getting to your more direct question, are you asking about the regulatory way that we address these issues?

Bill Streever, BP: The reason I ask—I'm not trying to put you on the spot. I'm just trying to get clarity because we have to advise our companies on when they do and don't need an IHA, and it puts us in a very difficult spot because we are saying, you know, sometimes they tell you this is allowed and other times not. There doesn't seem to be much in the way of a record when NOVs have been issued.

Jolie Harrison, NMFS: Oh, you are asking about violations?

Bill Streever, BP: Right, sorry. Yes, violations. Notice of Violations (NOVs).

Jolie Harrison, NMFS: I think where the majority of notice of violations have occurred, we have enforcement folks who work carefully through the situations that they decide to address as a law enforcement case. I think typically shipping and those sorts of thing especially where there are speed rules in place have been a really obvious place to go there. I guess what I would say is, again in the acoustic criteria, we will be addressing things in a not industry, but a more source-specific way and think we will probably have more guidance about what you are talking about. But I am going to defer and say you should talk to us specifically about this because obviously there are a lot of activities going on out there, and I understand why people would be concerned if there was a result in take. We try to explain this as well as we can as criteria comes out and

will attempt to articulate it better, but I don't want to make any sweeping statements here. It's better to have a conversation about it.

Colleen Swan, Kivalina: In your presentation you mentioned research being done on whales, losing their hearing. I wonder if the research is being done in a controlled environment or are you able to recreate the same environment as the species are up there exposed to? The noise level, are you able to recreate that? My other question is in your presentation you mentioned the bowhead and that there is less communication between them during seismic activity—are you able to determine why that is? Is it because they moved on or its gotten their attention or what?

Amy Scholik-Schlomer, NMFS: I will answer the first question: so you are correct. The studies on hearing loss on marine species are in a very controlled environment. It is in a laboratory setting, and there are concerns on how does this setting translate to what the animals experience in real-world situations. With the technology we have right now, that is the only place we can do those studies. Your point is well taken. It does not necessarily reflect what those animals experience in real world conditions, i.e., they can swim away, and in a laboratory condition they can't. We have to consider how does this translate to real-world, but it is the only data we have. As far as your next question, I will defer to Susanna because this is her study. These are not studies I did. I just summarized everyone else's studies.

Susanna Blackwell, Greeneridge Sciences: No, we don't know why they stop calling. The only thing I can say is that the levels at which (and that is actually not really apparent in the paper you refer to, but is apparent in the next paper we are working on), they do seem to stop calling low enough that it is not a masking problem. It isn't because they can't hear others for example that they stop calling.

Robert Suydam, NSB: There were some parts of your presentation where I was really encouraged by and parts where I was a little discouraged by especially since you are from NMFS Office of Protected Resources. The part I was really pleased about was on your emphasis on soundscape. I think that this is something the agency and all of us need to think about particularly around cumulative effects. It's not just seismic or drilling or ship noise or whatever. We really need to think about the entire system and not just single project by single project. I say this especially in the context of EIS that come out that is dealing with sound in the Arctic and hopefully soundscapes and evaluating impacts to marine mammals on a cumulative way is something we are moving toward. Some of the things I was discouraged by are that you really didn't talk about traditional knowledge. We are in this meeting talking about bowheads, primarily belugas and other species, but the data set, the information available from hunters in the Arctic, is much better than the science, and you didn't deal with that at all. That would be a recommendation for improving the presentation in the future. One of the other things I was concerned about is that you didn't really talk about variation among animals, differences among stocks or among species, and we know there is a huge amount of variation and so dealing with this is really important. My question is that you made some conclusions about the sensitivity on high frequency and mid frequency animals based on a sample size of one and that gives me great concern that an agency is making decisions, and I think that that conclusion trickles down into what you will talk about here next. I think that that is something that needs to be addressed

carefully and appropriately, so if you could comment on how the agency is making conclusions based on a single animal or two animals when we know variations are huge—it depends on the age of the animal, prior experience, etc.

Amy Scholik-Schlomer, NMFS: When you are talking about an n of one, this is mostly what we have in terms of injury. Obviously we have a lot more data on other behavior and apologize for not getting variation among individuals within a species and among species as well. We acknowledge that there is variation; I just did not have time to get into it. As far as having the need to have an injury criteria and the fact that we have very few individuals to base this on, I understand the concern. How representative of those individuals are animals in a laboratory setting? We only have one or two individuals in a lab setting, and there could be variation with age, sex, etc. It's the best data we have. I don't know what the alternative would be.

Robert Suydam, NSB: I certainly understand the predicament you are in, but the ship board monitoring that we are talking about here the main purpose of the on-board observers is to prevent injury. Even though the sample size is really small, we know the variation is huge and perhaps that means there needs to be additional precaution that is used for mitigation to prevent level A. To me, that is something that the agency really needs to spend more time on because so much money is being invested by the companies and how much time is taken to talk about how on-board observers are helping to prevent level A takes.

Request for note takers to flag recommendations throughout the report and produce a summary page of recommendation as appendix by Lisa O'Brien

Jolie Harrison, NMFS: One thing I wanted to add to what Robert said, is an injury criterion which we are talking about here is not directly tied to what NMFS would require as a mitigation measure. I just wanted to be aware that there is another decision point that comes after knowing when an animal may be injured. For example, when we describe how the 180 injury criteria were developed, we often explained that it was based on TTS criteria. We say we think Permanent Threshold Shift (PTS) occurs somewhere above that so there is a cautionary measure built into that. When and if new criteria are established, there is a second decision point that comes with deciding what to do as a mitigation measure and depending upon how much of an acknowledgement and uncertainty or variability in the development of the criteria, there is still another opportunity to say for example, that is where the injury criteria is but we might still in the field have a larger mitigation shift. I just wanted to make sure you know that there is not an automatic assumption of what mitigation will be based on where we think an injury might occur.

Robert Suydam, NSB: I'm not sure I understand completely what you said there, but maybe it is something Amy is going to get to in her presentation or is that a different topic completely?

Amy Scholik-Schlomer, NMFS: I don't know if I am going to get into mitigation necessarily.

Lisa O'Brien, Facilitator: Do we want to park it then? Robert, do you want to park the topic.

Robert Suydam, NSB: Well Jolie kind of brought it up and I'm not sure that I understand it well enough to say it needs to be a parking lot issue and so maybe we can throw it up there and Jolie and I can talk at a break or lunch and I can better understand what she's trying to get at.

Lisa O'Brien, Facilitator: Let's do this: go off line, have the discussion. If you think it warrants the large community talking about it, we will bring it back Thursday.

George Edwardson, ICAS: When you measure or calculate how loud, how much decibels there are in the sounds you are measuring, are you measuring sound only from the surface or following the water columns like the animals would? Because the deeper you set off a sound, the further it can go at the right depth or you can make a really loud noise at the top and it not go down. You understand what I am asking?

Amy Scholik-Schlomer, NMFS: Yes I do. I summarized a lot of different studies, and so I couldn't tell you off the top of my head how different studies took that into account. Yes, there is one thing that is happening at the source, and the receiver is a totally different situation, and, as you mentioned, it could be in different depths of the water column. They could be swimming different directions. It really depends on the study and how it was taken into consideration. Sometimes we have information where there are tags on animals, not with seismic unfortunately, so you know exactly what was received no matter where it is in the water column. Other situations were estimated distances from the source. Whether it was estimated at the surface or the depth of the receiver, I don't know but that is something that is important. It does change depending upon where the animal is in the water column. We know a lot more and are good at characterizing what happens at the source, but it gets more complicated when you are considering the animals because they are doing lots of different things.

Lisa O'Brien, Facilitator: Before we go on, I feel the need to do the following. Look at the time; we are behind again. What I think happens is some of you ask questions after a presentation, some of you make observations based on your body of knowledge or refer to colleagues. All of this is very appropriate and some of you end up making recommendations. Some choose to do all three when it is your turn. You have the right to, but we keep losing time. I am asking you to limit yourselves to one or two questions to manage our time. What I am asking you to do is one of the three or we will run behind like yesterday. At the same time, if you want to push back—because our role is to chauffer the meeting and get you out the door, have the presentations and have quality time with each other while staying on task. If the will of the group is to stay after five each day and everyone is okay with that, we will let it go but our fear is that we will run out of time. Suggestions?

Robert Suydam, NSB: I will push back a little bit. To me the purpose of the meeting has always been to have good discussions about things. Not just presentations that shares information, but actually an exchange of ideas with the ultimate goal of making recommendations. That is what the OWM was prior to 2006. Once it grew, it became a lot more difficult to do that so I look to Candace and Jolie and say, is the purpose of this meeting information transfer one way or is it to get feedback and recommendations from the community to improve the monitoring plans. To me the goal of the meeting will dictate where we end up going and how much time we spend discussing things and if we have to spend extra time after five.

Jolie Harrison, NMFS: Robert, we agree that the goal of the meeting is to get input and have a strong discussion. I think we are also trying to keep in mind the variety of topics we all want an opportunity to hit on and self-filter if something can be an on-the-side conversation. But I totally agree that it is not a one-way transfer of information. The whole purpose is actually the opposite direction of information flow into us if we look back to the goals of what the meeting is.

Lisa O'Brien, Facilitator: So the consensus is that those are good observations, but we want a quality dialogue and take the time to go back and forth. If it means we are here past five, so be it.

NOAA Acoustic Criteria

Amy Scholik-Schlomer, NMFS Office of Protected Resources

This presentation is about updating the acoustic criteria for marine mammals and a follow-up to my previous presentation. Acoustic guidelines are needed to assess activities that have the potential to injure or behaviorally harass protected marine mammal species under two main statutes: MMPA and the ESA. Applicants and NOAA must be able to quantify the number of takes—the number of injury and behavioral harassments—on a species-by-species level.

Updated acoustic criteria are based on received levels for injury, i.e., permanent threshold shifts. The updated criteria will address all underwater sources. For behavioral harassment, it more specifically focused on seismic activities. The goal is to broadly apply the updated acoustic guidelines among NOAA to promote consistency within the agency and with applicants. It will be the first time criteria will be documented in one place. I often get the question what are the criteria for seismic or pile driving, and, unfortunately, we don't have a single document we can point people to. One of the goals the new guidelines are trying to create is to have it written in one place. I want to point out what these guidelines are not. They are only a small part of a much larger assessment. This is to help us address take on an individual level, but if you are familiar with the MMPA or ESA, final determinations are made at higher levels of species or stock levels. The criteria are a tool; they are not the end-all, be-all answer to everything. Unfortunately the criterion doesn't cover fish or sea turtles, but we definitely recognize there is a need for acoustic criteria for these other species as well and are on the list. We are not forgetting these other important species.

Showed slide of current NOAA acoustic criteria for marine mammals for most situations:

Criterion	Criterion Definition	Threshold (RL)
Level A	PTS (injury) conservatively based on TTS	180 dB_{rms} re: 1µPa (190 dB_{rms} re: 1µPa*)
Level B	Behavioral harassment for <u>impulse</u> sounds	160 dB_{rms} re: 1µPa
Level B	Behavioral harassment for <u>continuous/non-impulsive</u> sounds	120 dB_{rms} re: 1µPa

These are shown to give you a basis of where we are versus where we'd like to head and also point out the current criteria is a decibel level, root mean square (RMS)-based meaning square level. We are moving to change some of our metrics for injury for example, and wanted to point out the difference. Our current criteria are extremely simplistic which in some ways is good because it makes it easy to use in most situations. In contrast, it may be bad because in some situations it produces an overly simplistic picture of what is expected. For injury, with current criteria there is one for cetaceans and other for pinnipeds. At the time, we didn't have any data on hearing loss so

the thresholds were based on expert opinion. For behavioral harassments, sounds are broken into two broad types: impulsive and continuous. Specifically, the data for the thresholds come from airguns from impulsive sources and drilling for continuous or non-impulsive sources. We get the question, how applicable are these criteria to other sound sources like pile driving for example? All our thresholds for behavior actually came from baleen whales, and we are asked how applicable is that to other species like whales and pinnipeds? There has been a lot of new science since our original criteria were derived. These are some of the issues we are trying to address with our updated acoustic criteria.

With the updated acoustic guidelines, there will be a 33-page main summary document that typically will be what most people will use and have the updated criterion for permanent threshold shifts and behavioral harassment. There will also be a detailed appendix describing how we specifically developed our criteria, what data were used and how we evaluated them. There will also be an appendix on peer-review and public comment. Currently we are working on them internally, followed by a peer review and public comment period which are very important to the process. There will also be definitions of terms, i.e., what is meant by TTS, impulsive or non-impulsive sound, which have not been defined before.

UPDATED INJURY CRITERIA

Updated injury criteria will have basic characteristics. The Southall 2007 paper, *Aquatic Mammals*, made some of these recommendations of what we should consider in terms of injury. For example, in terms of marine mammals, sources will be divided into two groups: 1) impulsive [explosive, seismic, impact pile driving] and 2) non-impulsive [drilling, sonar, vibratory driving]. This goes with what we know in terms of hearing. For example, impulsive sounds have fast rise and high pressure, so they actually have the potential to be more injurious than non-impulsive.

Dual metric criteria means there are two criteria for injury in two different metrics: peak pressure and cumulative sound exposure level. You don't get to choose which one you use; it is whichever one is exceeded first. This is to add a level of protection. We are also dividing marine mammals into functional hearing groups to account for the fact that all mammals don't hear at the same frequency or use sound in the same way. Previously we had the same criteria whether it was pinniped or odontocete—we didn't distinguish between marine mammals groups. Now there is distinction between groups. For example, we are dividing whales between low, mid and high-frequency cetaceans. Low frequency cetaceans mean they hear low frequency sounds better. These are our large baleen whales; mid frequency cetaceans are beluga whales and bottlenose dolphins; and high frequency cetaceans are porpoises and recognizing that these mammals hear sounds differently. Pinnipeds are being divided between phocids and otariids. Within the functional hearing groups, we recognize that animals don't hear sounds equally well and where frequency weighting is being incorporated (modified from Southhall et al. 2007). For example, bottlenose dolphins hear higher-frequencies better where they echolocate compared to lower frequencies. This is similar to what is being incorporated into some of the Navy authorizations as well.

To develop criteria for permanent threshold shifts (PTS), we evaluated about 20 available studies. We do not have any direct data on PTS in marine mammals, and have to rely on TTS studies. We determined PTS onset on individuals by these metrics and then applied appropriate weighting functions. TTS onset was determined by sound type, i.e., whether impulsive or non-impulsive sound, by functional hearing and had to develop a protocol on how to do this. There is more information in the criteria on how the protocol was established and will undergo peer review and public comment as well, so we will receive feedback on whether this is appropriate. We then had to extrapolate to injury based on what we know about terrestrial mammal data. For example, with chinchillas, we know the levels and amounts that go from TTS to PTS and used these data to make extrapolations.

Proposed PTS Criteria

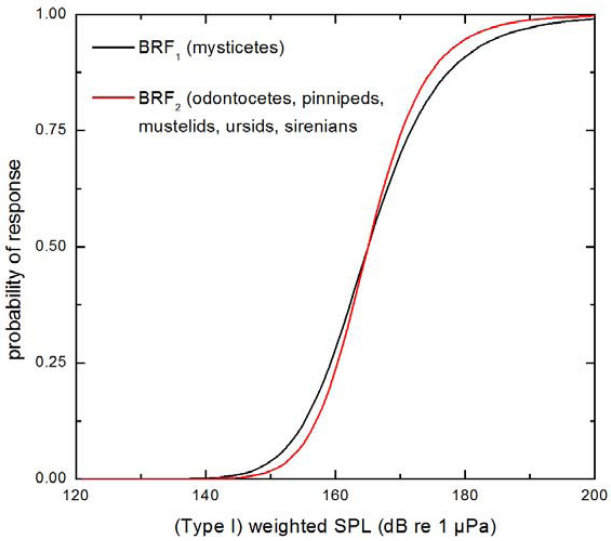
a. Numeric Criteria: Level		
Hearing Group	**PTS Onset+ (Received Level)**	
	Impulsive	**Non-impulsive**
Low-Frequency Cetaceans	*230 dB$_{peak}$ &* *187 dB cSEL*	***230 dB$_{peak}$ &*** ***198 dB cSEL***
Mid-Frequency Cetaceans	*230 dB$_{peak}$ &* *187 dB cSEL*	***230 dB$_{peak}$ &*** ***198 dB cSEL***
High-Frequency Cetaceans	*201 dB$_{peak}$ &* *161 dB cSEL*	***201 dB$_{peak}$ &*** ***171 dB cSEL***
Phocid Pinnipeds	*224 dB$_{peak}$ &* *181 dB cSEL*	***224 dB$_{peak}$ &*** ***186 dB cSEL***
Otariid Pinnipeds	*230 dB$_{peak}$ &* *215 dB cSEL*	***230 dB$_{peak}$ &*** ***220 dB cSEL***

* Dual criteria: Use on one [dB$_{peak}$ or dB cSEL] exceeded first. All cSEL thresholds (re: 1 µPa^2-s) are weighted.
+ The cSEL criteria could be exceeded in multitude of ways (i.e., varying exposure levels and durations). It is valuable for applicants, if possible, to indicate under what conditions these thresholds will be exceeded.

It is more complex than the criteria used before and is based on functional hearing groups and types of sounds, i.e., impulsive vs. non-impulsive and peak vs. cumulative sound. This takes into account levels in a mammal's lowest hearing range. For example, low and mid frequency cetaceans actually have the same threshold because there is no direct data on low frequency cetaceans, but when you incorporate weighting, it takes into account the animals' most sensitive level of hearing. For example, seismic activity is mostly low frequency and mid and high-frequency cetaceans don't hear those sounds as well as low-frequency cetaceans. So despite the fact that these two groups have the same actual numbers, their thresholds are identical, once you take into frequency weighting into account which would filter out some of the frequencies that these mid-frequency cetaceans are not able to hear as well what will happen is the isopleth will be much smaller for mid-frequency cetaceans than for low-frequency. I realize this is more complex and confusing and we are working on a user guide and tools to help people understand this. For example, we recognize frequency weighting is an additional complexity that people will have to consider so we are developing tools to make this easier as well as this cumulative sound exposure level giving them guidance on how long do you accumulate. We recognize that this is a huge change from the previous criteria and working on tools to make it more simple, but this is what things are going to look like.

There have also been updates to the Behavioral Harassment Criteria. The criteria have been divided by broad activity types, i.e., seismic, drilling, impact pile driving, vibratory pile driving, sonar, ice breaking and explosive. Previously it was categorized as impulsive vs. non-impulsive, which is adequate for describing the physics of sound, but we recognize with behavior that there are other factors that come into play. Even though seismic and impact pile driving in terms of physics are very similar, the activities are very different. For example, seismic has multiple vessels, it is a moving source vs. impact pile driving which is stationary. We wanted to take into consideration these factors and why we are dividing sound into broad activity types. Criteria for seismic activities will be completed first because 1) this is where we have the most data and 2) since this is new for us, we wanted to do it as a test case and obtain input through the peer review and public comment processes as to whether what we are doing makes sense before tackling other sound sources.

The criteria for behavior will be different than before. It will be in the form of an exposure-response curve or a dose response curve shown below. It means that the proportion of animals exhibiting behavioral harassment changes with received level. With the old criteria, we considered step functions. With the old level, if an animal was exposed to 160, 100% of those animals were taken; if you were below 160, none of the animals were taken. What the exposure-response curve takes into account is that the proportion of the animals exhibiting behavioral harassment changes with received level and more accurately reflects what we know about behavior. Logistics regression was used to develop the curves. It also divides marine mammals into broad species group based on how they respond to, hear and use sound. We are also looking at developing criteria on particularly sensitive species where we have data that they respond to lower levels than other species including harbor porpoises and beaked and bowhead whales. The above is an example. We are still working on exposure for seismic but wanted to give you an idea of what an exposure-response curve looks like. This is an example from Navy for mid-frequency sonar. The x-axis is received level; the y-axis is the probability of responses.



To develop these criteria, we looked at published and unpublished studies and summarized them by broad species group when we do and do not have received levels. The studies that do have received levels were further evaluated using logistic regression, which takes into account the response and severity of response considered into binary data. Using this, when there is harassment it is given a 1 and no-harassment is assigned a 0 and using logistic regression, you can develop a curve. It also accounts for individuals that do and don't respond. In the guidelines, we have information on how we have done this, what we do when we have to rely on surrogates and how we deal with multiple data sets, as well as a separate protocol for particularly sensitive species.

We are still working on exposure for seismic, but wanted to give you an idea of what an exposure-response curve looks like. This is an example from Navy for mid-frequency sonar. The x-axis is received level; the y-axis is the probability of responses. Under the old criteria, if you were looking at levels of 160, 100% of the animals respond. If you were at 159, none responded. In this case, at 165 if you have a group of animals exposed, you expect 50% to exhibit behavioral harassment based on the curve. As the sound gets louder, there is a higher percentage of animals that are expected to respond.

With lower severity responses, particularly vocal and respiratory responses, there is a general trend in the data. Especially with vocal changes, there are some responses that typically occur at lower received levels or greater distance from the source. This is seen not just for seismic, but other sources as well. OAWRS is a type of fishery sonar where we have seen baleen whales responding and changing their vocalization at long distances. We have also seen this with mid-frequency sonar because we know mysticetes are capable of communicating over large areas and ranges and we are trying to develop a way to account for these types of responses especially when there is the potential for harassment. So again, going beyond received level and trying to account for chronic effects and taking into account the duration and the context of exposure. We are recognizing that these more chronic effects are important as well.

Currently the guidelines are in internal review with NOAA with integration of comments and guideline update. There will be a public comment and a peer review, but I'm not sure which will occur first. Public comment and peer review are very important to this process. The guidelines have been designated by OMB [Office of Management and Budget], as a highly influential assessment, and we have certain criteria that must be met as far as a peer review. Hopefully, we will work with the Marine Mammal Commission to help us select peer reviewers and go through this process. The goal is to have the guidelines issued by late 2013.

Considerations for Monitoring Reports

Amy Scholik-Schlomer, NMFS Office of Protected Resources

This will be quick and not meant to detract from the larger discussion on monitoring we will have this afternoon. These are observations that I had when looking at monitoring data in terms of helping us develop acoustic criteria. Monitoring reports have an advantage because you are getting responses to actual activities versus having a play-back or laboratory study. These data are incorporated in updated acoustic criterion that I just spoke about. Received levels are important, but also distances from the sound source are important as well, and a lot of this information is often in monitoring reports. They also help us understand data beyond received levels especially with behavior, other factors, and context of the animal is very important. Peer review and publication are also important to increase the utility of monitoring reports. Another great thing about these reports is that there is often observation over multiple years rather than a snap-shot of what is occurring. The more data the better and helps us understand long-term trends and identify outliers. In terms of seismic, we need for more data on pinnipeds and odontocetes.

Some broad considerations for mitigation and monitoring include:

- Are there particular sensitive context or habitats? For example, reproduction, feeding or migratory corridors. Obviously there are time and space considerations in terms of the activities and how they overlap with the species we are concerned about.
- Are there sensitive species to seismic including small or resident populations?
- What are potential ecosystem effects? Understand effects on marine mammals are important, but what about prey species, fish, krill, etc.?
- Again, moving beyond the snap-shot for behaviours. Not with monitoring reports, but with other types of reports we have a single snap-shot of what is going on and you don't know what happened before, what occurred afterward or what is happening over multiple years. This is an area where monitoring reports are important and helpful.
- Consideration of cumulative effects with multiple surveys occurring and how sound interacts with other stressors as well.

This is a preview of what will be shown later which is the NOAA CetSound Project and biologically important areas that have been identified for cetaceans in the Chukchi and Alaskan Beaufort seas. The project will look at the bowhead whale (feeding areas, cow-calf areas, spring & summer migratory corridors and fall migratory corridor), the gray whale feeding and cow-calf areas and the beluga whale including feeding, calving, and migratory corridor areas. More information can be found at www.cetsound.noaa.gov.

Q&A | Comments:

Chris Winter, Crag Law Center: I have two questions: First, how is NMFS incorporating traditional knowledge into the process of establishing criteria you have been talking about, so how that has been done to date, and what opportunities are there moving forward to providing information to the agency and have them incorporate it into the decision making process? That would be my first question. Second, we saw some great information yesterday from Shell and you presented some very interesting information today on sound signatures for vessels, but I didn't see anything in the presentation on how NMFS is addressing impacts from vessel sounds. I know in the Arctic we do have some prior studies on beluga whale response to approaching vessels and bowhead whales and there is a lot of traditional knowledge on that type of information and wonder what the agency's plan is moving forward for addressing vessel sounds?

Amy Scholik-Schlomer, NMFS: Thanks for your questions. The first question about traditional knowledge, as was pointed out in my previous presentation, most of the information that was presented was publications and scientific knowledge. Obviously traditional knowledge is very important, and, to date, we haven't done a good job in incorporating that. I think we need to reevaluate how we incorporate that knowledge and obviously through public comment periods and information gathered here would help us incorporate some of that data. To date, obviously we haven't done a good job of doing that. As far as vessel sounds, do you mean vessels sounds specifically associated with seismic or more generic like commercial vessels?

Chris Winter, Crag Law Center: *Respondent not at microphone. He refers to Shell's presentation yesterday and sound signatures of the vessels.*

Amy Scholik-Schlomer, NMFS: Yes. So I mentioned as far as behavior, we are looking more at seismic activities that do have vessels associated with them, though most of the information we have is from airgun, etc., so I don't know if we've figured out exactly how to incorporate vessels into our criteria yet, but is something we definitely need to look at. I'm not sure if there would be separate criteria vessels at this point. It would depend on context of vessels and if they were single vessels or associated with an activity.

Jolie Harrison, NMFS: This is a topic that we continue to want to figure out a better way to do, but as of now we have addressed in our evaluation the effects of an activity and vessel noise associated with the drilling platform or with a seismic vessel in more of a qualitative way. Regarding commercial shipping and that sort of thing, I am sure you are aware that every person who drives a vessel is not getting an IHA, and we at NOAA work very closely and strongly with the International Maritime Organization (IMO) to work on quieting technology for commercial vessels and other vessels as a whole. That is an over-arching goal of the agency to work on quieting vessels, but context of activities we evaluate for an IHA, the vessel noise piece has been addressed more qualitatively. Elsewhere in our program we have thought about how to have a larger foot print that thinks about multiple vessels. I think this is an area where there is some flexibility, and we are still trying to figure out the best way to do it.

Bill Streever, BP: I have a couple of "yes/no" questions and then a couple of more involved questions. My first question is in the peer review, do you intend to invite any people from industry as peer reviewers?

Amy Scholik-Schlomer, NMFS: Actually, we haven't talked to the MMC yet about this, but we want them to pick the peer reviewers to keep us separate from the process, so I don't know how they will decide to that.

Bill Streever, BP: I guess it was a "yes/no/I don't know" question.

Amy Scholik-Schlomer, NMFS: I don't know. We haven't worked out all the details yet on how the peer review will happen.

Bill Streever, BP: Okay, no worries. My second question is in your first, excellent presentation you pointed out that airgun pulses actually become more continuous with distance as they reverberate and multipath arrival. In your second excellent presentation you said seismic would be treated as impulsive sound. I just wanted to clarify that.

Amy Scholik-Schlomer, NMFS: For injury.

Bill Streever, BP: Only for injury, so the clarification is it is… (*no microphone*)

Amy Scholik-Schlomer, NMFS: For behavior, it was more activity specific.

Bill Streever, BP: That is what I thought. I just wanted to make sure. The other thing I wasn't clear on is you talked about seismic and seismic includes of course airguns but can also include lots of other things like bottom profilers and various other devices. How are you defining seismic in this context?

Amy Scholik-Schlomer, NMFS: Most of the data we have for things like playback, we only have information on the airguns, but for more like monitoring reports, for seismic activity as a whole although the focus were airguns, they are sort of incorporated by association if that makes sense. I mean, granted the focus is on airguns…

Bill Streever, BP: I guess what I am thinking of is if someone has a sub-bottom profiling project with no airguns, are they going to be captured under this guidelines or regulations?

Amy Scholik-Schlomer, NMFS: And they weren't doing seismic they were just…

Bill Streever, BP: No they are doing seismic—well it depends. Some people would say sub-bottom profiling is not seismic. That is why I am asking the question.

Amy Scholik-Schlomer, NMFS: If it was something like sub-bottom profiling by itself, it would probably fall into a completely different category from seismic.

Bill Streever, BP: Okay. I encourage you guys to be clear about that because that has created confusion in the past. The last question has to do with the way you came up with your logistic regression. I think you said you had about 50 peer review studies that you used. One of the problems I see is there…

Amy Scholik-Schlomer, NMFS: When they all aren't peer reviews.

Bill Streever, BP: No, one of the problems I see is that there are thousands and thousands of observations of no observable effect. They tend not to be very interesting peer review papers and don't get into the peer review literature. So I could see where you could get 50% of animals are responding at 160 if you ignore all the observations that never make it into the literature because it is boring. I don't know how you are going to address that, but I think if you only look at peer review literature that focuses on places where people did see effects it will bias your results.

Amy Scholik-Schlomer: Absolutely. I guess I didn't make it clear, but it wasn't just peer review literature. There are monitoring reports as well that we are evaluating for behavior, but granted, yes, there could be a bias. People usually like reporting when something happens vs. when nothing happens.

Bill Streever, BP: Maybe over time that database could be looked at repeatedly as the data grows and we understand what you are using it for, we'd be more likely to turn in data.

Amy Scholik-Schlomer, NMFS: That's the thing I didn't mention that within the guidelines there is a mechanism for updating them on a regular basis. We recognize things are going to change; information is going to grow. It won't be a static document, and, as we learn more, we can update things better. And hopefully through the peer review process and public comments, people will let us know if we are missing important data sets that need to be incorporated.

Bill Streever, BP: Okay, thanks. I just wanted to close by saying I think you are doing a fantastic job. They were great presentations and really nice summaries of the work, and it is nice to see the effort.

Alicia Bishop, NMFS: I just had a point of clarification. When the table came up about PTS criteria, I was hoping that you could walk us through what the new metrics are so that people are not trying to do a direct comparison between our new criteria and the old criteria.

Amy Scholik-Schlomer, NMFS: Yes, I forgot to mention that. The new criteria are in different metrics compared to our 180 and 190 and often there is a temptation to compare the 180 and 190 that we previously used to the new criteria. It is not appropriate because they are in different metrics. I know this is an additional complication and can create confusion, so in the guidelines we recognize that we do need to explain very well how the new criteria compares to the old criteria and how they differ.

Unidentified Person: Can you do that now?

Amy Scholik-Schlomer, NMFS: Can I do that now? The hard part about the cumulative sound exposure metric is that it takes into account the duration that the animal is exposed. We've

never taken this into account like that before, so it is hard to compare. For example, if something is one second at 180 dB RMS in the previous metric we have been using is equal to 180 dB cumulative SEL because it is one second, but if it is shorter than one second, there is a different relationship and if longer than one second, there is a different relationship. It's complicated obviously.

Brettny Hardy, Earth Justice: I wanted to ask about when you categorize injuries that occur and temporary hearing loss factors in. It seems like if an animal has temporary hearing loss, especially for an extended time, there is a potential they could suffer serious injury. Have you considered including temporary hearing loss within the injury category at all or if it is in a different category and why it is within one or the other?

Amy Scholik-Schlomer, NMFS: Permanent threshold shift we have categorized as injury because there isn't complete recovery. TTS, since it does recover, is not considered injury. When you think about it in terms of the MMPA, we have Level B which is the onset of behavioral harassment and Level A which is the onset of injury. The onset of injury is permanent threshold shift; TTS falls into the upper level of Level B harassment. It isn't quite injury. It is more severe than behavior harassment, so it sort of falls in-between if that makes sense. We actually do have a threshold in the guidelines for TTS because that is where we actually have data.

Richard Kuzuguk, Shishmaref: I have a comment first and then a question about the level of frequencies as far as seismic activity. My comment is that I want to thank Robert for requesting traditional knowledge be recognized and included in some of this research. For example, with traditional knowledge by the time the offshore activity wherever the loudest noise levels are going to be taking place about July when Shell started drilling last season, at that time most marine mammals are up north because they are migratory and all the activity is up north. I believe there are only like 179,000 bearded seals which is a main species used for subsistence. I don't know if the number is correct; it may be about 259,000. I may have them mixed up with spotted seals, but, since they are migratory, all the seals, whales and belugas are up north, and all this activity is going on. There is a potential for adverse effect for noise impacts from seismic alone. My question is about noise level – on the 165 dB, the behavioral effect of 50 percent of animals and maximum decibel level at seismic activity can be up to 240 dB at full power and this number is only at 50 percent power at seismic. That would push most of the marine mammals that are up north at full power. What kind of adverse effects would that have on the whole ecosystem as far as the marine mammals at that time?

Amy Scholik-Schlomer, NMFS: The curve I showed was an example and may not look exactly like that for seismic. You have to consider that you have a source level. It is very loud at the source, and, obviously the closer the animal is, the more likely for injury. But as the sound travels away from the source, it actually spreads out so it's not as loud farther from the source. That is what the behavioral criteria are trying to take into account. The animals at 168 dB are not right on top of the source. They are actually much further away. Whether the number is 50% or not with seismic, I don't know yet. That was just an example of what the curve looks like so the numbers may be slightly different for seismic.

Michael McCrander, Shell: Thank you to you and NOAA for these presentations. I have a few questions about the upcoming document and what to expect. I am encouraged that it seems that, if I am reading the tea leaves correctly, this will be a more quantitative approach vs. qualitative. I am encouraged by that. I noted use of dose-response curves in terms of behavior. Can you make a few comments in terms of, again picking up on the conversation between Robert and Jolie earlier—I heard some of the buzz words—are there going to be explicit expressions like "risk" and "uncertainty" and is that going to be quantitatively expressed through the document?

Amy Scholik-Schlomer, NMFS: Definitely uncertainty will be addressed in the document.

Michael McCrander, Shell: Quantitatively?

Amy Scholik-Schlomer, NMFS: Quantitatively? It will probably depend on the situation. For injury, we have impulsive and non-impulsive sounds and these different species groups, sometimes we have don't have data, for example for pinnipeds, for impulsive sources so we have to use surrogate species. That will be explicitly stated when we actually do have data and situations where we don't have data and what we did so people can evaluate and see what we did. When you look at the table and the numbers showing, you assume we have data for everything, but there is uncertainty associated with each of those numbers, and we will try to make it as clear as possible.

Michael McCrander, Shell: Is it safe to assume that uncertainty factors be applied in a conservative fashion?

Amy Scholik-Schlomer, NMFS: Yes.

Jolie Harrison, NMFS: I was going to add, and I think Amy said this, we cannot underestimate the effects of the peer and public review of this draft material we have presented. It very well may be although we have thought about how to address uncertainty at some point to get to these numbers, someone out there may say it would make good sense to bracket things in this way or have three numbers—there are all kinds of things that could happen. So while we have thought about it, and Amy has talked about where we are, I don't want anyone to underestimate the importance and impact of all the folks in here, as well as the peers that are chosen to review the technical material.

Michael McCrander, Shell: A part of the point is that this will follow a more traditional risk-assessment kind of approach to the application?

Jolie Harrison, NMFS: We will see.

Amy Scholik-Schlomer, NMFS: Compared to what we've done, I think definitely there are some huge steps forward in how we are thinking about things.

Jolie Harrison, NMFS: We can talk about it more offline because I want to make sure I am interpreting what more traditional risk-assessment means so I don't want to answer incorrectly because I'm not sure what you are asking there.

Michael McCrander, Shell: Risk, uncertainty and dose responses follows…

Jolie Harrison, NMFS: Yes, it definitely…

Amy Scholik-Schlomer, NMFS: And the dose response that we are working on will have a 95% confidence interval, it will have confidence intervals associated with that too to try to take into account.

George _____ *(Does not identify last name or organization)***:** I want to thank Colleen for the question about the data collection under control environment or from scientific notes or wherever you got them from, but and how do you get a bowhead in a controlled environment? With all the stuff you talked about, with the criteria and all that, you say this is coming up, public meetings, and the presentations and something that will determine the future of the seismic studies and the future of offshore exploration.

Amy Scholik-Schlomer, NMFS: So you are asking if it is going to influence how seismic surveys are done? Sorry. You are asking how the criteria...

George _____: How will this affect—is it just for seismic studies or the criteria?

Amy Scholik-Schlomer, NMFS: Sorry. I didn't make that clear. The injury criteria that I put up are going to be for all sound sources, so it is more than just seismic. The behavioral criteria I talked about, we are just doing seismic for now, but once we get peer review and public comment, we will do all sound sources. Seismic is just the first one, but we are planning on doing other sound sources like drilling and pile driving as well, but at a later date.

George _____: So that will be done in real life, not just in a controlled environment?

Amy Scholik-Schlomer, NMFS: Yes. Most of the data on behavior is from the field, which is the most useful when you have actual data on what the animals are experiencing. The injury criteria, unfortunately we don't have the technology to do those studies in the field, so we have to rely on laboratory studies instead. As you mentioned, we don't have—putting a bowhead in a lab is not a possibility, so the data we have for hearing loss right now comes from smaller species like pinnipeds or beluga whales or bottlenose dolphins. Maybe in the future we will have ways to actually do the hearing tests out in the field, but we don't right now.

Dave Hannay, JASCO Applied Sciences: Thanks for the great presentations. I just had a couple of questions. My question is about the way the exposures are calculated. When we use the RMS exposures, it's really those are applied by looking at the highest level the animal receives. With the cumulative exposure that is proposed, those add up for multiple exposures, for multiple shots for example in a seismic program. Has thought been given about how you treat animal movements relative to a seismic airgun array?

Amy Scholik-Schlomer, NMFS: Yes, that is an additional complicating factor especially when you have sources that move and animals that move as well. If people are capable of doing more advanced modeling that takes that into account, we would definitely use that, but we are also prepared to develop default, some sort of more conservative criteria, if people can't take into account if animals are moving or not. Obviously it depends on the species too. If somebody is transiting through an area, you would treat them different versus somebody who is resident to an area. We will develop some guides for people on how to deal with those factors. Those are definitely important considerations because when you add the time component, now you need to take into account that animals can move away from the sound source, up and down in the water column, things like that and sources are capable of moving as well. It makes it more complicated, but we will try to provide some guidance on simpler default ways to think about it for people who can't take those factors into consideration.

Dave Hannay, JASCO Applied Sciences: Great, thanks. The second question is in regard to how they are applied in recovery of animals after exposure. These types of metrics are applied for human assessment and incorporate what is known as exchange rate and means after more exposures,

the further they are in the past, they are weighted less because there are recovering after the initial exposure. Are you going to include equivalent exchange rates for these types of metrics?

Amy Scholik-Schlomer, NMFS: Right now we don't incorporate them because I don't think we have data from marine mammals to be able to do that, but we do have data from other species as well, so there is the possibility to do that. Currently we are not taking that into consideration, but it can be brought up in the peer review or public comment process. We recognize especially for intermittent sound, there is the potential for recovery, but I don't know if we have enough data to do anything with it right now for marine mammals. If it is deemed appropriate in the public comment or peer review, we would take that into consideration. We can talk offline if you have ideas around this.

Dave Hannay, JASCO Applied Sciences: Great, yes. It is something that will have to be thought about.

Robert Suydam, NSB: I'd like to echo other's compliments that NMFS working on modifying and updating the acoustic guidelines. It is a strong and important effort and step. You mentioned that the old guidelines were perhaps overly simplistic, and I would say that is probably true but made them easy to implement and what you are suggesting now may actually be going the other direction. It is more complicated, and I will get to a more specific question here in a second. You also said that one of the reasons for having acoustic guidelines is to promote consistency across NOAA. I think that that is really good, but there is a difficulty because the systems aren't consistent. Species react differently, so I was a little worried at the beginning, but think you said later on that there may be ways to develop guidelines or criteria that may be specific for certain situations. Hopefully that is what ends up occurring here. My first question is about timing. In one of your last slides you said that the guidelines are now going through, February and March 2013, and that the MMC will somehow do the peer review sometime in the next six months or there about and the final guidelines will be issued at the end of 2013. I'm a little confused because in your presentation you and some of the other comments people have made, you and Jolie have said you need to think about this and need to incorporate that and so how is that going to happen? If you are already going through an internal review, how are things being mentioned today being incorporated into the guidelines?

Amy Scholik-Schlomer, NMFS: The feedback today is extremely useful because this is the first time we have really presented how we are going to do this in a public forum. I am writing down things, and it will be incorporated into what we are doing now before it gets out of the NOAA internal review. There will also be feedback all along the way through public comment and peer review where things will have to be updated and change. It will be a dynamic process to take into account the valuable comments we will get.

Robert Suydam, NSB: That is helpful to know the process may not be as strict as what was shown in the presentation.

Jolie Harrison, NMFS: Not to air our dirty NMFS laundry, but for example there was one thing that was written as a draft and went to some internal folks. Now we have it back and scheduling weekly meetings and drafting themes to address some of the things that those folks brought up. We can easily incorporate the things we have learned here. It is not as though we are done with the internal review—we are still deep into the review.

Robert Suydam, NSB: Okay, so the timeline may be a little different than what was presented.

Jolie Harrison, NMFS: Yes.

Robert Suydam, NSB: So I am impressed that some of the things that people have said here are going to be easy to incorporate.

Jolie Harrison, NMFS: I meant in the context of the process, not the substance.

Robert Suydam, NSB: Okay. And so my specific point is related to traditional knowledge. Amy, you kind of implied that a lot of traditional knowledge hasn't been published and while to a degree that is somewhat true, but there is a huge amount of comments that have been incorporated into EISs for the last 30 years that has gone to NMFS as traditional knowledge, i.e., here is how bowheads respond to sight, sound, etc. Those comments, that information, are available to you and could be incorporated into the acoustic guidelines. Not easily, but it has been available and has been for a long time. That doesn't mean that there isn't a need for other people, us perhaps, to try and summarize information and get it published, but there is stuff that is written now and available for you now. Another question that is a follow-up to what Dave just asked about. How are you going to deal with cSEL? How are you going to implement the acoustic criterion for mitigation? How are you going to figure out how a whale has been exposed to a certain level of sound? I don't see how it's going to happen. Maybe the new criterion is going to mean maybe there is no need for PSO's on board to tell the airgun array to ramp down or shut down, but if you could give us an idea of how you are going to implement criteria as a mitigation measure?

Jolie Harrison, NMFS: One of the points I was trying to make earlier and was apparently unclear – I apologize – is there is the estimated amount of animals that may be taken by Level A harassment and there is the mitigation you do to avoid that. What Amy was alluding to before is that there is a varying sophistication of modeling abilities that applicants might have that once we have criteria that has cSEL that requires that you do a certain level of modeling to get to, maybe has some conservative ways to do that in a rougher way that isn't as difficult. That is estimating take. Mitigation wise it is a different thing. You have to look at it and then think how are we going to not make that happen, and, I think again, there is modeling you can do once you know the cumulative level you are trying to avoid that has to do with how fast the boat is traveling, how fast you might expect the animals to be traveling in the vicinity, to come up with an isopleth that will contain the reasonable cSEL over a certain amount of time that animal might be exposed to a number of shots. We think there are mathematical things you can do once you know what you are trying to avoid and identify a distance that contains that within the normal circumstances of an activity that you are looking at. I'm not sure if that is what you are asking.

Robert Suydam, NSB: Kind of. I think going to cSEL is a positive thing especially looking at cumulative impacts. Modeling is great, but it's not observations, so I struggle with how you are going to actually have a mitigation measure to prevent PTS in marine mammals. Is it going to be a safety radii that if an animal moves within a certain radius that is variable depending on the activity? I am struggling with how you are going to use cSEL as a way to mitigate PTS in an easy fashion when you don't know when exposures have been previously. When a whale shows up near a seismic operation, how do you know what its previous exposure is?

Jolie Harrison, NMFS: Right. I'm sure there will be challenges with doing this versus a simple RMS measurement, but what I was trying to allude to is given a known speed of a seismic vessel, there is math you can do to come up with the same sort of approach and an isopleth that will

contain and takes into consideration for example, that an animal might have been exposed to 20 shots. I think there are things you can do that will help reasonably bound and get an isopleth that would contain the number and area of exposures that you are concerned about. I am not saying there isn't work to figure out how to do that, but I don't think it is an untenable problem math-wise.

Robert Suydam, NSB: Again, I am not asking about the modeling aspect of things, but how do you actually implement it? Will the devil be in the details?

Jolie Harrison, NMFS: I think in the same way. You have a distance that you shut down. Not that we aren't open to new ways of doing things, but I think there is a way to do it that is the same that we already use which is there is a distance. It's just the radius to 180 RMS. It is a radius to a distance that you figure out that can contain the cumulative exposures that you are worried about given the circumstances of the activity. You will have to make some assumptions along the way, and we will have to figure those out, but I don't think it is an untenable problem.

Robert Suydam, NSB: What I am thinking of is what happens when bowheads are in the Eastern Beaufort Sea being exposed to activities there? Not all of them, some of them, and then they move into Alaska waters where there must be some mitigation for PTS. Then they swim into Russia and maybe exposed there too. So how do you deal with these other exposures whether it's seismic, drilling sounds, vessel sound? How do you deal with the accumulation of these sounds in a specific context in an individual animal? I think what you are saying is you use a probabilistic approach or something, but…

Jolie Harrison, NMFS: Are you asking about injuries specifically? I thought you were asking about injuries specifically.

Robert Suydam, NSB: Yes, cumulative—PTS. Cumulative sound exposure over time.

Jolie Harrison, NMFS: I still think there are ways to probably do that, but I am not trying to downplay the importance of the complicating factors that you are talking about. We will have to figure it out because with every piece of science that you have, there is an interpretation and figuring out what to do on the ground to deal with it. If as you say those accumulated exposures lead to concerns for bigger distances than we are talking about, we will have to figure out how to deal with them.

Robert Suydam, NSB: Okay and will that be part of the guidelines that are coming out at the end of the year or is that the next step afterwards?

Jolie Harrison, NMFS: No. Mitigation is very explicitly disarticulated from this process. It is.

Robert: Okay. So then moving on to behavioral components, and I think I heard George ask about the approach to just use seismic right now for looking at behavioral effects. Amy you said you are going to incorporate the other activities. When does that all happen and before it happens, what criteria will be used for estimating takes?

Amy Scholik-Schlomer, NMFS: So before we update our behavioral criteria for other sound sources, I would assume we are going to use the criteria we are using right now. So you asked when will the other sources be updated. I think it will depend on the feedback we get during the public comment period and peer review on how we did seismic. Like I said, it is a very different approach to what we have done in the past. We have all data. We could have done all the sound sources right now, but we wanted to put seismic out and get feedback before we did all the sound sources. Once we get that feedback, there shouldn't be a huge delay in dealing with the other sound sources. Granted there is less data sometimes with the sound sources, and we

will figure out how to deal with that. There may have to be surrogate sound sources for things like pile driving until we actually get more information, but it will at least help identify where there are data gaps and we need more information.

Robert Suydam, NSB: So I am thinking about bowheads, and there are a lot of data of how bowheads respond and quite a bit of data on how they respond to vessel sound say at Northstar with all the great work that BP has done and their contractors. Again, its 160 dB is presumably the criteria you will continue to use for behavioral responses even though bowheads on occasion and frequently show behavioral responses at much lower received levels or presumably because of received levels. Are you going to continue to use the 160?

Amy Scholik-Schlomer, NMFS: The 160 is for impulsive sources so that would be for, well since we are dealing with seismic so it would be for things like impact pile driving and then the 120 would be used for non-impulsive sources until we update the rest of our behavioral criteria.

Robert Suydam, NSB: So it will stay the same even though there is data and science that says bowheads responds differently. That issue of bowheads being more sensitive to sound than NMFS is currently using has been in the parking lot in the past, and we have discussed it. I need to continue to bring it up. I just have one other comment that using logistic regression to do these dose response curves is an improvement, but one of the limitations of using logistic regression is that the switch is either on or off. There is no accounting for the severity of the response and that seems to me to be a problem. Some individuals may flee or stop calling or they don't. I'm not sure if NMFS considered perhaps other approaches, and I don't have one to suggest at this point, beyond logistic regression because of that limitation?

Jolie Harrison, NMFS: One of the things Amy mentioned about the criteria when she was saying what the criteria are and what the criteria aren't. What they are meant to do is to help identify the onset where animals are being taken. We are required to have estimates of take and that sort of thing, the number of animals that are affected to the level of what we consider are MMPA or ESA take. What they don't do is exactly what you said. That is what is supposed to happen through other pieces of the analysis. So that is why we look at the important areas and other contextual issues. That is why in biological opinions you might see a detailed analysis of the different types of responses you have. That is not what this criterion is doing. They have always been the on-set level to get applicants in the door, help them on the application, estimate how many takes they are going to have and help us get the scope of what is going on. Also to help under things about injury but that important thing that comes after that, which is there are 1,000 takes but are 900 of them something that is momentary and might not affect the fitness of an animal and the other 100 are a bit more of a concern. Then there are one or two—that is supposed to happen elsewhere in the analysis and is very hard to pin anything quantitative to as we know. That is what the criterion are not doing is saying how severe the impacts are from anyone of those takes are going to be aside from saying some injury.

Robert Suydam, NSB: I appreciate and understand that. I apologize for not doing a good job of framing my comments or my question. It's really related to what Bill said. He asked earlier, what is the definition of take? When is the on-switch on? Is it an animal that stops calling? Is it an animal is deflected by half a kilometer or five kilometers or ten kilometers or doesn't return to a migratory path within 20 kilometers? How do you define what a 1 is versus a 0 in the logistic regression?

Jolie Harrison, NMFS: The criteria will have to explain that because we have the data we have and with each situation we have to say whether or not we thought that one was a take. Some percent of the time it may be and some percent of the time it isn't. I don't think we will ever have an encyclopedia of every behavioral response and whether it is or isn't a take, but what you are saying should be articulated much better in the guidelines than perhaps it has been before.

Megan Ferguson, NOAA: I have been sitting back and observing the discussion and from my perspective I am seeing conflicting words that are going back and forth. On the one hand I am hearing concerns about that the timeline is too long and then I am hearing that there isn't enough opportunity for people to comment so it should be longer. But on the other hand there is concern that it is too long and things aren't moving fast enough. That is one observation. The observation is a criticism about the complexity of the new acoustic criteria and that they will be too hard to implement, but then the next question you are concerned about the fact that you are overlooking a number of effects. It is a lot easier to look at what someone has presented and say what is wrong than to come up with something from scratch that is right the first time. Second, it is really helpful that if you are going to criticize something and you don't like what is going on; give a recommendation on how to do it differently. From my perspective, there has been a lot of completely conflicting comments that are coming and makes it difficult to track and try to stay on target.

Robert Suydam, NSB: Thanks for that and the point is well taken. I apologize if I am contradicting myself or suggesting two diametrically opposed things. I think part of the problem is that this is the first time I've seen the acoustic criteria, and so the information given today and the presentation is incredibly limited so I don't know what is there. It makes it easy to criticize but difficult to provide recommendations. As we move forward, I can be more helpful if we know how the process will work and be implemented.

Candace Nachman, NMFS: We realize this and this is the first time this information has been presented to anyone outside the agency. We realized when she was putting the presentation together, it would generate a lot of questions, but keep in mind there will be ample time to get everything on the record when the document goes out for public comment and hopefully will answer questions that time. We really wanted to get you guys thinking about this right now, but the hard questions are not going to be answered today.

Craig George, NSB: Yesterday we heard some interesting information about the propagation and distances of seismic pulses and other sources, and Susanna identified the seismic source that NMFS had no knowledge of. For all we know it could have been coming from Norway, western Russia, or something. A few points: so the Nieukirk work where you described that seismic pulses were heard was called an extreme case. Maybe that's not so extreme, and it looks like these seismic operations are ensonifying major portions of the Arctic basin, so we can't consider these operations in isolation. Just regulating within the U.S. waters is probably insufficient. Noise does not recognize political boundaries. Where this might come to a more-grounded situation is with whale hunting. We've heard from hunters describe a skittish behavior and know from my own traditional knowledge of tagging whales that in some seasons whales would not let us approach. They blow twice, they are gone, they are moving fast; I asked Harry what is going on, and he said now you understand what we are talking about with skittish behaviors and

whether these animals were affected elsewhere? Maybe it had to do with feeding opportunities—who knows—but nonetheless, ultimately we need to think about the possible effects on the hunts and these sorts of things. The main point is that we can't consider these operations in isolation, and clearly these seismic operations are ensonifying large regions.

Jessica Lefevre, AEWC: This is a fascinating discussion. As a lawyer, a lot of it is over my head, but I will try to bring it back down to the concrete issues I can understand. First, in your discussions of take and mitigation, it would be helpful for some of us if we could also have a discussion on how density estimates are calculated so we can have some sense of take relative to what. In some of the presentations there have been references, but that is one I continue to struggle with is how the density estimates are calculated. Without that understanding it is difficult to understand what take means. It would also be helpful, given why we are all here, if these discussions could also reference subsistence and how take is being evaluated in the context of impacts to subsistence. Because while the MMPA speaks in terms of level B behavioral changes, probably most of us feel like behavioral change, even if they are observable, aren't doing a whole lot to the animals but can mean the difference between food or no-food in coastal communities. The high level academic discussions are important and helpful to a lot of people, but we are also here to do a concrete job. Continuing on that—I'm going to beat this horse again—you had a slide up Amy about impulse versus continuous sound and on the slide it references 120 as being the criterion level for continuous sound and a quote something to the effect of "all data was from mysticetes". We know from hunter observation, from monitoring reports and even some published literature that bowheads do respond, sometimes dramatically, to seismic impulse at 120 dB. It would be really helpful that instead of continuing to put this in the parking lot as Robert said, we could hear some discussion with the idea that you are not going to apply 120 dB as a criterion to impulsive sound and if you are going to change it. I've heard some intimation that maybe you are, it would be nice to know that and when are those changes going to take effect. It is important for people out on the water trying to use the food and trying to operate within a legal and regulatory context that is formed by the criteria you put out. On that note I was also curious, Amy in your slides and I am certainly not trying to be critical of you, I didn't see a reference to migratory changes. You have especially sensitive animals, and we know migratory bowheads are very sensitive to sound, and one of the principal behavioral changes that is important from a subsistence perspective is migratory change. It would be nice if we could include some reference to that. My next point, going to the question of peer review of your criteria, I applaud you for wanting to be independent and letting the Marine Mammal Commission to choose your peer reviewers. I would encourage you to ask them to include subsistence hunters among the people designated. Having someone like Harry Brower who has spent a lot of time listening to these discussions and has a very high level of sophistication on some of these issues could be helpful in informing your peer review. The final comment, referring back to Harry's opening comments, and Amy you said something about your discussion on some of the data you have is snapshots and you need more than just snapshots. From the perspective of those of us sitting over here, in fact the monitoring reports themselves are snap shots. It's an amazing phenomenon as I listen to this, it's sort of like we have significant amounts of industrial equipment that suddenly appears in the middle of the Beaufort and Chukchi Seas. Nothing happened before and nothing happened after – it's just there. When Harry made his opening comments yesterday, he noted that in fall 2012 at Barrow they were seeing bowheads

50 miles off shore and questioned. Shell was moving the Kulluk and going back and forth doing work there. Not to point fingers at Shell or criticize anyone, if that is an impact from an anthropogenic source, we need to know what the source is so we can mitigate to it. I am perfectly confident that if we knew, for example, that that was due to Shell's movements, that we could work with Shell and mitigate those impacts. If we don't know and no one insists that the question be asked and answered, then we can't. This ties back into what is the purpose of monitoring. You have to estimate takes and why are you estimating take? Because you have to mitigate and by the way you have to make sure there is no impacts to subsistence, so you have to be able to mitigate. As someone who has spent a big part of my life thinking about mitigation, it is important to keep in mind that mitigation requires planning. If you have an emergency, you might try to mitigate to the emergency at that moment, but to have effective mitigation especially in context of subsistence, you have to plan. You have to know what is coming, what the impacts of those activities are going to be and how you can set the situation up so that those impacts don't reach a level that is effecting bowhead and other marine mammal behavior and subsistence. I would encourage you to move away from monitoring as a site-specific snapshot and start thinking in a broader, more cumulative sense. What is the life history through the season of this activity so we can know everything that is going with it and be prepared to work in a way that works within the context of subsistence use?

Jolie Harrison, NMFS: Jessica, we asked Amy to come because she is the acoustic scientist in our Office of Protected Resources. We have had some research presentations in the past at the OWM and received comments from others to shape the information we give to address impacts more directly that we look at through the IHAs. That is why we asked Amy to come and talk about it. To speak to your first point, when it comes to estimated takes, as you know there are multiple pieces. One that we asked Amy to talk about is the acoustic criteria. The density is another piece of that, and it certainly is a valid and separate conversation, but it is not the piece we asked Amy to talk about. I guess that I would acknowledge the rightness of snapshots and the need to think about our comprehensive monitoring plan and more conversation along that line would be good. We acknowledge impacts to migratory corridors that may be seen in behavioral studies. Amy was giving a summary and in parentheses was listing some of the types of behavioral responses we looked at. The whole reason we are talking about changing the criteria is because there is new science and information out there that bowheads are responding sometimes in ways we consider a take at levels below 160. I think Amy's presentation suggested we are going in that direction.

Lisanne Aerts, LAMA Ecological: I think it is good to take into account new information that comes your way, and I would like to add to Robert's comments on something that came into my mind on the cSEL values as a criterion. It will be difficult, and maybe it would be worthwhile and something that will be in the guidelines, is to have a level of where the duration stops or if you are looking at only specific durations. I don't know what it should be but be clear about it so people know what to expect. It still will be difficult to implement. Which is actually my other comment and what Robert also said, but I want to echo it. As someone who has to implement these guidelines in the field, and even the simple ones are already complicated for someone that is on the boat, so if I quickly think of three types of cetaceans and pinnipeds, two types of criteria, there may be 20 different zones that we might have to monitor. You don't have to

answer today, but I do want to try to encourage you that when you look at the guidelines, and if I understand Jolie you said you don't want to look at mitigation. We want to decouple it; there is probably a reason for it. But I encourage you to look at how these things will be implemented in the field because in the end, operators will have to comply with the regulations, and the only way to do this is to be able to observe and know at all times what your acoustic level is and which in itself is very difficult. It may be very difficult to comply with guidelines just from practical reasons.

Jolie Harrison, NMFS: I will just re-emphasize that the guidelines are not the mitigation. They are a completely separate thing and while I totally agree with what you are saying, we have to require mitigation that makes sense and that can be implemented. At the same time, if criteria are meant to help analyze and assess where an injury is likely to occur, we can't not have it be different for different species if that is what the information points to. But what you have to do in the field, we can take practical things into consideration. If that means you have one zone that encompasses some buffer and all of the injury, then we do that. Or if it means that animals that are visibly different like smaller ones, you have the largest zone that encompasses all the injury or those guys and for larger ones...we mean...you are totally right. We have to take implementability into consideration when developing mitigation, but in terms of criteria which is supposed to be directly based on the science and enable you to say where injury is likely to occur; it has to be based on what's out there. It's not related to the implementability.

Lisanne Aerts, LAMA Ecological: I just don't understand that somehow. I don't think you can de-couple it, but maybe don't understand.

Jolie Harrison, NMFS: They are related. One influences the other, but you can totally decoupled it to make it implementable. We will err on the precautious side because if you are going to lower the number of zones, you are going to pick bigger ones if you are going to have to encompass multiple injury areas.

Lisanne Aerts, LAMA Ecological: That sounds very easy, but it might not be that way. We don't have to discuss it...

Jolie Harrison, NMFS: And we can talk about it...

Lisanne Aerts, LAMA Ecological: I just want to make the point that it is important to take into account how you would implement these things in the field and how it relates to a violation and a non-violation. As we already know, that is already difficult with the current, simple measures.

George Edwardson, ICAS: I have a simple question. You were talking about impacts of seismic on whales, and when you talk about impacts on whales all you have given us is numbers to go by distractions. Like your frequencies and sound you are making because when you look at seismic, you are looking at from the time the fleet of boats go out there to do seismic—the seismic boat and its service boats, it supplying, its travel. All this has to be considered as impacts from seismic. You also have to look at the food chain of the animal that is going to be migrating through there and the decibels you are giving us, it might affect the whale itself, but if it affects that whale's food, it is being affected by seismic. With that being looked at in that way, you have no choice to look at not only sound, but contaminants you put in the water whether it is sand, or chemicals, or natural minerals from the ground. You have to look at that because, that is where the real impact is. When you look at contaminants, you also have to look at solutions that are being put into the ocean from grey water or exhaust from diesel engines. Those have to

be considered and you never, ever have mentioned this from the beginning of OCS or even at Prudhoe Bay. The real culprit, the real law breaker in the whole system. You have the MMPA you have to follow. You have the Migratory Bird Treaty you have to follow. All of these are being put aside, and we are sitting here talking about the noise frequency of a seismic shot. Let's quit the distraction and look at the real impact.

Edith Vorderstrasse, **UIC Umiaq**: Thank you for your presentation, but I am a little disturbed that you have put traditional knowledge at the very bottom where you seek public opinion last when the scientists such as late Maxie Breuer did science in Barrow. His research people relied on traditional knowledge. Here you are telling us, and we hear this time and time again, that traditional knowledge will be considered. When will the federal government learn to begin to reach out to our communities with traditional knowledge as part of western science from the beginning instead of the last?

Billy Adams, Barrow: I am from Barrow. I am a hunter. I work for NSB Department of Wildlife Management. I am going to talk a bit about bowhead whale behavior. The natural things we see over time. I have been whaling for 42 years, 6 days and 22 hours. I have watched a lot of whales during my lifetime. I enjoy every minute of it. There are a lot of whalers here that go out in the fall time. I learned a lot. We watch whale behavior when they are migrating in the spring they are coming from the south going up north. They have their own communication. They are talking. When they come up near Barrow, a lot of them breach, so that tells us it will probably get windy. So they breach a lot and are probably happy too that they made it that far up north. They went through a few communities that take them, so they are happy at that time too. They have other behavior too when they are along, near the ice, going in and out of the ridge. We can watch them all day long; the same whales. – We watch them feeding. We call it _____ *(Inupiaq word)*. When they hit the water, all different types of whales do that, they are also exhibiting communication—this is a good place to feed, a good route to travel. They do that natural stuff. When they are migrating, they can hear the ice, they can hear us walking. Those are quiet noises. They can hear someone tap an oar on the boat, and you won't see that whale again. They hear those things, so they are very sensitive to noise. There are other different types of behavior. When they feeding, it is easy to approach the whales. They don't care as much about noises. There is a big group of large whales and trying to breed, they don't care about anything. They have to do it. They don't care what is happening. They are intense. These are the natural things that we see. We also experience things as hunters during the fall after whalers from Potters Island and Nuiqsut are done with their quota. Then on goes the seismic to the east of Barrow, and then we see different behaviors. They are skittish and quiet and only put their nose up to breath. We see a lot of this when seismic occurs east of Barrow. We have to go further out to catch whales when there are seismic activities, maybe 25-30 miles. Usually it is around eight miles. We experienced going out as far as 50 miles at one point. I grew up whaling all my life. Enjoyed hunting with friends and family. I applaud Craig, Robert and Harry's work conducting bowhead surveys. The tagging is important to learn a lot from just tagging bowheads. The aerial surveys; they do a lot of good scientific work. They always know where the whales are migrating. There are a big bunch of whales that travel through when we are trying to hunt them in September and October. We usually go out six or seven miles, but the

big bunch this year were 30-40 miles out. Those bunches are like 100 in each pod, 50—those are the whales we see in normal year. But when there is a lot of activity going on, like this fall, we had to go way out. These are things I have experienced.

Vicki Cornish, Marine Mammal Commission: My question is about a somewhat related subject. In a couple of IHA notices that we reviewed lately, the estimated take for certain activities have been ratcheted down to account for potential animal behavior responses to sound. In other words, there is an assumption that animals will avoid seismic activities and therefore won't be exposed because they will move away from the area and get themselves out of the area of exposure. We have commented on that and the assumptions made about how many animals would actually avoid sound and how good the data are to suggest that. How are the revised acoustic criteria going to take into account avoidance of animals to certain sounds? Is it going to be a straight take estimate that then is going to account for avoidance and then reduce those take estimates or will these criteria instead just be used to calculate straight take estimates? I don't understand these calculations where animals are assumed to avoid sound sources and then so the take estimates are reduced. Is that clear? Do you know what you I am saying?

Amy Scholik-Schlomer, NMFS: Yes, I think I understand what you are saying. Right now, the acoustic criteria I presented do not take into account avoidance.

Jolie Harrison, NMFS: Yes, I understand what you are saying, and I think maybe we need to talk off line to understand the specific activities you are talking about. I don't think the general plan is to have a post reduction of takes, and I'd have to review the actions you are talking about to think about a certain circumstance there. We do have some limited situations where we have criteria, and the criteria is intended to help you estimate takes, we have had a few certain circumstances where we have taken other things into consideration, like a very high ambient noise or something, and made adjustments afterward. But the general intent is not to have a criteria that leads to a number which is then habitually reduced because there are data on avoidance that have been incorporated into the criteria which cannot always be said because the development of the 160 is probably a little less explicit, more simple and based on older data. Maybe there would have been room for more adjustments there, but the general intent would not be to subsequently reduce the numbers. Maybe we can have a discussion offline if that's okay.

Vicki Cornish, Marine Mammal Commission: Thank you. That's helpful.

Bill Streever, BP: This is a follow-up to what Jessica was saying earlier and what I said yesterday. We have takes by harm which is pretty easy to understand, PTS. With behavioral takes we get into some judgment calls about what constitutes behavior, but then we have to protect the hunt. Some of the confusion is still around how do you translate all this science stuff into protecting the hunt? I just want to make sure we don't overlook the work that Mike Galganitis was doing. For BP anyway, that has been the most helpful document we have of ensuring we aren't impacting the hunt and of course the CAA. I think that is really important to keep that in mind because ten years ago when we had these discussions, everything was about protecting the hunt and all this other stuff fell out of it, and, now, it seems like it is almost the reverse of that.

Earl Kingik, Point Hope: I will turn my time over to my elder. He has asked a very serious question. As agencies you should be able to answer him.

George Edwardson, Inupiat Community of the Arctic Slope: I was waiting for an answer and you just kept on continuing. I was wondering if you heard me. My question was I was explaining the animals and their ecosystems and how seismic is more than just the picture you take with the sound. How come you are not classifying as the seismic boats come in with receivers around them and the operations of the whole boat? How can you distract us into taking a picture with the boom and talking about numbers when the whole seismic impact is from when the moment the boats come in and do their work and when they leave?

Jolie Harrison, NMFS: Thanks George. Sorry if it seemed like we were ignoring your question. That was not our intent. The main thing that I wanted to point out is that when we look at seismic activities under the MMPA and in the EIS, we are definitely looking at impacts from other parts of the activity besides just noise. We just asked Amy to present the information related to the noise because it is just one piece that is evolving, and we wanted to make sure we gave people the new information. I actually completely agree with you that the numbers game of identifying numbers of takes can be distracting from the meatier part of the analysis of understanding the impacts that those takes have. But unfortunately, the MMPA statute says that those folk that come in for an application must give us this number. So while I agree that sometimes that piece of the analysis overshadows some other parts, we do address the other parts, but we have to keep looking at that number part as well. That is why we asked Amy to come and talk about that one piece but agree that we shouldn't get distracted from the important pieces of the analysis including discharges and contaminants, so thanks for that good comment.

Cumulative Effects Workshop Overview

Melania Guerra, Bioacoustics Research Program, Cornell Lab of Ornithology

I'm here today representing the working group that for past two and one-half years has been assessing cumulative sound exposure and its effect on marine mammals. Thanks go to BP for the main source of funding for this project. I hope to show the advances the group has made and some of the remaining challenges. This really is not a 'silver bullet', nor does it bring all the answers to questions that were brought up this morning, but it will show a different approach and a new tool that can be used to help address concerns that have been voiced.

All of us have come to recognize that current paradigms are not enough and should be improved for more adequate assessment of sound exposure. Typically, assessments are done on individual sources, but when it comes to multiple sources we turn to qualitative or narrative sources. Different operations can assess those differently. We need to expand our current assessment to include cumulative sound field from multiple sources and ecologically meaningful spatial/temporal scales and chronic effects.

The working group was convened through funding by BP. The group is managed through an independent contractor which convened an expert committee. The contract specifies academic freedom, and six meetings have been held from 2010 to 2013. The objective is to advance the

development of systematic, quantitative and qualitative methods for calculating cumulative acoustic impact and to test these measures on a case study to estimate sound exposure.

The working group participants represent an array of backgrounds and affiliations. All participants have day jobs in varying organizations. Some of the members are here today.

The conceptual steps of a quantitative method for assessing cumulative exposure are

1. Identify region, time period and species of interest
2. Compile operational and acoustic data on multiple anthropogenic activities
3. Model continuous and impulsive sound fields for each activity and for all activities combined
4. Collect information on natural behaviour and avoidance response for species of interest
5. Simulate animal movements through individual and cumulative acoustic sound fields
6. Calculate estimates of acoustic exposures for each simulated animal and movement data, with and without avoidance response.

We then applied this to real world scenario:
The first step was to identify the region, time period and species of interest; basically the where, when and who. Given the current interest in Arctic, the Working Group selected a case study loosely based on events from the 2008 open water season. So the "where" is the Western Beaufort Sea Alaska; the "when" is September 1 to October 23, 2008; and the "who" is bowhead whales migrating westward towards wintering grounds in the Bering Sea passing through multiple oil and gas activities.

The second step was to compile operational data on who was out there and what were the significant sources of sound, focusing on those most likely to contribute to cumulative acoustic footprint. The sources were: Northstar's production island, construction of Oooguruk production island, offshore barge tow, nearshore barge tow, offshore seismic exploration in Harrison Bay, offshore seismic exploration in Camden Bay, and nearshore seismic exploration.

The third step was to utilize propagation models from JASCO to model continuous and impulsive sound fields, both individual and cumulative. These were the times when offshore seismic were currently occurring with the largest aggregation of other smaller sources. Some of the assumptions included: sound sources are stationary, sound sources are omni-directional, seismic airgun surveys either off or full array (mitigation gun not modelled and no consideration of inter-pulse reverberation and assuming SPL is 10 dB above regardless of the range to source). We chose to begin with a simplified scenario; although, the models can handle more complex inputs and more realistic parameters.

Step 4 moves away from acoustic and pays more attention to the species of interest. It was to collect information on the natural behavior and avoidance response for bowheads. The sources were traditional knowledge, airborne surveys, satellite tags, etc. The parameters we wanted to know were: how were these migratory animals moving along the corridor, and we learned that they moved in migratory waves. We started modelling week by week. We also modelled different populations (those migrating close to shore and those migrating offshore). We incorporated data on

dive and surface durations, dive depths, heading variance, range of speed, range of depth, probability of avoidance behavior. We incorporated all of these things and created a new species called an "animat." All an animat is, is a simulated whale that incorporates all these parameters and informed by empirical observations.

Step 5 submerged these animats into the footprints that we had created before utilizing a model called the Acoustic Integration Model (AIM). On this slide (displayed) you can see where the source is, and around it are five or six animats that are swimming towards it. I'm going to show a movie of the six animats moving past the source, and you're going to see a few of the whales react at some point and deflect away from the source. More specifically, the parameters that we included about deflection or avoidance was where 99% of the animals were avoiding the source at levels of 180, 85% avoiding at levels of 170, and 60% avoiding at levels of 160.

I'm going to tell you a story of two different animats that took two differing routes. Imagine you are an animat, and you are migrating far from shore. You are going to pass relatively close to the major seismic operation going on, and, as we are assuming, you are going to pick up an exposure. In this graph (displayed) you have the received levels on one axis and the time on the other axis. The duration total is approximately 150 hours. There are three different curves in the graph: the lower is going to be the contribution of the exposure from the small seismic source; the major one is going to be from the large seismic array and then almost overlaid with that large seismic array curve is the combined of both of them. So if you are an animat swimming far from shore, you are going to pass close to that large seismic array. About 48 hours in to your swim you're going to pick up an exposure of 170 dB. As you keep swimming, you pass the small array but you're going to be far from it, so the contribution of that small curve is going to dominate over the far away larger survey, and it's going to peak at about 135 dB. We have included as a reference the line of the ambient noise for that duration that was at about 100 dB. Conversely, if you are a whale that is swimming close to shore, when you pass that large seismic array you are going to be far away from it, and it's going to contribute about 140 dB SEL, but as you move further in to your migration you're going to pass very close to the second, smaller seismic array and that one will contribute a peak that is almost equivalent to that large source that was far away.

From a regulatory point of view a lot of the assessments have been rated based on these acute or peak levels that are shown here (displayed). That is the old paradigm we discussed this morning. But, these exposure histories are showing that this insight in to the chronic exposure from multiple sources can be just as important and that the current assessment of just utilizing the rms peak level is not providing the information about the long exposures that these animals underwent at levels of about 100 dB for over 60 hours in this case and above 140 for over 15 hours. In the consideration of cumulative exposure you have to include the chronic long term affects.

When you look at population levels, multiple whales, you can create histograms. With that you can create a comparison of the impact of aversion versus no aversion on exposure. The animals that did not deflect when they encounter certain levels are going to be exposed to higher levels. Another method output is the whale-odometer. Basically the distance the whale is travelling as it deflects or

does not deflect so you can start incorporating the energetics, or cost, that this whale is having to add by having to deflect and swim further by avoiding the operations.

In summary, the Working Group accomplishments are:

- Six general working meetings
- Various subgroups have met
- Quantitative method developed and trial completed
- Two internal reports written
- Proceedings paper published
- Peer review paper is being drafted
- Multiple public presentations

What this method is:

- One positive first step towards understanding the assessment of cumulative noise exposure
- Work in progress
- Needed and timely because anthropogenic activities will only increase

And what it is not:

- A final method. Future work could build on the current method and add complexity, test different case studies and address impacts, etc.
- Does not produce a single output metric
- Does not make management decisions

Lessons learned and issues to address:

- Insights on input variables and identification of data gaps
- Critical need for spatial and temporal dynamics for all individual sound sources
- Challenges of assessing impulsive and continuous sounds simultaneously
- Modelling requires simplification/assumptions
- Modelling does not address masking potential
- Model does not include considerations of elevated noise levels between impulses as a result of reverberation and reflections
- Consequences of avoidance behavior
- Histories of individual modelled animals offer insights

Q&A | Comments:

Susanna Blackwell, Greeneridge Sciences: I did not understand what the SEL values shown were. Were they single pulse values?

Bill Streever, BP: All single pulses.

Robert Suydam, NSB: Didn't they also measure CSEL?

Melania Guerra, Cornell University: These are not all of the results. We used other metrics including cumulative SEL as well.

Chris Winter, Crag Law Center: This is great work. Can the model account for feeding and resting behavior in terms of whales' deflection? So does the model account for different reactions from feeding and resting whales demonstrated when they are exposed to underwater noise? Also, is there a way to account for lost feeding/resting opportunities?

Melania Guerra, Cornell University: Incorporating feeding behaviors from the perspective of the model would be a slowing down or stopping of the animat. That could be done. I forgot what your second question was?

Chris Winter, Crag Law Center: If you're talking about a whale odometer and then factoring in the energy expenditure of having to deflect around a source, could you also integrate into the model reduced energy from feeding if there are missed feeding opportunities as a result of the deflection or missed resting opportunities for cow/calf pairs?

Melania Guerra, Cornell University: The energetic output isn't there yet. The model outputs the length of the journey that the animat took from beginning to end, and then we can create distributions of the median of the migration for the ones that diverted and the ones that did not. It would have to be a future step for a future working group that looks into the actual energetic and what the energetic cost would be.

Bill Streever, BP: Remember, these are animats, they do what we tell them to do, so we're guessing at what bowheads really do. We program the whales to swim along, and, in the absence of sound, they are periodically slightly changing course. You could add programming in there that would make them probabilistically on a 1% chance every 24 hours that they would stop and feed or do something else. You could do that. You'd have to convince Bill Ellison, which is quite a challenge. The way we had it set up was we had the whales programmed and compared distances whales travelled with or without aversion, and what we found was the random movements whales make in the absence of avoidance is noisy enough that the level of avoidance that occurred in this particular scenario was lost in the wash so to speak. There was no energetic difference because there was no difference in the distance travelled overall because of the variability of the way the animats travel. Whether that is true in real life? You'd have to get some whales tagged and ground truth it with this model.

Robert Suydam, NSB: I'd like to add to that. For aversion, the model wouldn't handle whales averting at 120 dB, received levels. If they did, the whales would not swim past the sound source; they would always stay to the east. Bill said we couldn't put 120 in at the received level for aversion; that whales would never swim west. In order to simplify things and make it work and get output and simulate what might be going on is why the 160 dB level was the lowest received level of industry that was used for aversion.

Bill Streever, BP: I think Bill's argument was that because the entire migration corridor is ensonified at 120, whales are clearly passing through the 120, so, if they are averting, they are not completely turning around, but it doesn't account for skittishness and that sort of thing.

Robert Suydam, NSB: I was making that comment from your last statement, Bill, about whales averting and not averting and not a difference in swimming; that if they actually started averting at 120 received level that there may have been some differences.

Bill Streever, BP: Absolutely if you change the model you'll get different results, and we're really just guessing.

Melania Guerra, Cornell University: The take home message is that these capabilities exist, and once we have better input we're going to get better output.

Chris Warren, Exxon Mobil: My first question was around evaluating the model in terms of how predictable it actually is, but I think Bill answered that. I guess tagging whales would be one way to do that. If you have evaluated the predictability of the model, have you done a sensitivity analysis on parameters to see which of those parameters are key to find out more data in order to improve the predictability?

Bill Streever, BP: We've spent hours talking about it, but haven't gotten past talking about it. I also wanted to mention that Exxon Mobil, Russell Tait and Jennifer Dupont attended from Exxon Mobil at least some of our meetings, so there has been interest from some other parts of your company.

Darren Ireland, LGL: My question is along the same lines, but it essentially gets at the calibration idea not necessarily to what animals are actually doing out there but calibration to make sure the model, in the absence of seismic arrays or whatever might be going on, is that the animats are actually moving as one would predict so is the model calibrated and run ahead of time and are metrics produced to make sure those things are running as expected?

Melania Guerra, Cornell University: We did do several runs of the model, although I'm not sure if it was done as a calibration. The first run was done without aversion, and the second run was done with aversion, so we could vary those two outputs but not sure it was done as a calibration.

Darren Ireland, LGL: I think for the most part the non-aversion run is more or less a calibration run. What I was thinking of is, in an equivalency, is your run a vegetation model predicting vegetation cover of an area and you want to use that model to predict what vegetation might likely be like under climate change in a future year, you run that model on past data until you get it to predict what your current vegetation cover looks like so you know the model is treating your data correctly before you start projecting forward. The aversion versus non-aversion model appears to be essentially what I'm getting at there, I think.

Bill Streever, BP: There are a lot of things you can do with this. Our main goal for this project from the very beginning was to get people moving forward and quit saying there wasn't a way to do this because there are ways to do this. This is just one way.

George Edwardson, ICAS: On your animat, did you program it to go through the cultural shock of loss of ice cover in the Arctic Ocean?

Melania Guerra, Cornell University: So these animats are only looking at the model in terms of acoustic exposure. The cumulative in the title does not refer, like you're saying, to other impacts like climate change, ice cover, etc. For true, realistic, cumulative impact we will have to incorporate all of those.

Jolie Harrison, NMFS: Obviously the goal is to help our understanding when there are multiple sources, and you've done that for the case study that you did. I think one of the things we struggle with as a regulatory agency around figuring out what to do about multiple sources is that there are few examples and limited data about how an animal will respond to one source. But I think intuitively, when it comes to mitigation, we have some ideas on what to do. With cumulative sources, there is little to no examples of behavioral responses that can really be tied

to multiple exposures. And intuitively, because of how complex the interaction of sounds are from what the sources are, it is really hard to do. So what would be useful … I am wondering how close you think we are to having a model where regulators could put in different scenarios, and be able to say when I do that here is where the highest level is or here is where animals would be exposed, etc. I'm sure there are other good ways to use this besides what I'm suggesting but what I'm suggesting is I'd like to be able to say if I at least did these things I would have a picture of what these animals peak and cumulative exposures are in different situations, so I could think about what to do about it. My question is, do you see it going in that direction where somebody less experienced in modeling specifically might be able to do something like that?

Melania Guerra, Cornell University: We have had this discussion at the working group because some of the members are from organizations like yourself and are interested in using it and having it become a regulatory tool. We believe it is not there yet, and there still needs to be discussions as to whether that is the interest of the group and if that is the direction we want to go. We have definitely identified enough future work that has to be done before it is at that level.

Bill Streever, BP: What you're really talking about is using the software for 'what if' scenarios. The software has to become more user friendly and more available where people can essentially play with it on a desktop, and, I hope when Dave talks tomorrow about the software he's developed, he can talk about the possibilities of more user friendly versions of this kind of software. I also wanted to add the only thing you get out of this is chronic exposure.

Jessica Lefevre, AEWC: Thank you BP and the NSB for putting money and effort into this groundbreaking work. Thank you Jolie for thinking about how this tool can be used. In this kind of process where data are gathered that could be gathered in a way to make these kinds of tools easier to use, please raise it because this really is critical work.

Arctic Biological Important Areas

Megan Ferguson, Cetacean Ecology and Assessment Program, NMFS/NMML

I'd like to show you some draft maps and a framework that has been developed and at one point in this presentation I would like to ask for your help. I work at NMML and one of my jobs is to work on the BWASP/Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA) aerial surveys, now known as the Aerial Surveys of Arctic Marine Mammals (ASAMM). In 2011 though, I got involved in an effort by NOAA which is referred to as CetSound. I am on the CetMap working group - cetacean density and distribution mapping.

CetSound and CetMap are web-based tools for information repository. If you want to look at it, there is a website you can go to (google CetSound and you will find it). So how did this project come about? It's no surprise to anyone here that human activities in the ocean make noise. Sound in the ocean travels long distances, and there is more activity every day, so the oceans are getting nosier. That begs the question 'How does it impact marine life that uses sound for so many parts of their life functions: finding prey, sensing environment, communication, etc.?'

NOAA's involvement can be dated back to 2010. There is a multifaceted commitment to address cumulative impacts of human induced sound including developing tools and soliciting stakeholder input. The initial goals were: convene working groups that would produce a product. CetMap working group is to compile existing information and create new products to enhance and explore knowledge base for cetacean distribution and density. The Biologically Important Areas (BIAs) is one of the products that came out of CetMap. SoundMap was to develop new products to predict wide ranging long term noise contributions from multiple human activities. Another goal was to host a symposium to share the products, the website, talk about potential management applications and solicit input.

The working groups convened in January 2011 and consisted of 35 technical experts. Two analytical teams (HLS and Duke) were contracted to support modelling and mapping work. The working groups met twice and worked throughout the year. A symposium was held in May 2012 in Washington DC. Products are available on the CetSound website.

The CetMap objective is to create comprehensive and easily accessible regional cetacean density and distribution maps that are time- and species-specific, ideally using survey data and models that estimate density using predictive environmental factors. CetMap products include: information hierarchy, cetacean data availability analysis, new density modelling, biologically important areas, and one stop data visualization and discovery tool for scientists and managers.

The ideal resolution of the information is at the level of species or population, is on a month level, and by region (Arctic, Gulf of Alaska, Aleutian Islands and Bering Sea, East Coast, Gulf of Mexico, West Coast and Hawaii).

BIOLOGICALLY IMPORTANT AREAS (BIAs)

The rational for BIA's is to supplement quantitative information on cetacean density, distribution, and occurrence. However, numbers aren't all that should be considered. We want to identify areas where cetaceans are known to concentrate for specific behaviors, or be range limited, but for which insufficient data exist for a quantitative mapping effort. It provides additional context within which to examine potential interactions between cetaceans and human activities.

The definition of a BIA is for cetacean species with distinct migrations we identify reproductive areas (areas in which breeding, mating or young tend to concentrate), feeding areas (two types: areas where animals tended to congregate year after year after year and the more transient feeding areas), and migratory corridors (areas where animals are found in higher densities, travelling through and often bound by land or ice). Another type of BIA is that of a small or resident population (such as North Pacific right whale).

This is based on expert knowledge solicitations. We first identified regional experts, and we asked them to look at all the information out there and take their best stab at drawing polygons on a map to identify BIAs. The best available information typically came from books, peer reviewed articles, government or contract reports, published or unpublished data. The data types included sighting,

acoustic, tagging, photo identification, and historical whaling records. The products included narratives, maps, and metadata tables.

There was, in the solicitation process, an external review by the CetMap Working Group and by regional experts in academia, at the science centers, and we're having conversations with the North Slope Borough to hopefully have Robert and Craig look at them and also to see if they can help us figure out how to incorporate traditional knowledge. I don't know what is the most effective way to get that traditional knowledge in to this information, and we are very interested in figuring out how to do that. Essentially what I have is a bunch of maps for three different species showing where they undertake these different behaviors, and I'm hoping this can be part of a discussion we have. Eventually we will be submitting these BIAs for peer review and publication. At each step we are trying to gain trust in these products because we believe they will be useful in trying to understand the effect of human activities on these animals.

There are some caveats or cautions. One is that we limited this analysis to just the U.S. Exclusive Economic Zone (EEZ) only (200 nautical miles from shore) because the access to information and availability of information beyond the U.S. EEZ varies pretty widely. These BIAs represent only known areas of importance. There tends to be more important areas identified in areas where there has been research. We acknowledge that and say this is a first step, and we acknowledge that there could be other areas. There is a lot of variability in quantity and type of data used to define BIAs. The Arctic is data rich, but most of the data available for the Arctic was not packaged in a way that made it easily available to the public. In order to understand the maps you need to consult summaries and metadata tables. They provide references and sources of information. The metadata tables are an attempt to provide a very transparent way for you to look at the type of information that was used to define the important areas. BIAs are not equivalent to habitat or range.

Bowhead Whale Cow-Calf BIA. This (displayed) is a draft of how we got to the current bowhead whale cow-calf biologically important area map. For this figure, sighting data was really important. It shows all the bowhead whale cow-calf aerial survey sightings. I think this was from the entire historical BWASP data from 1979...is that right Janet? 1982? Okay. These are the sightings, and they were plotted by month and then drew polygons based on the outer boundaries of those sightings. Based on the sighting map, we come to this map, the standard map we are using for the BIAs. It shows that in July and August, BWASP has had lots of cow-calf pair sightings in the eastern part of the Alaskan Beaufort Sea. As the migration progresses on, the sightings are much further to the west as the animals are moving and in October is this dark chunk. One thing that was inadvertently left off this figure, and it will be fixed before it is distributed, is, off of Barrow in the springtime, there tends to be the cow-calf pairs that pass by Barrow on their way to the east.

Bowhead Whale Feeding is also another important topic that informs a lot of management decisions. Plotted here (displayed) is every year from 2000 to 2012 all of the sightings from ASAMM either feeding or milling whales. Each year is plotted in a different color. The circle size represents the group size. Two definitions were used: persistent feeding area (where whales were found year after year feeding) versus ephemeral area (some years they're there, some years they're not) but in a broader area you can draw a line around the two. The persistent area is between Barrow and

Smith Bay. Every year you tend to get quite a few feeding bowhead whales and some of the largest groups of whales. The rest of the Alaskan Beaufort also has feeding bowheads. If they are migrating, getting food is important. We classified the area from about Smith Bay to Demarcation Point as one of those ephemeral feeding areas. This includes information from spring survey work showing the feeding area in the lead system in May. What this shows is that between Barrow and Smith Bay, kind of close to shore, in August to October, is a persistent area and the rest of the Beaufort Sea shoreward of the barrier islands is an ephemeral type BIA.

Bowhead Whale Spring Migration BIA. This map (displayed) is based largely on satellite data, old BWASP data, and acoustic recording data. There are bowheads that hang out near the Barrow and Wainwright area in July and August. The July summer corridor extends from Wainwright offshore 80-90 km to the outer continental shelf in the Alaskan Beaufort Sea. In August, we see distribution further offshore from Barrow to Deadhorse and then it comes closer to shore. This is largely based on aerial survey and tagging data.

Fall Migration BIA. This is better known. The whales tend to be closer to shore. This map was from aerial survey data, acoustic data, and tagging data. This polygon ends right around Barrow Canyon. What the tag data seemed to tell us and what the aerial survey data and acoustic data tells us is that after you get past Barrow the distribution of the migration fans out; they aren't as concentrated. If we go back to the definition of a BIA, what we wanted to do for this exercise was ... The migration in Chukchi Sea doesn't fit that. It is too diffused and spread out.

Beluga Spring Migration: April to May shows the Beaufort Sea stock coming through. The cross hatching is June to July and that is likely the Eastern Chukchi Sea stock. The diagonal lines here in the Alaskan Beaufort Sea from over the continental slope and off shore of that is June to August Chukchi Sea stock.

Beluga Fall Migration: There is an abrupt edge of the polygon right around Barrow. The available information is that the beluga migration tends to get more dispersed as you go into the Chukchi Sea.

Beluga Reproduction & Feeding: For beluga reproduction and feeding we know they concentrate in the Kasegaluk Lagoon area; the Eastern Chukchi Sea stock. It is an important cow-calf area and feeding area in June and July.

Gray Whale Reproduction & Feeding: When we refer to a reproduction area, it is where we see lots of calves, and, especially in 2012, we had our highest number of gray whale calves. The areas where we see calves tend to overlap where we see the rest of the adults and that is from Barrow, past Wainwright and down to Point Lay. Cape Lisburne wrapping around to Point Hope and then a little further offshore of Point Hope and down south.

Next steps include:

- Application of tools to NOAA decision-making
- Formalize leadership, funding, and staff structure for the effort
- Continued outreach to enhance support and utility

- Maintenance, refinement, and expansion of tools

We want feedback. There is a link on the website to give feedback directly. You can indicate which tool you're commenting on and a place to give input. Everyone working on the project has added this on to an already busy plate. Our goal was to produce something that was going to be helpful in the management model. If it isn't helpful, we need to know that.

We have in the parking lot traditional knowledge, and my question to the audience is 'how can I tap in to that for this particular question?'

Q&A | Comments:

Pasty Aamodt, Inupiat Community of the Arctic Slope: I was newly elected in December, and this is my first meeting. I have been very alarmed in listening to some of the information that has been provided to those of us attending. The reason being, is the perception I get of the people, those of us from the Arctic, are looked at as though we have no expertise, no experience, and no credibility regarding our environment. It might be that we don't have everything nicely written in black and white on a sheet of paper we can provide as documentation of our expertise, but I would hope that the people who are doing the research will take seriously the comments that have been made by those of us who live in the Arctic year round and the knowledge we have that has been passed on from generation to generation. I was alarmed when I got to the section listening to you, Megan, and I respect the work that you're doing, but I think there is a huge gap that will need our expertise to fill in all of the gaps that I see. Primarily because of that little statement that was made that the product that is going to end up once completed as a potential management decision making tool. And without our input, I think it is unfortunate, NOAA, and other agencies, that it would be used to make major decisions. I kindly suggest you get in touch with the Inupiat Community of the Arctic Slope and also the NSB department that has been working on our whaling research and have us be the lead in providing you with information and documentation. It is all fine and good for research that has been done already about our area to be used as your foundation, but I believe you would be better off by using our traditional knowledge as a foundation for your research. I would strongly make that my recommendation. If you do that I believe you will find that some of the information may not be accurate that you have put together as part of your research. I am not saying this to be critical, I am presenting this as a way for you to have a well-rounded research document.

Megan Ferguson, NOAA: Thank you for your comment, and I was actually looking for criticism, and I apologize if I wasn't clear in stating that we are planning to work with NSB on how to tap in to that traditional knowledge. There are a lot of ways you could take a solicitation like this. One is you can try to come up with everyone who possibly has input and put them in a room and set them on their own and have them draw a map. The approach we took was to identify people that we thought were knowledgeable and have them come up with a draft and then open it up and ask 'how did we get this wrong'. One of the challenges to this endeavour is trying to convey within the restrictions of English language, our goals. We aren't trying to get at an entire range. We are trying to identify critically important areas. So if you are going to set aside the most

important areas, what should they be? And I think those discussion are going to be challenging but a necessary part of this. I appreciate the context you provided.

Bill Koski, LGL: I think by restricting the area you're looking at to the EEZ you are missing, or not capturing, biologically important areas to the animals. I think you need to look at the range for the whole year, and the tools to do that are the satellite tags that have been applied to belugas and gray whales and bowheads and look at how much time the animals have spent in various areas and include it in to your perspective over the whole year.

Megan Ferguson, NOAA: I agree. We aren't getting every BIA out there, and that is in our caveats. We needed to start somewhere, and, for this initial exercise, we had a year to come up with a prototype to show to people and say is this useful or not. In order to do that we had to chip it down to something that could reasonably be accomplished. Can we get a prototype in a year and if so, how to do that. If you're mentoring a student in something, someone new going in to a field, they want to tackle the world all at once but their chances of success in doing that are pretty unlikely. It's easier to start in small steps. So, we've taken a small step and restricted our focus to what we could accomplish and see where that goes and if it is helpful. I agree completely though, there are areas, a lot of areas, we haven't gotten.

Bill Koski, LGL: I think the problem with the approach that you've taken is you're spending effort in areas where you may not have to, and so it is kind of counterproductive in the long term. If you first identify the critical areas from the life stages of the animals, then look at those areas in detail, I think you'll end up with a better product.

Jolie Harrison, NMFS: I understand what you're saying, Bill. The one piece about biting off what we're capable of doing, but I do hear what you're saying about if you only look at small piece of range your prioritization might be different. I totally understand what you're saying and in part of what we have in the narrative and what we call metadata, although that's probably not the exact right word, is some of the things a manager would look at to evaluate the importance of an area like how many observations have been made or over what number of years. One of the things that we tried to get to is the acknowledgement of other areas. I understand what you're saying, I still don't think it diminishes the importance of getting this start. I totally understand what you're saying and generally one of the things we've been pushing is these are long lived species that go over a huge range that go outside of our jurisdictional boundaries from our statutes, and we have to take that in to consideration. We still think this is a very useful first step.

Megan Ferguson, NOAA: There was another comment I forgot to mention before and that was Patsy's concern about the application of this for management decisions. The reality of it is without a tool like this we get emails or phone calls from the people that are required to make the management decisions and they say 'hey, what do you know about the bowhead whale feeding?" I could let them know what I know, I could point them in the direction of someone else who might know. We feel like a tool like this is a step above that person to person communication. The questions are out there, and they need to be answered and answered today. So how can we come up with the best source to do that, that's better than the status quo that's going on today which is to go to your contact book for an area and say 'what do you know?' This is better than that.

George Edwardson, ICAS: I want to thank Patty for mentioning what I had in mind. These decisions will be made with this tool but in regards to your next step I would recommend you take the next step now and get together and set a time to go to the North Slope and at least spend a month because if you don't you won't know what's there. Go up there and do your research up there to get it done right.

Megan Ferguson, NOAA: Thank you for that comment, and I do go up there, and I help conduct those aerial surveys, so I've been up there in the summer, but I haven't been up there in the winter. I'm not trying to pass myself off as an expert on the ecosystem up there. I know what I know from my experiences I've had. They're undoubtedly limited. That's why I'm trying to reach out to you today and say help me. What's the best way for you to give me the information that we need to add to these to make them more accurate and more useful tools.

Chris Krenz, Oceana: Thank you for the presentation. I think this is important work, and I'm glad you're opening it up, and I'm glad you started it even if it's not necessarily as perfect as everyone thinks it should be. People in the communities and working with people like Henry Huntington and Lori Quakenbush who have done work to incorporate traditional knowledge and published it in different papers. I think there are methodologies out there for incorporating traditional knowledge. One question I have is do you have an anthropologist at NMML or at the Alaska Fisheries Science Center to begin to work with communities to incorporate traditional knowledge in to the work that you're doing? You said you went to the relevant experts. Just a clarification ... was that the western science experts or the co-management organizations as the other experts through their connections with the hunters to delineate these areas?

Megan Ferguson, NOAA: For this initial step, and we're talking about a nationwide effort, it was the traditional western science experts. As for your second question, we have a social anthropologist scientist, is that right Robyn, on staff at AFSC?

Robyn Angliss, NOAA: We actually have a division at the AFSC that includes a program of social scientists, and Megan and I were talking earlier today about trying to pull them more actively in to this project.

Megan Ferguson, NOAA: We also have the unfortunate problem of being the federal government who currently have no funding, and we have to pull teeth to make it to a meeting of the AFSC in Seattle. So there are some financial and logistical hurdles we have to overstep, but we're working on those too.

Chris Winter, Crag Law Center: I echo the thanks for work and presentation. It's important work, and drawing boundaries on a map is tough and presenting that information is also difficult. I have two comments/questions. I echo the concern about how traditional knowledge is incorporated in to the process. A recommendation, I just saw a presentation about a project on the Olympic Peninsula where a researcher went in on a GIS mapping project, worked with the community, laid out maps on a table and had the community in a systematic way provide input and then took that and factored it in to and built it in to a structured process for how that community input would then go in to developing some target areas and informing lines on a map, so I think that type of systematic structure would be really helpful to apply to the collection and analysis of traditional knowledge versus first drawing lines on a map and asking for feedback. The second point or comment is that I'm concerned a little bit about the treatment

of much of the Beaufort Sea as a single unit in terms of its importance as a BIA and whether that reflects the traditional knowledge or even the western science that I think tells us that we know more with a greater level of specificity of detail about different areas in the Beaufort that maybe provide unique habitat characteristics, and so I guess I would ask that you take a closer look at whether it's appropriate to classify that whole large area as one unit. And a good starting place might be NMFS' 2010 biological opinion for offshore Arctic activity where NMFS concluded that the best available information shows that Camden Bay is actually a unique special place of importance for bowheads because of this feeding and resting activity. So maybe that type of information can inform a finer grained analysis of the Beaufort as to what areas are important rather than treating that one whole area as the same.

Megan Ferguson, NOAA: I'm just going to reiterate that this is a draft, and we're looking for feedback so I appreciate your feedback.

Sudie Hargis, Coast Guard: When you're finished, if you could keep in mind when you spend your month in Barrow collecting traditional knowledge if you could also share that interagency wide once it is finished so it could go in to things like, for example the Arctic Slope Siberia Contingency Plan, so that that very important biological information can be available in case there is a situation where we need that information on the spot for a response. The other thing, for conference organizers, is the potential for making some changes to the structure of this meeting to engage folks further and have more opportunity to have real dialogue and perhaps taking Wednesday afternoon or Thursday morning and having some working group breakouts so that, for example, traditional knowledge could be discussed in a more in depth level and identify key people and key ways to do that.

Megan Ferguson, NOAA: We are in touch with Arctic ERMA, and that is one place where we would like to show these areas.

Richard Kuzuguk, Shishmaref: I would like to commend your program for trying to start the process of acknowledging traditional knowledge and how to best use it. It would be unique for specific areas, villages, and traditional hunts. I want to comment on the sites you talked about earlier, the persistent area and the ephemeral area, and that it is important that you check back as to why, in the ephemeral area, the number of bowhead are not going back to where they were as compared to the persistent areas. There is probably some sort of event or something that happened for the mammals not to go back to that area. Working together we have to include traditional knowledge to make the full package and to figure out how these impacts are affecting marine ecosystem and wildlife.

Megan Ferguson, NOAA: Thank you for that. I completely agree with you. It would be really nice to know why they're going where they're going, is it due to changes in prey distribution, is it due to changes in the oceanography, is it due to anthropogenic activities, or is it just a yearly variation.

Ron Felde, Facilitator: There was a question as to whether the website is ready?

Megan Ferguson, NOAA: Yes, it should be able to receive feedback.

Enoch Shiedt, Maniilaq: A recommendation is that if you are going to take the traditional knowledge, I think it should be done not only at North Slope but along the coastline of Alaska

because it is going to impact all of us. And for your information, all our sea mammals go up north. Before you do your seismic studies, I think what you need to do is an aerial survey and see what kind of sea mammals you see and how far they disburse after the seismic survey 12 hours up to 48 hours to see how far they are being disturbed.

Megan Ferguson, NOAA: That reminds me that we didn't include seals or sea lions in the CetMap effort. We restricted it to whales and dolphins just so that we didn't bite off more than we could chew in the initial effort.

Robert Suydam, NSB: When Chris Krenz stood up a second ago I thought he was going to say something different. In particular, I wanted to make sure that you know that Chris, Oceana, and Nature Conservancy and Audubon have done something really similar to what you've presented here. They call them Important Ecological Areas. I highly encourage you to talk to Chris so there isn't unnecessary duplication of effort. When you decided what were BIAs, it seems like you've done it subjectively. Is that true, and will there be effort to come up with some objective criteria for what a BIA is?

Megan Ferguson, NOAA: It is subjective. We thought about coming up with objective criteria and that's what led us to the metadata table and it's because the amount of information varies so greatly in the marine areas around the U.S. It was really hard to come up with objective criteria, but we needed answers now.

Robert Suydam, NSB: The maps you showed look like it is just for the Arctic, but has it been done in the Bering Sea?

Megan Ferguson, NOAA: Those are still in internal review, but yes, we are working on those as well.

Eleanor Huffines, Pew Charitable Trust: Really this might be up to Johnny, Harry and the other whalers but one idea might be, in your criteria you talk about feeding, resting, and migration but perhaps the actual hunt, where people go, and that might have to be confidential and not on the public mapping, but to include the actual subsistence use area as part of the criteria might be one idea.

Megan Ferguson, NOAA: Thank you for that suggestion.

George Edwardson, Inupiat Community of the Arctic Slope: You asked earlier what should we do? To start off with, you conducted a lease sale when you were not prepared. Now you are in the process of hurrying us up to give you your information so you can be in order with all the environmental regulations the United States has plus the international treaties. My suggestion is that you retract the leases and get the education done right first and then let's look at it together. Right now you have put the United States in a very critical situation. The Coast Guard even says they are not ready. They do not have ships that can take care of you when you're out there. Back off and then let's do it again. When people make mistakes we admit it, and then we correct it. It's your turn.

Daniel (*did not identify last name or affiliation*): Yesterday I heard someone say they used traditional knowledge to modify a discharge permit. That doesn't make sense to me. There is nothing in traditional knowledge or values that parallels dumping waste fluids in to the ocean.

I'm afraid traditional knowledge is being used as a rubber stamp. "Yeah, we talked to the subsistence users. We got traditional knowledge." This whole process involving traditional knowledge is important, but, like I heard yesterday, 'we used traditional knowledge; we modified the permit' ... I think "used" is the proper word. They're using our traditional knowledge to stamp these permits. "Yeah, we went to the villages; we talked to the people; we got the traditional knowledge; now issue our permits." It's all premature. There is no spill response; yet we are continuing the whole process of permitting, and studies and more studies. Before anything moves, we need to get rigorous spill response, design, and research. If you look at any other industry ... energy, coal, landfills, nuclear … they have to prove containment before they proceed, and, yet in our waters, we are the exception. A single spill response drill that is successful … we don't have it. Can you give me examples of traditional knowledge and how it will be incorporated in this?

Megan Ferguson, NOAA: I envision distributing the maps and documentation that we have and explain what we're trying to achieve and ask what additional information do you have, where have we gotten things wrong, where we have gotten right, show us how you would do it. This is something you can look at and through your observations alone you have information about it, and I think this is a good case study for trying to do that.

James Patkotak, AES: I have a solution to your problems folks. I hear people from the feds, state, and industry, and I don't see a local person on your staff or on the panel itself. Why is that? You are crying for traditional knowledge. Get someone on board that can help you guys along and act as a liaison between you folks and the local Alaskans.

Rhonda Sparks, Alaska Nanuuq Commission: I am the Regional Coordinator for the Alaska Nanuuq Commission, born and raised in Nome, half Siberian Yupik and half Caucasian. I went to school and got my anthropology degree and got hired by the Alaska Nanuuq Commission to go do a traditional ecological study. We are working on a co-management plan with Russia and USFWS incorporating traditional knowledge on how to manage a population of the Chukchi Bering Sea polar bear population. That is a way traditional knowledge can help. Also, recording that history. It is a two-year project, and we've lost five members from the initial study so it is important to document those studies, traditional knowledge and information before it is passed on. Traditional knowledge is important. We use it for management decisions. Alaska Nanuuq Commission is using it to make management decisions, and it compliments scientific western studies, so it works together. There is a solution. A two year study, we did one species. The Northwest Arctic Borough is doing an array of species.

Lisa O'Brien, Facilitator: In my history with this meeting, the issue of traditional knowledge ebbs and flows. For some reason, this year, it is a topic that keeps coming back. It needs to be dealt with. I'm going to suggest a structured model for this. (Relayed a story about a past client about Citizen Advisory Committees.) What is being said around this room is 'my knowledge is just as valid as your science.' You all need to figure out a way to get the soft and the hard sciences together. You will keep hearing about this again and again until you figure out a structure to marry and integrate the soft science (the heritage, observation, etc.).

Report Out from 2013 Peer Review Panel

Megan Ferguson, Cetacean Ecology and Assessment Program, NMFS/NMML

2013 panel members: Michael Cameron, Christopher W. Clark, Megan Ferguson, Jason Gedamke, Brandon Southall, Robert Suydam.

4MP objectives, as indicated by MMPA implementing regulations:

- Document effects of activity (including acoustic) on marine mammals
- Document or estimate the actual level of take as a result of activity
- Increase knowledge of affected species
- Increased knowledge of anticipated impacts on marine mammals populations

Additional goals, recommended by NMFS include:

- Marine mammal presence, abundance, distribution, or density
- The nature, scope, or context of the likely exposure of marine mammals to any potential stressor associated with the action
    - The action itself (acoustics)
    - Affected species (life history, dive patterns, etc.)
    - Co-occurrence of species with the action
    - Likely biological or behavioral context of exposure to stressor (age class; known pupping, calving, or feeding areas).
- Marine mammals' behavior or physiological response to specific stressors associated with the action
- How anticipated individual responses to individual stressors or anticipated combinations of stressors, may impact either
    - Individual long term fitness and survival
    - The population, species, or stock
- Effectiveness of mitigation and monitoring measures
- Manner in which the authorized entity complies with the incidental take authorization and incidental take statement
- Increased probability of detecting marine mammals (improved technology or methodology), both within the exclusion zone and in general

There were questions posed to the peer review panel to consider for each application being reviewed. Recurring themes that came up

1. Will the applicant's stated objectives effectively further the understanding of the impacts of their activities on marine mammals and otherwise accomplish the goals stated above? If not, how should the objectives be modified to better accomplish the goals above?
2. Can the applicant achieve the stated objectives based on the methods described in the plan?
3. Are there technical modifications to the proposed monitoring techniques and methodologies proposed by the applicant that should be considered to better their stated objectives?

4. Are there techniques not proposed by the applicant (i.e. additional monitoring techniques or methodologies) that should be considered for inclusion in the applicant's monitoring program to better accomplish their stated objectives?
5. What is the best way for an applicant to present their data and results (formatting, metrics, graphics, etc.) in the required reports that are to be submitted to NMFS? (NMFS' implementing regulations require IHA holders to submit a 90-day technical report that is due 90 days after completion of activities under the IHA.)

The panel met in Seattle on January 8-9, 2013. There were closed door presentations by IHA applicants, and then the applicants were excused and the panel members discussed the applications. Each panel member was assigned individual reports to draft, and they were circulated among all panel members to comment on. Individual reports were revised, and the final draft is expected to be delivered to NMFS on March 15, 2013.

There were seven IHA applications reviewed

1. BP's North Prudhoe Bay Ocean Bottom Cable
2. ConocoPhillips Chukchi Sea Exploration Drilling
3. SAE Beaufort Sea 3D Seismic Survey
4. Shell Chukchi Sea Exploration Drilling
5. Shell Beaufort Sea Exploration Drilling
6. Shell Chukchi and Beaufort Sea Marine Surveys
7. TGS Chukchi Sea 2D Seismic Survey

Noted improvements

- Willingness by applicants to consider and test alternative monitoring approaches
- Chukchi Sea Ecosystem Studies Program - ConocoPhillips, Shell, Statoil
- Shell's 2012 aerial surveys collecting high resolution photo and high definition video data (needs further testing and evaluation)
- Suite of broadly distributed acoustic recorders
- PSOs including data acquisition and archival software, stationed on vessels most likely associated with impacts, and observation location on vessels optimized for sighting animals.

A complete IHA application includes

- An attainable, defensible, and detailed 4MP for the panel to review.
- Overall objectives should provide reliable and statistically robust estimates of the number of marine mammals in the project area and information on their distribution and movement patterns, with sufficient power to determine if, and if so how, all aspects of the project's operations affect marine mammal density, distribution, and movements.

Take Estimates

- Take estimates come up twice in the review process: once in the application process as to "how many animals will be affected." The status quo is to take rough density estimates from aerial survey data and multiply by predicted acoustic footprint. It does not account for animal movement, multiple takes on a single individual, variability in density estimates and cumulative effects.
- Take estimates also come in to factor at the end of the season. The concern of panel is that of low sample sizes and biased data.
- One of the recommendations is there needs to be a workshop to tackle the topic of take estimates. Potential solutions include
  - Multiply by a temporal component,
  - Provide two extremes: lower bound (density times area) and upper bound being density x area x time. This would help to provide uncertainty estimates.

Estimating Safety Radii

1) During the pre-season:
   - Should be based on site specific acoustic propagation models and empirical measurements.
   - Should err on the precautionary side
   - Should include all sound sources.

2) On Site
   - IHA app needs to specify types and quantities of data and the levels of analyses necessary to meet sound source verification requirement.

Protected Species Observers (PSOs)

- PSOs can likely implement mitigation measures to prevent or limit level A takes because it typically relates to nearfield monitoring
- One PSO on duty at a time is insufficient for mitigation monitoring
- Increasing the number of PSOs on duty at one time increases detection probabilities only up to a point but this leads to logistical issues
- Detection probabilities diminish drastically in darkness and bad weather
- PSOs should not focus on recording behavior at the expense of sighting animals
- PSOs alone cannot estimate takes, evaluate impacts, provide baseline data on distribution, density, movement, or behavior (observations are limited to animals that surface close to the observation platform; PSO data are not equivalent to rigorous scientific surveys)
- PSOs must have authority to implement mitigation actions when necessary and safe

Passive Acoustic Monitoring

- Effective tool for far field monitoring
- Should
  - be conducted before, during and after operation enters the project area
  - be broad spectrum

    - include bottom mounted recorders and near real time monitoring by satellite phone
    - allow localization and quantification of marine mammal acoustic detections

Aerial Surveys

- Communication protocols among programs should be established before season begins and followed throughout the season
- Aircraft should circle to estimate group size and determine whether calves are present

New Technologies for Far Field Monitoring

- Underwater vehicles
- Gliders
- Satellites
- Unmanned aerial systems

Acoustic Exposure Criteria

- Level B harassment radii
- Distinction between 120 dB isopleth for "continuous" sounds and 160 dB isopleth for "impulsive" sounds is artificial
- Bowhead whales response to sounds less than 160 dB, so should monitor all activities out to 120 dB.

Other

- Handling/monitoring of discharge
- The definition of "non-seismic" should be stated explicitly in the IHA application and any resulting analyses

Cumulative Effects

- Collaboration with other operators is essential
- Data collection and access
    - Record and archive all vessel and aircraft tracks and activity states
    - Make all activity logs, vessel/aircraft tracks, and monitoring data publicly available
    - Standardization needed
- Integration of data across observation platforms or monitoring methodologies and operators is needed
- Include all aspects of operations when evaluating effects
    - Need to monitor and characterize the ensemble acoustic footprint
- Spatially explicit information on the sound field and activity states
- Examine variability over time
- Need acoustic signatures of all sound sources

Presentation of Results

- Useful summaries and interpretation of results of monitoring plans
    - Efficacy of marine mammal measures
    - Summary of measurements and observations
- Clear timeline and spatial representation of operations and important observations

Preview of 2013 Panel General Report

- Take estimates
- Development of best practices for mitigation monitoring
- Development of a comprehensive monitoring plan for the Arctic
- Integration of information to understand cumulative effects
- Acoustic exposure criteria
- Methods for monitoring ice seals

TGS 2013 Chukchi Sea Seismic Survey Operations and Monitoring Plans

Steve Whidden, TGS

I am the project development manager and program manager for the proposed 2D seismic program. The team includes myself, Troy Nelson and Brad Torry from TGS, along with ASRC Energy Services (AES). I will be presenting program details, and then Mari will talk about monitoring and mitigation.

The proposed survey location is here (displayed). The majority is in U.S. waters, but there is a part outside the EEZ. The closest community is Point Lay about 55 miles from the nearest track line. One question that is often asked is "why do seismic?" Oil and gas uses seismic data to help make decisions as to whether they should explore and where should they position their 3D survey.

In U.S., waters the survey will start between mid-July and mid-August. Seismic should last approximately 35 days; the operational period will be approximately 45-60 days. The plan is to complete the survey lines closest to the Alaska shore first (July – August). In International waters, the survey will start mid to late September or early October. Seismic will be acquired over a period of up to 33 days. It is positioned greater than 200 nautical miles from the Alaska coastline. We may not get a lot of the international program acquired depending on the ice year.

Projected project vessels include the Aquila Explorer with a five mile long (8 km) seismic receiver cable and a 3,280 cubic inch seismic source (reduced from 4,100 cubic inches). The Scout will be the monitoring vessel. It will operate in advance of the survey vessel and will assist in emergency or equipment failure.

MONITORING AND MITIGATION

Mari Smultea

The standard monitoring and mitigation includes vessel based PSOs on both vessels, including Inupiat PSOs and traditional knowledge, scientific PSOs, big-eye binoculars and night vision devices. We will have two observers on during seismic, except possibly during meal breaks. We will be doing sound source verification study. JASCO will be conducting that and will be taking measurements in real time of the seismic vessel. All the standard measures of power down, ramp up and shut downs along with speed/course alterations. Will participate in communication centers, and we are getting ready to sign the 2013 Conflict Avoidance Agreement.

The basic steps of standard mitigation outlined are:

1. Sound Source Verification (SSV): 160, 180, 190 dB zones (PSOs monitoring pre-season modelled exclusion zones)
2. Before ramp up (30 minutes): PSOs to monitor 180 and 190 zones. Scout vessel monitors 160 zone.
3. Ramp-up starts: gradually increase sound over 15-20 minutes
4. Power down to one small source if marine mammal is approaching or in the exclusion zone
5. Shut down if animal near or in one airgun exclusion zone.

These are the modelled sound source radii. However, I do want to point out that these were based on the original larger array of 4,100 cubic inches, which has now been reduced to 3,280. So these are actually farther than what would be equivalent for the smaller array now. JASCO and TGS are working on revising the distances. Modelling was done for three different water depths. The 190 dB in shallow waters is 810 meters and in water depths over 100 meters it is 430 meters. The 180 dB goes from 2.4 to 2.6 km out and the 160 dB at this point is 9.6 to 18 km. These numbers will be smaller based on the remodelling. The 120 is included as well. JASCO usually adds a 10% buffer to be more conservative, so these numbers reflect that 10% buffer.

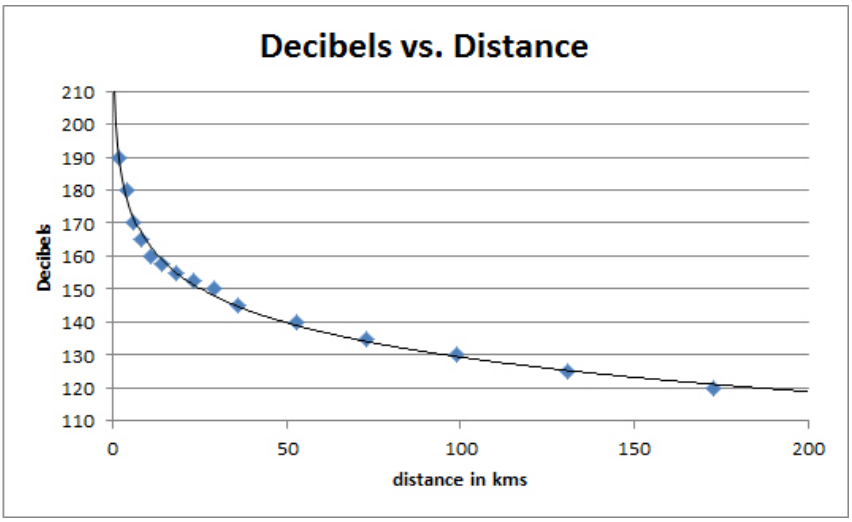
When we were going out to community meetings there were a lot of questions about equivalent sound comparisons to the NMFS Regulated Zones, so we pulled it together in this chart (displayed) to give a general overview. The blue is where the NMFS mitigation zones are for the impulse sounds.

Underwater Sound Levels in decibels (dB)*	Sound Source
206-225	Beluga whale
193	Icebreaking
190	**NMFS monitoring criteria for polar bear & seals**
128-189	Bowhead, fin, gray whale
180	**NMFS monitoring criteria for whales & Pacific walrus**
162	Chainsaw/skidoo
160	**NMFS monitoring criteria for large groups of whales**
151	Fishing vessel
122	Normal human conversation
60	Ambient noise, sea state zero (0)

***dB re 1 µPa [rms]**
Sources: Richardson et al. 1995, Richardson 2005, Tervo et al. 2012; http://www.acousticecology.org/oavalidtocompareairwater.html; http://www.dosits.org/science/soundsinthesea/commonsounds/; http://www.arc.id.au/SoundLevels.html

Another question was how does sound drop off at a distance. A graph showing decibels versus distance shows how quickly the sound drops off (displayed). The project sound characteristics

include intermittent pulses about every 11 seconds. They are brief in duration, less than 3 milliseconds at the source position. They are directed to the sea floor but there are reverberations that go off to the sides as well, which is why it travels longer distances. The sound drops quickly with distance.



I'll speak a bit to how the project was designed and how we took input when we went to the different villages to work on the design to try to avoid and mitigate potential impacts to marine mammals. The survey lines are mostly offshore, 55 miles from the closest community (Point Lay). The survey lines fall outside most of the main bowhead and beluga migration corridor. We did get some feedback from the communities because of the walrus hunt to try to do the nearshore lines first and as quickly as we can move offshore. We've taken that in to consideration with the proposed project operations. We also got feedback about the importance of starting after the spring whale hunts. TGS proposed to be in far offshore waters during the fall. This is where TGS proposes to be in the summer and fall (displayed maps).

Some more on our mitigation to minimize impacts. We won't be using any multi beam sonar or sub-bottom profilers, only standard vessel fathometers. There will be only one small source element operating during line changes with an estimated 5-12 hours to travel between each line. When we presented this to the panel in January we proposed during the turns between the lines to reduce the number of seismic pulses. There doesn't seem to be any studies on the effectiveness of this but overall seemed like a potential approach to reduce sound.

We will also introduce some new, additional technologies:

- Mysticetus program (an all in one survey system). It allows the user to configure the input to the data sheet. It produces a highly detailed topographic map that you can display as you go through the waters. It can produce the distances to the mitigation zones while on the water. You can hook up to the fathometer to measure water depth. You can produce a summary by day. Dave Steckler will speak more on this tomorrow.

- AIS Real Time Mapping System using Mysticetus. This technology doesn't go as far, about 24 nautical miles, but we're planning to use this so the vessels have a radio system and a laptop that can display what the other vessel is seeing. There are more features that Dave will talk about tomorrow. We are hoping to more effectively monitor mitigation zones.

We received the NMFS panel review recommendations on February 26. One recommendation was to reduce sound emissions. We are now reducing the size of the array, the number of pulses that are emitted, and turning off the fathometer when not needed for safety purposes. Regarding the sharing of sightings, tracks and sound data: we've been open to making data available. One of the ways to do that is a database run by Duke University called OBIS-SEAMAP. Mysticetus puts data easily into a format to upload to the site. They will provide the times the seismic pulses are occurring. We do hope to integrate with other 2013 studies. Constant PSO communication was also a recommendation. We will be using real time AIS multi vessel map display using Mysticetus. There has been a concern because of the large size of the array that TGS is using how to monitor out to the 160 dB zone and beyond. It is a very difficult thing to do, as we all know. Right now we're investigating a different type of autonomous acoustic recorders that are moored on the bottom. They're also looking into different technologies that are available and one of the keys is being able to record beluga sounds, and we'd like to have some kind of tool that can be used to record belugas as well. The one limitation with that is they can't be heard quite as far as bowheads, but TGS is looking at putting multiple recorders out. TGS is looking into possibly, or ideally, at the beginning of the season going up to the north to set hydrophones in areas above 72 degrees where there haven't been many acoustic recorders. There is not a lot known about movements in that area, so putting them out where there isn't much information and then as TGS moves up there they can take out the recorded information. The panel recommended revaluating beluga take estimates. We will be looking at that and gathering more information to estimate takes. There was a suggestion to use the scout vessel out in front of the seismic vessel to look for marine mammals coming near the seismic vessel. We are working on a systematic design to survey animals out ahead of the seismic vessel.

Understanding and engaging with the communities and addressing concerns is very important to TGS. (Displayed a synopsis of 2012-2013 consultation and outreach efforts).

Our current project status and progress includes ongoing engagement with affected subsistence communities, we are implementing a Plan of Cooperation, and we are participating in AEWC 2013 Conflict Avoidance Agreement. We are responding to NMFS comments on the IHA, and we've updated the IHA and 4MP. We are submitting the USFWS LOA and 4MP. We have submitted BOEM G&G and Plan of Operations. We are currently developing our 2013 PSO program.

Q&A | Comments:

Brad Smith, NOAA: Is that going to be through the AK Marine Exchange and will it be available online in real time or is it propriety to your company?

Steve Whidden, TGS: No, it's not proprietary, and it will be as real time as possible. The idea is we are going to upload the data as we can and when we do have connectivity to shore. It will be

relatively close to real time, as close as possible. It will be digital, can be uploaded to website in a useable format, and anyone in the public can access the website and see that data.

Mari Smultea, SES: This is a different kind of AIS than what is being used by the vessels, so it won't transmit by satellite or anything, but it will be live between the two vessels. It is much less expensive and has a smaller range. Dave Steckler is the one that is working on it. Dave, do you want to add anything on that?

Dave Steckler, Entiat River Technologies: (unable to hear)

Brad Smith, NOAA: Will you be contracting with Marine Exchange to get a transponder on the vessel? *(over talking by multiple people at once)*

Brad Smith, NOAA: I think we're talking about a couple of different things but we can take this offline. My second question is, one thing that has become apparent is that the modeling that is done prior to SSV can vary widely with results, how long might your company be operating before the results of the SSV are in and you've made adjustments?

Mari Smultea, SES: We are required by NMFS to have it within a certain number of days, I think 3-5 days. Is that what it is? It's currently five days. We would have that information within five days.

(Unidentified): Does that mean five days after the survey? Or how long could they operate before the survey takes place?

(Unidentified): It's five days after they get the data back to where it's being analyzed.

Steve Whidden, TGS: The logistics of picking up those sensors, and maybe JASCO can comment on that. So these sensors will be deployed, and there's a pattern that their deployed, the vessel will come online at a certain distance from this array of sensors, we'll start firing our source, acquire data, pass the sensors, then when we come back, I anticipate that's when logistically we would be picking up those sensors and begin the analysis. That's kind of the way I anticipate it. Pick a line on the southern edge, acquire our line past those sensors, come back relatively the same direction, and, as we come by, we would have our scout vessel pick up those sensors. I do realize if the scout vessel is not online, and not with us mitigating our program, we'll have to turn off our sources, but we'll do that because I know it's important to get the data as quickly as possible.

Mari Smultea, SES: We will be using the original estimated distances to the zone until we get the information back from the sound source verification, and if those change we'll change them and concur with NMFS on that.

Richard Kuzuguk, Shismaref: Can you paint the picture on how the seismic activity works? You mention that you reduce down to one airgun when a PSO sights a specific species. How many airguns are going off prior to reducing to a single airgun?

Steve Whidden, TGS: I don't know the exact number off the top of my head but it is in the range of 30 that are in our seismic array.

Richard Kuzuguk, Shismaref: My other question I'm having a hard time picturing is that you say there is a blast every 11 seconds and that comes out to about 15,840 blasts with all airguns?

Steve Whidden, TGS: Every one of the sources fires at exactly the same time within a half millisecond. So it is really one pulse when all these elements fire.

Richard Kuzuguk, Shismaref: Each of them with 160 dB?

Steve Whidden, TGS: No, that varies with distance. On the Sound Source Radii slide, at those different depths in meters, that's how many dB we have. As you get closer the numbers go up. In our graph there is a very approximate drawing of approaching essentially zero distance. Some people don't realize it isn't a point source like a stick of dynamite. This energy is distributed through a box, and this box is 20 meters by 15 meters so to say that you can extrapolate this back to position zero isn't valid because it isn't a point source. It is distributed through a 15 x 20 meter box.

Richard Kuzuguk, Shismaref: That would still have some type of immediate take, direct hit, on the bottom. How far is the survey miles?

Steve Whidden, TGS: It is approximately 9,500 km in total in both U.S. waters and international waters.

Colleen Swan, Kivalina: On your plan of cooperation I don't see Kivalina on there. We are a whaling community, the only one in the Northwest Arctic Borough. We have concerns about migrating mammals. Last fall we had ringed seal come in to the lagoon to get on the ice, and that never happens. They were not trying to get away from people who were approaching, and, so I begin to wonder, what is distressing the seal. They never come in to the lagoon. They didn't want to go in the water; they just stayed on the ice as thin as it was. There doesn't seem to be an elimination process to help us determine what is causing it. Our hunters have a lot of knowledge. They are willing to give information but in order for us to find answers we need the information you have. Earlier I had raised my hand on the traditional knowledge subject, but I was overlooked. When you are coming to one of the communities, call one of the governing bodies and establish protocol on how it should be done because every community is different. There is a whole process to gathering traditional knowledge, and there are different ways to do it for different types of different activities that go on. We really need to have this information, and I still don't know why we aren't in that plan of cooperation.

Steve Whidden, TGS: I appreciate that. I think that is something we need to address. We talked about that earlier in the open meeting, the TGS team, on our oversight or neglecting having your community as part of our process. I commit to you that we will address that. With regards to traditional knowledge, I am far from an expert. I understand how deep and complex traditional knowledge is to the people in your communities and how to a certain degree we've done what we could to incorporate that in to our LOA and plan of operation and mitigation methods. We've only scratched the surface, and we're open to considering more ways to help us minimize the impact to the North.

Jolie Harrison, NMFS: I was noticing the two bullets on Current Project Status and Progress (responding to NMFS comments on IHA and updating NMFS IHA), is that referring to just fixing the things that we've asked or are you anticipating some changes that we don't know about yet? I just wanted to remind folks of the timelines for our process.

Mari Smultea, SES: We actually have a call in to Shane, but we're just addressing your comments.

Bill Streever, BP: I think I saw on one of the slides that if you sighted dead marine mammal carcasses that you were going to stop operations? In the past we've had negotiated

arrangements with NMFS that are pretty standard because you're going to come across carcasses that are obviously nothing to do with your operation.

Steve Whidden, TGS: I definitely understand that. I attended a meeting with USFWS, and they did talk about what kind of carcass you shut down for and what you don't, so I understand there is a set protocol for that. That is a very good point.

Robert Suydam, NSB: If you don't get all the survey lines in this year, is it likely TGS will be back in 2014 to complete the survey or move to other areas?

Steve Whidden, TGS: I'm hopeful and there is a high probability we will get most of the lines in the U.S. waters. International waters, I'm not sure that we would come back just for those. I hope TGS will be a long time participant in the activities whether 2014 or 2015. We want to be a part of the process in the North.

Robert Suydam, NSB: If you leave acoustic recording instruments out at 72N over winter, I assume you will have a plan to pick them up if you are not coming back in 2014.

Steve Whidden, TGS: That would be part of our consideration as to whether we leave them there or not.

Mari Smultea, SES: We've been coordinating with some other folks to see if they could pick them up if we could not.

SA Exploration Inc. 2013 Beaufort Sea Seismic Survey Operations and Monitoring Plans

Rick Trupp, SA Exploration Inc.

We have a non-proprietary program planned for 2013 with multiple lease holders in the area. We anticipate starting the permitting process and engaging with agencies. We've had some stakeholder engagement, but will continue our community meetings prior to the program in early June. We anticipate mobilizing our activity in early July with boats moving to the prospect area. Our acquisition timing is planned for approximately July 25 through September 15, and the sound source verification will be within 72 hours of initiation of activities.

The prospect area on the scope of Beaufort Sea side of things has been placed in a location as it relates to the limitations to the geophysical activity based on the geographic area in the conflict avoidance agreement. And to further define our prospect area, we've highlighted it on this map (displayed) so the prospect area is really in the Colville Delta region and relating to the conflict avoidance area limitations of geophysical activity, the blue area signifies there is to be no geophysical activity from August 25 to the close of fall bowhead whale hunting in Nuiqsut but geophysical activity is allowed at other times. In the purple area, prior to July 25 inside the barrier islands there is no geophysical activity. So when we say we're going to start around July 25th we do that for a couple reasons. One is because typically in nearshore the ice is still in the area so it isn't prudent to come in too early, plus also to work under the Conflict Avoidance Agreement we won't start activities in that area as well. The prospect preplot is defined here (displayed).

Some of the features of the Kuukpik SAE program include:

- Kuukpik Corporation - Joint Venture partner
- Experienced marine mammal monitoring program
- Experienced personnel
- Nodal technology
- Use of local industry vessels – some of the vessels on the slope but also vessels we've used in previous applications.
- North Slope traditional knowledge base
- Experienced Inupiat PSOs and communicators
- Participation in Conflict Avoidance Agreement

Vessel Configuration

- 1 acquisition source vessel mothership: 1760 cui array
- 1 acquisition source vessel – 1750 / 880 / 440 cui array
- 2 nodal layout vessels
- 2 bowpickers to support the nearshore areas with layout/pickup
- 1 mitigation vessel
- 1 supply vessel (groceries, personnel, supplies, etc.)

Marine Mammal Monitoring

- 3 PSOs on each source vessel
- 3 PSOs on the mitigation vessel
- 1 Inupiat communicator/PSO included as PSO staff per monitoring vessel
- Daily comm center call ins as per the CAA, when and if a com center is set up during our timing window

MARINE MAMMALS

Greg Green – Owl Ridge

Since we last met with some of this group here there were a few recommendations, and we've made some changes based on those recommendations. We've added the mitigation vessel to our fleet for marine mammal monitoring. The seismic box has been greatly reduced; the top of the box is 8 km further inshore than it was before keeping all seismic within the 15 meter isopleth. One of the bigger things in question was regarding our take estimates. The recommendation was that we use specific take estimates from empirical data collected by JASCO at the Liberty prospect for 880 cubic inch guns. Up to about a mile and a half you see a linear relationship and this transmission loss, and from there it drops off a bit so you basically have two different transmission loss models, one sort of like a nearshore and one basically nearfield and farfield. We used that in a couple different ways to recalculate safety radii. If you look from the data we were using from the Liberty when they had a model for their 880 cubic inch gun with a 228 dB source, they came out with 390 meters and 880 meters. We then actually went and did the empirical measurements. They came out to 167 and 494. We used that same model and adjusted for the louder guns and came out with 319 and 838. These values are larger than those values, which makes sense, so these are the values we are then going to be using for our safety radii rounded off to 350 and 850 meters. What we find

here in using this model is we get out to 160 dB at about 3 km, and we're at the 120 dB at about almost 10 km.

	Jasco/BP Liberty 2008 Modeled	Jasco/BP Liberty 2008 Emperical	SAE Using Jasco/BP 2008 Emperical	SAE Using Jasco/BP 2008 Emperical
Isopleth	**880 cui** *228 dB*	**880 cui** *228 dB*	**1,760 cui** *236.6 dB*	**1,760 cui** *236.6 dB*
190 dB	390m	167m	*319m	*319m
180 dB	880m	494m	*838m	*838m
160 dB	3,430m	1,500m	***2,990m**	**1,640m
120 dB	16,000m	3,498m	*9,560m	**4,020m

What we did then was we took both the 3 km and the 1.64 km and put a box around it and then put a buffer zone around it and considered that the ensonified area. For bowhead habitat is considered anything greater than 5 meters, for beluga greater than 1.5 meters, and for seals all the water we're operating in since we're operating right to shore.

One of the points here is that our take estimates in the deeper waters of 22 and 24 meters based on these densities estimates times that area, actually we don't expect this to occur at all because the seismic work will be done beginning in the east and working towards the west and working the outer lines first. It is likely that by the time we reach August 25 and the migration begins, we will be working between 12-16 km south of the area of the migration corridor of these animals. So, part of the mitigation plan is to get close in to shore as soon as possible; get everything offshore done first and more nearshore by the time migration begins in earnest.

Species		Summer Average	Summer Maximum	Fall Average	Fall Maximum
Bowhead	*Migration Corridor*	**0.5**	**2**	***14***	***16***
Bowhead	*General Area*	**3**	**14**	***104***	***118***
Beluga		**4**	**14**	**4**	**17**
Ringed Seal		**448**	**375**	**317**	**1,269**
Spotted Seal		**22**	**19**	**16**	**63**
Bearded Seal		**22**	**89**	**16**	**63**

Q&A | Comments:

Robert Suydam, NSB: Candace and Jolie, the peer review panel didn't really review this monitoring plan in January because there wasn't enough information in there to do so, so how are you guys going to deal with that?

Jolie Harrison, NMFS: We're still trying to figure that out. We've done different things in the past.

Robert Suydam, NSB: Greg, I've got two more specific questions for you. The first one deals with far field monitoring. The box there off the Colville Delta and operating there and it's a distance far enough where it's over the horizon from the onboard PSOs. Do you have plans for any other monitoring other than PSOs?

Greg Green: We've discussed that internally, and we know there are other operators with acoustic recorders out there. We've discussed sharing cost and data analysis, and we've discussed putting our own monitors out there.

Robert Suydam, NSB: I would recommend collaborating with Shell. Because some of the far west acoustic array have been moved to Camden Bay adding some additional instruments to make the array broader so it can listen farther to the south closer to shore would be a worthwhile consideration, and it would be a recommendation that I would have that you have acoustic monitoring out there.

Robert Suydam, NSB: My other question is a spotted seal question. The survey area includes spotted seal haul outs. I'm not sure anyone has surveyed those haul outs in a while. I think some of the high counts included 25-50 seals at the haul outs. And I know that spotted seals only use the haul outs about 10% of the time, so those 50 seals may represent 500 animals. Given how sensitive spotted seals are when they're hauled out to human activities that if you have boats moving in and out of the area, your potential take of spotted seals may be substantially higher. Have you considered potential impacts to spotted seals? And how and are you going to monitor haul outs of spotted seals?

Greg Green: Rick and I had this discussion already. As you know, I've worked out in the Delta there, and I've had concerns ourselves with the spotted seals and the numbers we've seen when we've gone through the barging there. This is under discussion right now as to how we are going to operate around those because the lines will come to shore, and there will be use of helicopters. We're going to have to do something different around those haul outs. We're very sensitive about those haul outs.

Robert Suydam, NSB: Thanks for that Greg. One of the things I would also recommend is because Pioneer and Repsol are also operating in the area, perhaps they're your clients for some of the seismic work, but we've been trying to encourage Pioneer especially to survey the spotted seal haul outs for some years, and they haven't done it for some reason. Maybe since you're all operating in the general area there would be some benefit to collaborating for that monitoring.

Greg Green: Yeah, well, we will be at those haul out sites so we'll be part of that. This is something that we've already discussed, but, yeah.

Candace Nachman, NMFS: Can you go back to slide 19? I'm looking for the picture of the survey area. I've seen various versions of things over the past couple of months. How big ... what is the area of the box?

Rick Trupp, SA Exploration Inc.: 380 square miles roughly.

Candace Nachman, NMFS: Can you explain what does the different coloring mean on the far right side?

Rick Trupp, SA Exploration Inc.: We put that coloring in there based on the Conflict Avoidance Agreement. There were dates that were reflective of certain coordinates of when you could or could not have seismic operations. The purple represents the area that is restricted to seismic activity prior to July 25. The blue area restricts you after August 25.

James Patkotak, AES: I have this desire to ask the NOAA panel regarding PSOs. I've seen and heard in one of the presentations during AEWC convention regarding dead or maimed whales on shore. I'm sure the oil industry is doing pretty good avoiding collisions with sea mammals, and I believe the only vessels that might be to blame might be commercial shipping going through Northwest Passage and on to our waters. I don't think they give a hoot about colliding with our sea animals. Does NOAA have anything to do with the international transportation companies that are going in to our waters and causing this murdering of our food sources?

Megan Ferguson, NOAA: Our aerial surveys did see a number of carcasses, and we are collaborating with the NSB. They are doing necropsies on some of them. We are trying to look at some of those from 2012.

Robert Suydam, NSB: There were eight or nine gray whale carcasses last year and several the year before. We don't know who or for sure what was the cause. Some of the carcasses looked very like they were killed by killer whales. Your point is a good one that being able to take a look and do the necropsy so we have a better idea as to why they died is important.

Day Three – March 7, 2013

Day 2 Recap

Lisa O'Brien | Ron Felde

The day began with a safety minute from Andre Williams, Anchorage Convention Center, who again reviewed several features of the building:

- Building and alarm lights will strobe and then directions will be announced.
- Exits in the building: east end goes to E Street; west goes to F Street. First floor exits were explained as well.
- Meet at Town Square across the street in case of evacuation. Walk, do not run. When the situation is corrected, you will be re-admitted to the building.
- The defibrillator is located by the security office; first aid kit is at security as well on the 1st floor on the east end of lobby. All management is CPR certified.
- In earthquake, do not exit on the south side due to glass. Exit out of the north of the building. Contact anyone with red shirts in lobby with name tags.

Facilitator Lisa O'Brien also brought to the group's attention that the facility recycles and pointed out the location of the recycling bins. She also asked that the aisles be kept clear, that people put personal items under their chairs and asked that people do not stand in aisles.

For those attending for the first time, the group reached consensus yesterday that the preference was quality of discussion versus being on time, therefore if you need to leave early, feel free to do so.

Parking Lot: Reviewed need and purpose of the parking lot for topics that are not part of agenda. Currently there are four parked items:

1. Invasive species mitigation measures (Art Ivanoff).
2. Definition of traditional knowledge (All). With this subject, throughout the day please identify what is currently working well vs. ideas for improvement. During the parking lot segment this afternoon, we will review these items. The more specific your suggestions, the more beneficial the exercise will be.
3. Careful consideration of sound isopleth (Bill Streever).
4. Review meeting structure (Sudie Hargis).

People who "parked" an item were asked to define expected outcome when issue is discussed.

ConocoPhillips 2014 Chukchi Sea Exploratory Drilling Operations and Monitoring Plans

Mike Faust, ConocoPhillips

We are currently operating in the Devil's Paw location, a very large feature in about 200,000 acres in size, roughly the size of the Kuparuk field. ConocoPhillips is the operator of the Kuparuk and Alpine fields, has two large units at the National Petroleum Reserve, Alaska (NPRA) where they are currently drilling a well. Conoco has been actively exploring on the North Slope for over 40 years and a major interest owner in Prudhoe Bay. Historically, about 30 wells have been drilled offshore drilled in Beaufort Sea, five in the Chukchi and six in Norton Sound. Conoco has been a party to all of those wells but one and operated several of them.

The Devil's Paw prospect is approximately 120 miles due west of Wainwright and 93 miles northwest of Point Lay. Conoco plans to only drill during the open water season with the goal of drilling one well, two if possible. One well, from rig up to drill to rig down is 40 days; the actual drilling takes about 30 days. This operation is different as Conoco plans to drill with a jack-up rig which can drill in the open water season in less than 3/10 ice. These types of rigs have been used in Cook Inlet, Norton Sound, Norway, and Canada, all for exploration. This is not the type of equipment that would be used to drill development wells. It is only for open-water. A major difference with a jack-up rig vs. a floating rig is that the deck of the rig jacks up above the water. It floats in, the legs jack down to couple the sea floor and then actually lifts the rig up 40-50 feet above the waves. The hull of the rig is not coupled to the sea floor. It is quieter in a sense that there is no vibration from the whole rig and generators going directly into the water column. Another significant advantage is that the blowout preventer, the major well control device, sits at the surface. Any repairs, adjustments, checks and tests can be done very easily. We've taken an extra step and installed a preposition capping device that sits on the sea floor. This is effectively the type of cap that was put on Macondo blowout well in the Gulf of Mexico. What shut that well off was a capping device essentially identical, with a few modernization modifications, to the one ConocoPhillips is building. The device has the capability of being triggered remotely. The cap is put in place before drilling of the well begins, and we drill through it.

Showed slide of the last 14 years of satellite imagery. Satellite data has improved significantly in the last eight-ten years with Synthetic Aperture Radar (SAR). This type of radar can see through cloud cover, darkness and images ice well. Conoco went back and looked at SAR and other satellite data for several years over the well location and mapped ice placement within 25 nautical miles radius around well location. If there was no ice within the circle for an entire week, it was indicated in blue; red indicates 100% total ice coverage. From the middle of July to the end of October, middle of November, for many, many years there has been total open water during this period. On average, there is 100-120 days of open water season at the well location. There is certainly time to get in, drill the well and vacate before the ice comes back. There are a few instances where the ice came in in late August or early September. It is possible to have an event where ice comes back in for a brief period of time, but it usually melts on location; however, sometimes the wind blows it in and then back out. To deal with this possibility, Conoco has developed a robust Ice Alert program to ensure

timely departure. Through satellite imagery, the ice is monitored continuously with images received four times per day. The ice typically moves ½ knot per hour, and they have the capability to track motion and speed of ice much smaller than what it would take to cause damage to the rig or well. Based on the size, speed, and motion, we calculate how long it takes to finish the operation in process on the rig, how long to jack down and move off location. A 24-hour safety margin is then added to determine the total time needed to move out—this area is indicated by a red alert ring. If ice enters the red alert ring, the process is finished; the rig is jacked down and moved out. If ice enters 50 km further out—indicated by a green ring—it is tracking, monitoring and ice vessels are sent out to ensure size and speed are being calculated properly. If it enters the yellow alert ring no new operations are started and preparations are made to move off location.

The well has been in the planning stages for four years. The well has been drilled on paper for the last three years through the Virtual Drilling Exercise. SAR satellite images were used to monitor ice conditions and responses were made to actual ice and weather conditions. Even though last year there was heavy ice, Conoco was able to "drill" the two wells on paper during the open water season. These exercises have been helpful as every year there were lessons learned which were applied to the following year's exercises. The 2013 Virtual Drilling Exercise has just begun, and Conoco has brought in its contractors into the exercise so they can practice as well

Caryn Rea, ConocoPhillips

In addition to the drilling exercises, Conoco's studies team will also be involved in the virtual drill exercise this summer and reaching out to communities to include them and get reports out to them in a timely manner.

Melanie Austin, JASCO, will be introducing the study on the acoustic model that was done surrounding Conoco activities. She will talk about the monitoring and acoustic modeling they are proposing for 2014. Lisanne Aerts will then talk about the marine mammal monitoring program.

Conoco is currently in the preparation stages for continuing the Chukchi Sea Environmental Studies Program in 2013. They are working with Olgoonik Fairweather to develop the scope for this year. Olgoonik Fairweather is doing a great job of operating the program since 2010; there have been five years with no recordable injuries. There are technical manuscripts in various stages of preparation. Most have gone through the peer review process. We hope to get a special edition of the continental research published with all disciplines in that. Dr. Bob Day has also led an effort to include a synthesis paper to synthesize that information. Conoco is also involved with North Pacific Research Board and the National Science Foundation data synthesis project. The North Pacific Research Board and the National Science Foundation have put together a team to pull together historical information for the Arctic Outer Continental Shelf into one synthesis document. The schedule is to have a draft by this summer with a final report next year. Shell is co-sponsoring this effort with the goal of pulling together information and see what the ecosystem looks like.

<u>Regulatory Process</u>: Conoco is currently modifying its plans to various agencies. The Letter of Authorization is being revised because incidental take regulations for the Chukchi are not finalized,

so Conoco expects to revise and resubmit this document next summer. The Exploration plan will be submitted this month to BOEM; the IHA was submitted to NMFS last October. It is important to understand what is being required in 2014 in the monitoring program and want to make sure Conoco has the best program put into place.

The 2014 monitoring and mitigation program is for drilling activity. It is not a large scientific study like the Chukchi Sea Environmental Studies program has been. Activities with potential disturbance would be a) drilling operations, b) support vessel on dynamic positioning to resupplying on a set schedule, c) vertical seismic profiler (VSP) testing and d) physical ice management.

ACOUSTIC MODELING

Melanie Austin, JACSO

The objective of the acoustic modeling that was done in preparation for the IHA application was to quantify the underwater sound levels associated with the project. First we determined the sound levels as a function of range and direction from various project noise sources. From this, we compute ranges to specific sound level thresholds. Three noise sources were considered: 1) drill rig and sounds from drilling, 2) support vessels, specifically from dynamic positioning, and 3) airguns associated with the VSP. Airguns for the VSP are a small array and fired at a single location for a few shots at a time. *Map shows modeling area and photo of airgun.*

The modeling report follows the source-path receiver paradigm using computer modeling. First, you need the source level and how much sound is being generated by the specific equipment. For this exercise, the source levels for the drill rig and vessels, we took from literature; previous measurements that were available published publicly or collected by JASCO. For the airgun array, we modeled the source level. The next step is solving the path part of the equation again using a model, JASCO's marine operation noise model. The model computes how sounds propagate throughout the water taking into account features of the water column which defines sound speed, bathometry, and the properties of the sea floor. With the source and path information, you can then compute received levels. The model area was 50 x 50 km from the rig position and computes sound level at each depth in the water column. From that we take the depth where the sound level is maximum and compute sound level contour maps which shows contours of constant sound levels. *Showed maps of the different sound levels*.

Three scenarios were modeled. The first was drilling and from the jack-up rig itself. The sound levels were expected to be quite, low as the only path for the sound to be transferred into the water was through the legs of the jack-up structure. We see low, small sound levels with no preferred path of propagation—it is fairly constant in all directions. The second scenario was drilling with a support vessel along the rig under dynamic positioning. In this case, it was the sound from the ship that dominates but is still fairly low sound levels. We did not model ice management separately but considered this scenario to be representative of the sound ranges for ice management as well because it is also a situation when a vessel is under dynamic positioning. The final scenario that was modeled was the VSP airgun array which is the loudest sound source, but the time that the airguns

are firing is very small. From these sources, we compiled maximum distance from source to received sound levels (RSL):

Acoustic Modeling Results

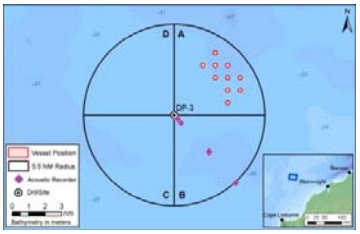
Maximum distance (in meters) from the source to various received sound levels			
SPL (dB re 1 µPa)	**Drilling (continuous sound)**	**Drilling + Support Vessel (continuous sound)**	**VSP Airguns (pulsed sound)**
190	--	--	**160**
180	--	--	**920**
160	**<10**	**71**	**4900**
120	**210**	**7900**	**71000***

**Distance extends beyond edge of modeling area, resulting in underestimate of radii.*

The green cells are important for estimating exposures. For continuous noise sounds, the threshold is 120 dB; for impulsive sound sources, the threshold is 160 dB. The sound from the drill rig is very small, about 210 meters. For the drill rig with the support vessel aside, it extends to 7.9 km, which is within the range we expect for a large vessel on dynamic positioning. The VSP airguns with the range to 160 dB is about 4.9 km. These ranges are used to estimate how many animals may be exposed to sound at these levels.

ACOUSTIC MONITORING

There are several objects for monitoring. First is to verify pre-season modeling results shown above and ensure the ranges are appropriate for activities that will occur in the field. There will be two rounds of VSP profiling. After the first round, we will collect the acoustic recorder and verify the modeled ranges are correct. The second objective is to characterize the acoustic footprint of the activities, both drilling and support activities. This will be done with bottom mounted sound records deployed in a selection of ranges away from the activity. The data will be analyzed after the first round of VSP to ensure sound ranges match preseason expectations. A detailed post season analysis will be done as well. The final objective is to record and monitor marine mammal vocalization to complement visual observations.



A minimum of four records will be used. The recorders will be deployed at ranges of one-half, one, four and ten kilometers from the rig. The drill rig will be in the center of the circle, and support vessels will be within five and one-half miles from the rig. The grouping in the upper right of the circle indicates the support vessels which will be anchored to minimize noise. The vessels may have to move due to weather or sea conditions, but they will remain in a group. The recorders will be placed away from the rig and will not be placed close to the support vessels but should be able to capture sound from them. AMAR recorders will be used to measure noise. They are deployed, sit on the sea floor, and then retrieved for data analysis.

CALCULATION OF EXPOSURE

Lisanne Aerts, LAMA Ecological

Potential exposure to marine mammals from the activities during these activities: I want to focus on exposures because all exposures are not necessarily takes and even all known exposures may not be known takes either. This calculation at least provides an estimate of Level B or disturbance of mammals. The estimated exposures are just that—estimates—because there are level of uncertainty at each step of the calculation. Marine mammal exposures were calculated as follows:

The expected (seasonal) species density*

x

Estimated area ensonified by:

- **160 dB (VSP airgun operations) ~5 km**
- **120 dB (Drilling+Support Vessel in DP+Ice Management) ~210 km, 8km**

x

ESTIMATED TOTAL DURATION OF EACH ACTIVITY IN DAYS (24 hrs)

*To estimate whale species density, the COMIDA aerial survey data (aka Aerial Surveys of Arctic Marine Mammals—ASAMM) was used. To estimate seal density, information from the Chukchi Sea Environmental Studies Program (CSESP) was used.

Estimated Number of Exposures to Pulsed Underwater Sound | Levels of ≥160 dB (VSP airguns)

Species	Number of Individuals Exposed to ≥160 dB					
	July/August		September/October		Total	
	Avg	Max	Avg	Max	Avg	Max
Beluga whale	0	0	0	0	0	0
Killer whale	0	0	0	0	0	0
Harbor porpoise	0	0	0	0	0	0
Bowhead whale	0	0	2	5	2	5
Gray whale	0	1	0	0	0	1
Humpback whale	0	0	0	0	0	0
Fin whale	0	0	0	0	0	0
Minke whale	0	0	0	0	0	0
Bearded seal	1	1	1	1	1	2
Ringed seal	2	5	2	5	4	10
Spotted seal	1	1	1	1	2	3
Ribbon seal	0	0	0	0	0	0

Estimated number of exposures to pulsed underwater sound are low because airgun operations is only two hours per well although 12 hours were used in the calculations. The slide below shows estimates for continuous underwater sound levels of 120 dB. The numbers are higher because the

sound levels are further out and the duration of activity are longer. Two species are highlighted – bowhead whales and seal estimates.

Estimated Number of Exposures to Continuous Underwater Sound Levels of ≥120 dB

Species	Number of Individuals Exposed to ≥120 dB					
	July/August		September/October		Total	
	Avg	Max	Avg	Max	Avg	Max
Beluga whale	4	7	4	9	8	16
Killer whale	0	1	0	1	1	2
Harbor porpoise	4	7	0	3	4	10
Bowhead whale	4	8	62	187	66	**195**
Gray whale	28	56	7	14	35	71
Humpback whale	0	1	0	1	0	2
Fin whale	0	1	0	1	0	2
Minke whale	0	1	0	1	0	2
Bearded seal	48	87	39	72	87	**159**
Ringed seal	181	442	150	366	331	**808**
Spotted seal	86	125	71	103	157	**228**
Ribbon seal	7	21	6	17	13	38

Estimated bowhead whale exposures are 195 based on bowhead density using available aerial, satellite and tagging data for the past four years. They plotted the data which shows the spring and fall migration patterns and then plotted their drill location in the migration path. All of the years, the highest level of calls are north of the Klondike service area. Estimated seal exposure was based on density from the CSESP data. Estimates within each year because high confidence limits because of how seals are distributed in a specific area. When seals are spotted, usually there is more than one—it is usually a cluster occurrence.

MARINE MAMMAL MONITORING

The monitoring program is not a scientific study but to comply with monitoring requirements for the IHA to verify estimates of exposures. Observers (PSOs) will collect data on occurrence and distribution of marine mammals during project activities, communicate with coastal communities and implement mitigation during VSP tests. There will be four observers on the drill rig, two on the ice management vessel and two on the monitoring vessel in place to monitor for compliance for the EPA. PSOs may do additional monitoring around the drill rig when not engaged in 4MP monitor-related activities.

Next steps in the monitoring plan are to finalize marine mammal and acoustic monitoring plans. A peer review has just been completed and review panel are writing its recommendations. When received, the recommendations will be reviewed, and Conoco will determine how it can adapt its plan. Feedback from the OWM and planned community meetings will be considered along with any guidance from NMFS. They will also continue with logistics planning, resources, and other project aspects.

Q&A | Comments:

Colleen Swan, Kivalina: About the monitors, the native monitors on ships, I appreciate the work they are doing and that you include monitors that do this, but I wonder what is your process to address potential impacts that activities have on coastal communities that rely on marine mammals? I appreciate ConocoPhillips coming to Kivalina to have meetings but wonder what happens to the comments you receive from the community members. Do you update your report and work based on those comments? I thought we had some pretty meaningful meetings/discussions, but today we haven't heard about those and the reason why they are important is because based on surveys done in the community survey on diet of our people, 79% of the Inupiat diet came from the ocean. Kivalina is economically disadvantaged by western standards, but our cultural standards very rich in our ability to feed our families. When I say this is how we make our living, I am serious. This is how we feed our families. When you go to an area and your monitors see a marine mammal, it tells you are having an impact. Not just on the mammals, but the people who rely on them and so you need to ask the community how it affects them. Our monitors are the hunters who are out there, and if they can't find the sea mammals where they used to be, they have to find them and look for them constantly. It takes time for recovery once you have disturbed an important area that mammals congregate or feeding at or migration route. For the community meetings, we had joint meetings with the tribe, city, and ConocoPhillips and made suggestions on how we could implement our elders' expertise, history, and traditional knowledge so it could help you have less impact. The things we want to do as community leaders would benefit not just us, but industry – everyone. Because if you don't work with community people and continue to have impact on our ability to feed our families, there is going to be a fight. I have stated this many times.

Mike Faust, ConocoPhillips: Thank you. Those are great comments. We come to the communities several times per year; we will be in Kivalina in a couple of weeks. It is hard to describe all the ways we have developed our plan, but it has changed significantly over the past four years in many ways because of community feedback and hunter/whalers observations. One of the main things we do at community meetings is ask for input – you live there, you see the waters. We come and put buoys out and have scientists there, but we have only observed for five years. You have observed for thousands. There is good information that we can get from the communities. We have asked for it and received a lot of feedback and have tried to incorporate it in the plan as much as we could. Some feedback, particularly around Kivalina, is we talked about a staging area for the jack-up and heard clearly that there were issues around that. We are looking now of keeping the jack-up on a heavy lift vessel and trying not to stage it there. We will see how it works out with ice conditions at the time, but we are certainly listening and trying to incorporate that into our plans. All operations will be offshore, and all vessels will stay 100 miles off shore. There will be a small amount of traffic in Wainwright where we will do our crew changes. We heard clearly from that community to try to reduce the numbers of crew changes. To address this, the ship we have has very large crew quarters so this has eliminated some of the changes needed. They also indicated that they rather not have the helicopter through town, so we built a road four miles out of town and put our pads out there. Now we are in regular discussion with elders, whalers, tribe, and city and to understand exactly how those helicopters

should fly and what routes and times they should take and what changes are needed during the season. We want our operations to have the least possible impact on subsistence activities.

Chris Winter, Crag Law Center: Thanks to ConocoPhillips and NMFS for getting us the information early in the process. It is helpful to have the IHA application and have time to talk about it. It is a change to what has happened in the past and a really good development. We didn't hear much about how ConocoPhillips is viewing its activities with respect to subsistence. Based on a quick review of IHA, there were a couple of issues I wanted to ask questions about. One was with the staging of jack-up rig near Kivalina because my review of the IHA application shows it is still being staged near there. I want to understand based on that representation in the IHA whether and how ConocoPhillips and NMFS are looking at the no unmitigatable adverse impacts standards based on where and when it would be staged and if you have a map showing the staging location? The second question is in regard to support vessel traffic. The IHA application indicated about one trip per day between Wainwright and rig and where the support vessels will be staged, maybe five miles off Wainwright. Could you detail for us where the support vessels will be staged, which ones will be staged there and how much traffic will occur using a map? Also, if NMFS and *ConocoPhillips* could respond on whether and how the support vessel traffic and staging of these vessels are being looked at under the no unmitigatable adverse impacts standard?

Mike Faust, ConocoPhillips: Good questions. I will start with the staging of rig near Kivalina. Our plan is to come up with rig on a heavy sea lift vessel, a large dry tow vessel. It sits on the back of a huge ship. It is not a wet tow, being tugged across the water with tugboats. It sits on a large, very heavy sea lift ship. We are trying to time that ship so that it can come all the way to the drilling location, ballast down and taken off the ship so we never stage. That's the perfect scenario and our basic plan. Timing that exactly right for ice conditions we probably can't do that perfectly. We get a good idea early in the season – the rig is coming from Singapore and takes 23 days to get there, so we will try to time that such that it can go all the way into the Chukchi. If there is a storm and the ice stays and blocks the Bering Straits or we can't get all the way to the drill location, there is a possibility that rig may need to be off loaded before that. We had to look for a location where the substrate was strong enough to hold the rig if we jacked up and left it. That location has been picked and mapped; we didn't bring the map here today. We are going to pull up the map, so that is the location we have been talking about. We heard from the community that could be a problem and not crazy about staging the rig there, so we are trying to make sure we don't have to, need an option to do that for a few days if weather prevents entry.

Caryn Rea, ConocoPhillips: Our plans are fluid and changing and happy for input as we are finalizing. You had a question on subsistence impacts I believe. We do have one landing craft in the IHA. Right now, we are planning to have all support vessels in one quadrant or another depending on weather. If we have to resupply out of Wainwright with a landing craft, we will closely communicate with Wainwright and have a community liaison to mitigate for impacts. We want them to know when and where we will be. Having Inupiat communicators on our vessels (ice management, monitoring and rig), the plan is to have coordinated, scheduled calls to the communities and encourage them to also call us. That goes to Colleen's question about how we are taking their information into our planning. In the summer, we have been getting

feedback from communities when we visit about when, where and what animals they hunt. We will have that information at our disposal as we go through our virtual drill. I am still working out the details of how we are going to practice with the communities this summer. We are hoping that mechanism will help mitigate any impact and are open to suggestions if people think that is not robust enough, but it is our intention for open communities from operations to the shore.

Candace Nachman, NMFS: I have a copy of ConocoPhillips' application with what you just asked and I will show it to you if the project is fixed. Secondly, the questions you asked about how we are taking into consideration the no unmitigable adverse impacts, these are actually the same questions that I sent to Conoco in my reviews, and it is things we are talking about and that Mike and Caryn just said, but it is 100% being considered in our process and questions have been sent from me to Conoco.

Chris Winter, Crag Law Center: Thanks, I just have one or two quick follow-up questions and make sure I am understanding…

Lisa O'Brien, Facilitator: I am going to hold you to one more because we have 20 minutes, and we have 12 people wanting to ask questions.

Caryn Rea, ConocoPhillips: You can catch us too after the presentation

Chris Winter, Crag Law Center: Sorry. Is the one support vessel per day between Wainwright and the drill vessel accurate, and will there be support vessels staged right off the coast of Wainwright about five miles?

Mike Faust, ConocoPhillips: The one support vessel traffic per day is a grossly exaggerated maximum. We put that in to have at least that flexibility, but all of the support vessels will be within 5½ miles of the rig. All the vessels are staged (more for safety than anything else) in one of the four quadrants around the rig within 5½ miles. There are a couple of vessels in the plan that is there for oil spill response which is the large barge and tug. Barges and tugs can't take the same weather conditions that a 300 foot ship can and at times may need to be closer to shore from a safety stand point. We have built this flexibility into our application. The plan is to have the vessels offshore the whole time. The only one close to the beach would be the landing craft that would come in for perishables, but we aren't using a vessel for crew changes. That will be done by air.

George Edwardson, ICAS: With your MMOs, are they taking account of the mammals they are seeing? And regards to that, and regards to Colleen's comment about impacts, it is good to do it on the computers but it is different when you are actually out there doing it. You need to know if you drill, there will be impacts. We know that. One thing about traditional knowledge, you talk about it, but you have no concept of what it is. It's a writing, what you see. Someone has commented, like Jim does, but he doesn't know it. He's talked to people that know it.

Richard Kuzuguk, Shishmaref: I appreciate the information that oil companies are sharing in regards to seismic activity. I have two questions. For people at my level, the public, it's hard to imagine with what goes on with the airguns, the seismic activity that takes place and the impacts that effect the environment, ecosystem, and marine mammals. My question is there has to be an understanding that this based on self-reporting form the oil companies themselves. I appreciate that, but that information has to be verified or documented by some other entity that has no

interest in oil production. Industry will look after their interest, and we will look after ours which is subsistence and impacts that are caused by oil production by offshore drilling. A lot of the reports are set the 160 dB. My question is whether or not and why are the reports being set at a maximum? At any time is there any need or reason to reach the full blast level of 240 dB during seismic for more detail?

Mike Faust, ConocoPhillips: Thank you; really good comments. I will let our seismic specialist describe the dB, but in our activity our only seismic will be a vertical seismic profile. That is where we put recording devices in the well, hang the airguns off the side of the rig in the water and shoot over the whole well twice, adding up to two hours. We will basically be shooting for an hour each time or 45 minutes the first time and an hour the second, but it is very short period of time. It is not a big, 3D seismic survey out there 90-days shooting continuously. It is a short program, and we only do it twice, and each time we do it, it lasts only a short period of time. We will have a lot of mitigation procedures in place to make sure there are no whales, and if there are, we will wait. I do agree that we need independent verification. I point out that ConocoPhillips has been operating in the North Slope for over 40 years, shooting seismic almost continuously for almost 20 years and had excellent subsistence advisors on our crews. For many years, we hired through ICAS and have had fantastic help to help identify a fishing camp, hunting camp, ice cellar, grave site, or archaeological site, but also help keep us out of trouble. They are part of our team and think we have a good record of working with local communities so everyone is comfortable with us doing what we say we are going to do. We do the same thing on this one. We will have people from the communities on the vessels to be independent eyes to help us monitor and see things and to verify we do what we say.

Richard Kuzuguk, Shishmaref: Thank you. The reason why I asked that question is because yesterday Shell admitted that their recorders were actually recording different airguns, I think they stated most likely from the east, a different unidentified source. For those recorders to pick up that activity from long distances, that statement indicates the activity that is going on as far as recorders picking up airguns from a different site, that is a long range. It tells us that the recorders shouldn't be limited to 800 km. Maybe they should be further to see what impacts and what the noise dB are reaching.

Caryn Rea, ConocoPhillips: Thank you for that comment, and we are in the process of considering additional recorders at this time. We haven't arrived at a decision, but your point is well taken.

Vicki Cornish, Marine Mammal Commission: This question is for Lisanne. I am trying to understand how take estimates were calculated. I am not an expert and hope I can understand how you did it. The take estimates are a multiplication of the density x area ensonified, then it's the last calculation of the duration that I have a question about. For VSP seismic and dynamic positioning which only at certain parts of the day and on certain days is it appropriate to sum that into total time and divide by the number of days or wouldn't you look at it on a per exposure basis? So the duration is what I am asking and how it is accounted for. Maybe that is why the takes appear to be so low because I think that the time parameter is not in there appropriately, but not sure what your perspective is on that.

Lisanne Aerts, LAMA Ecological: My perspective is that no one is an expert because everyone tries their best to estimate as best we can. To answer your question, I don't know what is the best way. We did do it was to calculate how many hours we thought we would have dynamic

positioning occurring, how many hours we would have airgun sounds occurring, and assume so many hours multiplied by the number of days taking into account that the whales would pass by on certain days, etc. We don't have experts in this, we try to come up with the most reasonable process to estimate.

Vicki Cornish, Marine Mammal Commission: Maybe we could discuss afterwards, and I could give some more ideas and have discussion about it.

Lisanne Aerts, LAMA Ecological: Sure.

Vera Metcalf, EWC: I am interested in your ice coverage work. Is that specific to that area or could it be used in other areas? The EWC has been involved in a project, the Sea Ice and Walrus Outlook, with the University of Alaska Fairbanks, NOAA and the National Weather Service where we provide five-day weather forecast to several of our walrus communities and ice information and are very interested in your comment that you can see ice through clouds. It is something we are still pursuing. We will be doing it again in the spring working with five communities where local observers and hunters look at the ice information and provide comments back. We are interested in expanding and improving capabilities for providing weather forecast and ice information. A recommendation to everyone is a lot of traffic goes through the Bering Straits and what is helpful is that we'd like transit schedules. Shell was very good at providing this information because we don't know how many vessels will be passing through. If you or others are going to be transiting through the Strait, it would be helpful to get the schedule.

Mike Faust, ConocoPhillips: We can certainly do the transit schedule. I think that is reasonable and a request we can meet. As for the ice imagery, we buy it from different commercial providers. There are four satellite companies that have shots of the Chukchi Sea. Our data that we have licensed is targeted on our locations and then made it big enough to see a few 100 km away. We don't own the data, we license it from them. It is fairly expensive and perhaps an opportunity for a proposal from the commission to industry to help.

Robert Suydam, NSB: My first comment is related to Vicki's question, and I think Conoco should be commended for including duration for part of the equation for exposures and takes. It is being responsive to the peer review panel and moving in the right direction. Basically it is assuming that animals that are exposed to sounds from your operations are different every day, which is probably more realistic than what has been done in the past. Thanks for including that and hope to see it more frequently in other take estimates. My question about those estimates is Lisanne, you said there is a level of uncertainty and you showed some of it in the density estimates but did not carry it on into the take estimates which is something the peer review panel has been asking for that for a while. There may be some uncertainty which is included as you have an average take and a maximum take, so if you could comment on that.

Lisanne Aerts, LAMA Ecological: I think the average and maximum is like a surrogate for the uncertainty. Again, I don't know how I would do that. If someone else does, please let me know.

Robert Suydam, NSB: I think one recommendation might be to talk to a statistician to see how to carry the various types of uncertainty that are there forward into the estimates of take or the estimates of exposure to make it more realistic and honest. I am not saying that in a negative way, but figure out a way that the uncertainty could be carried forward into the take estimates

so the public and decision makers have a better idea of well maybe there are three belugas are taken or maybe there are 3,000 and to help portray what we know. A comment on belugas so not to disappoint. You had an estimated take of 195 bowheads and maximum take of 16 belugas. Just to put it in perspective, the population estimate is around 15,000 for bowhead but for belugas it's more like 45-50-70,000 that are moving through the same area, and there is no evidence that migration through the Chukchi Sea differs. So something is wrong with the density estimates just from the fact that there are three or four times as many belugas moving through the Chukchi, yet the estimate of exposures is only about $^{1}/_{10}^{th}$ of what it would be for bowheads. My next question is about far-field monitoring, which includes over the horizon monitoring or issues related to vessel impacts. This is really important since Conoco is proposing to use a jack-up rig which is a new type of rig for the Alaska Arctic, perhaps the Arctic in general. The potential that the jack-up rig makes less noise than a vessel makes sense but because it is new process, it is important to have far field monitoring which may include acoustic monitoring or unmanned aerial systems. Shell is monitoring with cameras from a plane that just has pilots is a really positive move forward. So trying to maintain some type of monitoring more than PSO on board the rig and vessels is important. Can you comment on how ConocoPhillips feels on moving forward on far field monitoring?

Caryn Rea, ConocoPhillips: Let me get to the beluga comment first because every time we meet with you, you speak about belugas, and you did not disappoint again. The three of us have been going through the data that we know is available and looking at it in context of when we know we will be operating. The data that was collected by Janet Clarke and Megan last year, we looked at that, we looked at the satellite tagging data and the timing when the Beaufort Sea whales come up in April and May before we are there. The Chukchi Sea group comes through in June and July, perhaps you can correct me if I am wrong, but when I look at the satellite tagging work that you guys have done over the years, it appears to me that the whales are going right up the coast, going north and staying there until late October, early November. Certainly right when we will be leaving. We talked about why we don't pick up more calls on the recorders and Melanie can correct me if I am wrong, but I believe with the belugas being high-frequency callers, for us to pick them up with our recorders, and we have 44 recorders out there, they have to be very close. I understand within two kms. That is the line of evidences we looked at to support the estimated exposure number we came up with.

Robert Suydam, NSB: Let's talk more about that off line, and I think there are some other things worth considering.

Caryn Rea, ConocoPhillips: Okay. A short answer to your question on far field monitoring, yes we are considering that. We can talk more about that later and appreciate you bringing that up now because we still are revising plans.

Mike Faust, **ConocoPhillips**: I think someone commented earlier that doing this application a year early has given us an advantage and appreciate NMFS taking this on early because I know it is sort of out of process. We had the discussion down in Seattle where far field monitoring came up, and we have been talking about it a lot since then. We are going to figure out how to do something and have time to do it. As we get that more firm feedback and the final report back, we can address it and a testament to doing this a year early.

Unable to identify: Thank you for a very good presentation. A couple of comments on the ice management: I thought that was very impressive and the first thing that came to mind is that the best accident is one that doesn't happen. I think you did a really good job in your ice management system. My question to you is simply a request for comments. The measurements on the 120 and I read that drilling was 210 meters and when you start adding the support vessels you are at 7.9 km. Is it because the ships were closer to the receiver? Do you care to comment about that?

Melanie Austin, JACSO: The model scenario with the support vessels with the drilling, we had the support vessel directly alongside the rig. The high sound level, the long propagation range, comes from the noise from the thrusters while sitting on dynamic positioning.

Brettny Hardy, Earthjustice: I wanted to clarify with the jack-up rig, has another company used one either in the Alaska Arctic or general Arctic before? Is this the first time?

Mike Faust, **ConocoPhillips**: No, jack-up rigs have been used in the Arctic, all depends on what you mean with the definition of the Arctic, but used regularly in Cook Inlet. We used them in Norton Sound where ConocoPhillips drilled five wells with jack-up rigs. They have been used in the Arctic of Norway and a few other places in eastern Canada. It is an open water device though. It's not meant to be out there when ice covered, middle-of-the winter conditions.

Harry Brower, AEWC: Thank you Lisa. I am getting frustrated in a sense. Thank you for your presentation. I look at the name Devil's Paw. Where did that come from when we are talking about the Arctic Ocean that people use for sustenance? You come up with the name Devil's Paw. It is kind of embarrassing in my view, in my observation, as how we as native people use the ocean. It has been identified as our garden. And yet an oil company comes around and places a name in the very ocean we depend upon for resources, Devil' Paw. It is insulting in a sense if you look at it from a hunters' perspective. I'm not sure if you heard it from anyone else, but it is my opinion. In regards to the number of support vessels and fleet, I don't see a number of how many vessels you are planning to bring to support the activity. You are bringing a barge, tug, ice breaker and support vessels, but what is the actual number? We don't know the number of vessels you are bringing to this prospect. The other thing is regarding the numbers being used, they are identifiable but in a sense you use $^{3}/_{10}^{th}$ ice coverage and give a chart of what it means to you, with your observations of the years and you have identified that it's ice free, ice presence and that kind of stuff, but it would be good of what $^{3}/_{10}^{th}$ of ice coverage means. Instead of using the numbers, a visual depiction would be great. You identified the jack-up rig being used and a great picture of your location and ice presence there. That could have been a great slide to show what $^{3}/_{10}^{th}$ of ice coverage means. I have to think back as hunters we have been taught from a young age what the ice means to us and how we use it as a platform. The ice moves in and out with the currents, winds oscillating in different directions in that sense. Again, you identify in your graph the most times of open water, but the ice still has a presence. I know the ice is receding and thinning over the years, but you have to use Shell's example from last year for ice monitoring. In that event, in their monitoring of the ice, they had to move their rig because of the conditions they were faced with. I didn't hear anything in that nature in your presentation and whether you are able to have similar monitoring for the ice conditions. If a big ice flow comes toward your rig brought on by the oscillation and ocean currents, so that raised a

flag for me when I didn't hear too much about that. You may have stated something, but I didn't catch it. That is one of the comments I wanted to share with you and whether if you are able to move the rig in the event there is a massive ice flow heading toward your prospect or drill rig in an appropriate time. Referring back to the virtual drilling exercise, each year there was significant learning and improvement of procedure and tools within your operations and what you have seen and learning to apply them here, but then you don't identify what those tools are and if we can learn from the new tools. I know some of the technology that are used is satellite trajectory, ice imagery, etc., but in terms of being compliant to the regulations and conditions too that Conoco used for the criteria identified for your operations. I will learn more about it. I know we go through these peer reviews, but again, it's a whole lot of information. I am just one individual and don't think I can learn everything that has been presented. Sharing this type of information would be helpful in a sense that we all go through a learning curve in terms of how to manage and steer operations into the oncoming activity. In regards to some of the monitoring—this may be more to the agencies—any thoughts of documenting displacement? You said you will have ice management to support your rig. I know as a hunter and have been taught that when the ice recedes, our elders tell us it is going out to retrieve animals. When it comes back it will be full of animals for us to subsist on. Walrus, belugas and other marine mammals you have identified. That is something I am not sure that you've captured that in a sense or the agency has captured in a way. It is something that you have to identify. I understand the MMPA and harassment authorization that are given to these types of authorizations, but what state does that extinguish in a sense if there is 60,000 walrus on the ice coming toward your rig. Are you considering using ice management to move and harass those animals? I am not sure if you see this in a sense of just having Arctic biologist 101. Ice is used as a platform by these resources as well. I just share this and want to bring those up. I have a few more comments and will get with you at the break.

Mike Faust, **ConocoPhillips**: Thank you Harry. A lot of good comments there. First, let me apologize for the name. It wasn't intended to insult anybody. It is a sort of a tradition in the oil companies when we go to lease sales to name our projects along a theme. If you look at the five wells drilled in the Chukchi Sea in the 90's, they were named after snacks you would find in a movie theatre—Popcorn, Cracker Jack, Burger. They were named that way. In this sale, we named our prospects after mountains in Alaska. We had Stellar, Forraker, Devil's Paw is a large mountain in the Wrangell's and that is where the name came from. It was not meant to be in any way derogatory. In our application, we had 10 vessels. We've been able to eliminate one, so we are now down to nine. We were able to reduce our footprint, optimize and now have nine vessels in support. Three are strictly spill response only; the other vessels will have multiple functions—resupply, tow the jack-up out of the way if ice comes in. We absolutely have a plan to move the jack-up if ice comes back on location. What I tried to describe with the rings are set at a certain distance on how long it will take will take to get out of there should ice come in. The size of rings will change daily, maybe several times per day, based on what our activity is and how fast ice is moving. We will get a depiction of what $^{3}/_{10}{}^{th}$ of ice looks like. It is not meant to mean there is a huge pack of ice over 30% of the area. It's over the whole area, spotty pieces of ice that covers 30% of the water. Seventy percent of the water would still be open and that would be first year ice; thin, new ice. We are not talking big icebergs. That would be multi-year ice. Lessons learned during virtual drilling, that was another great one. This year alone we have

a list of 200 items. They are getting smaller every year in terms of how important each of those things are, but we've learned a lot by practicing. One of the things we learned the first year is that we were buying satellite imagery every three days. We learned that was not often enough based on feedback from subsistence hunters. They said the ice moves and can change much more quickly than you think. So we went back and started buying ice imagery every day, and they were right. It does move quickly. Now we are buying imagery a couple of times a day, and, when we are in operation, we will be buying it more often than that. Another lesson learned was that we needed a state of the arts operations center. We needed a place where we could put all of the information, the ice imagery, where the vessels are, where the aircraft are, where all our people are and put it on the screen at the same time, to be able to overlay all that, and work it 24 hours a day, seven days a week. We built a really nice operations center across the street at the ConocoPhillips building that will be manned 24/7 when we are out there operating. Lots of small things, but those are the big ones that come to mind right away.

Brad Smith, NMFS: You explained a bit about well control technology on the rig. Is the rig new construction or retro-fitted and whether noise reduction made as a design element in the retrofit or design of the construction, not only of the rig, but of all vessels? You can get considerable bang for your buck by throwing money at technology and engineering of vessels and rigs for noise reduction. Things like where you place a compressor, bushings and different things. I wonder if you could talk about what specific features the rig employs both for noise reduction and our conditions and then generally whether ConocoPhillips has noise reduction for its vessels as an engineering goal?

Mike Faust, **ConocoPhillips**: The rig itself is a new build. The class is a JU3000. A new Noble rig, and they are building six of them. It is built for harsh environment for North Sea conditions, so I can't speak for Noble and what went into their design criteria. But there are a lot of features in these new rigs that are specifically designed for health, safety, and environmental protection. There are a lot of things built in there to remove hazards, minimize air and water discharges. There are a lot of things that are put into the design to reduce vibration which has the effect of reduction on noise as well. I can't speak to what exactly they did for noise, but they are dealing with the desire from the oil companies to have more environmentally benign equipment, and they are responding. On the vessels themselves, it is harder. We are in the middle of contracting for the vessels, so it is hard to talk about it because of the need to keep it pretty tight around exactly who we are getting vessels from, but we are employing same philosophy that we have employed on the rig. We are not going to bring up a 30 year old piece of equipment. We are bringing up state of the art, new stuff, that is meant to work in the Arctic.

Brad Smith, NMFS: *Response with no microphone—cannot hear.* The reason they don't have noise technology in their newly contracted vessels is simply because they were not asked to and were surprised by that. So just because a vessel is new doesn't mean you are going to get this technology with it.

Mike Faust, **ConocoPhillips**: Good point. Thanks.

George Edwardson, ICAS: On your jack-up rig, what are the limits? How high of a wave action can you deal with? The comment you made on $^{3}/_{10}^{th}$ ice coverage is foolish; very foolish because when the ice starts to pile up at 6" thick, it can get over 60, 70, 80 feet in minutes. So that type

of statement is foolish. When you look in the McKenzie Delta in Canada, over 70% of those manmade islands of theirs were sheared off by pancake ice that was as thick as the depth of the water and literally sheared below. Your blow-out preventer, what is it doing out of the water? If the pipe gets sheared, what are you going to do if it is sheared just a little below the surface? You are in trouble right there to start off with, and what type of back-up do you have when you have those kinds of accidents? If you are going to talk about running from the ice, where are you going to go? You have to have a place to go. In the Arctic Ocean, the northern shores have no protective water where you can run into unless you go quite a ways. So I am waiting for your comments on those.

Mike Faust, **ConocoPhillips**: Typically you would lift the rig above the water in the 40-60 ft. range depending on weather and sea state conditions that you would expect to find. They are built for the North Sea. They are essentially designed to handle conditions where the wave heights are significantly higher than we have ever seen in the Chukchi Sea. You can jack the rig up well above what you would expect any horrible, fierce storm in the North Sea to be able to withstand. They are extremely strong. The legs are built to put into water depths of 400-500 hundred feet deep so they are huge rigs. We are only in 140 feet of water, much shallower where we are going to be, so the rig is very strong for those conditions. But it is not meant to handle large sheets of ice coming in or multi-year ice ridges or anything like that. If we see major pack ice headed our direction, the solution is to get out of there. We will have the capability and large tow vessels to pull it all the way out of the Chukchi Sea and past the Bering Straits if that is what it takes. The whole purpose of the ice alert system is to make sure we see it coming a long way away and have plenty of time to get out of there. This is essentially like a land rig. The blow out preventer (BOP), the main control device, is at the surface on the drill floor. This is where you want it because this is where you can repair it and where you have complete control of the device. You are not relying on remote equipment to work on a BOP on the sea floor. It is much better to have it on the surface if you can. A lot of times you can't always do that. Every land rig on the North Slope has a BOP on the surface right there where you can work on and deal with it. We have what BOEM calls a Level 1 well design where the casing is strong enough all the way to the BOP to withstand all the pressure in the well. There is no way for the outside of the casing to collapse. It can't collapse. It can't burst, and has a high pressure pipe all the way to the surface. There really isn't a possibility for anything to be sheared off at the bottom. It is very different than you saw at Macondo where you had a drill ship and low pressure riser which essentially has to be able to move because the ship is moving on the surface. This is a fixed rig that doesn't move, so you can put really think thick steel, cannon barrel type steel configuration, all the way to the surface. On top of all of that, we are employing another set of cap at the sea floor, putting a capping device before we begin as a layer of redundancy. If everything got knocked off the strongest part of the well, the connection on the sea floor and the capping stack that is in place, so you can shut the well in at the sea floor if everything else failed.

Bill Streever, BP: There were comments earlier on take estimates about how you incorporate density estimates into take estimates and timing and statisticians to propagate error and all that. I still don't know how you can possibly estimate take when we don't have a clear, legal definition of what constitutes a take.

ION Geophysical Corporation 2012 Monitoring Results for Beaufort Sea In-ice Seismic Survey

REVIEW OF 2012 OPERATIONS

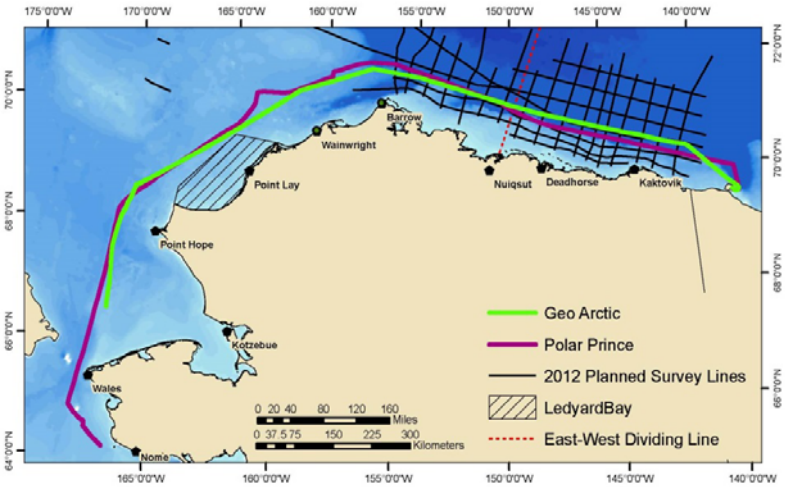
Ed Nelson, ION Geophysical

This morning I'd like to start with the operation summary. Our seismic vessel was the GeoArctic and lead ice breaker was the Polar Prince. Airgun array permitted 4450 cubic inches; we used 4380. The mitigation gun was 70 cubic inches.

2012 Transit Timeline

October 7-10	**Mobilized in Nome**
October 11	Departed Nome
October 11-15	Transited to Hershel Island; remained over 40 miles off shore during transit
October 12	Received BOEM G&G permit
October 15-18	Took on additional fuel at Herschel Island
October 17	Received IHA from NMFS and LOA from USFWS
October 19	Transited to SSV location in eastern Beaufort Sea
October 20-23	Conducted SSV shallow water site test at 50 meters and deep water site at 500-100 meters.
October 24	Started seismic data collection
October 30	For approximately 6.5 hrs, the two spare airguns were unintentionally fired resulting in total discharge volume of 4880 cubic inches instead of the intended 4380 and reported to BOEM, NMFS and USFWS. *Showed map of location*
November 9	Seismic data was completed in the Beaufort Sea
November 9-13	Transited to Chukchi Sea. Retrieved airguns and streamer cable during transit
November 14-15	Collected seismic in central Chukchi Sea. The intent was to shoot the middle tide line, but ice prevented that. Instead shot the south most tide line.
November 15	Ended data collection
November 15-20	Transited to Dutch Harbor
November 20	Demobilized in Dutch Harbor

2012 Seismic survey lines completed: 7,242 km were planned. A total of 1,844 km of transect lines were surveyed or 25% of the program.



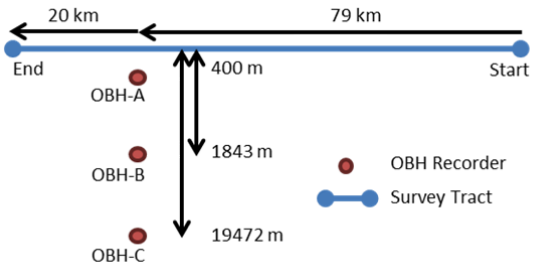
SOUND SOURCE VERIFICATION RESULTS

Dave Hannay, JASCO Applied Sciences

The purpose of the program is to verify, using field measurements, the zones surrounding the airgun array over which sound levels remain above certain threshold that NMFS uses to assess different effects on marine mammals. The thresholds important to this project were Level A and Level B thresholds. Level A takes threshold for cetaceans is 180 dB and for pinnipeds 190 dB for impulsive sounds. Level B takes for all species is 160 dB. Model-based results were used as estimates of the threshold distances at the start until the SSV measurements are available. When an airgun is being towed behind a seismic vessel, the sound footprint is not always uniform. It is not a circular sound pattern around the array. Generally the array has a directivity pattern which means they produce more energy in some directions than others. For the airgun array ION used, the sound emissions were predicted to be higher in the side directions than in the front and back of the array. This is important in how we go about measuring levels because we have to make sure we configure our measurements to capture all directions from the array. Another important factor about sound measurements is that they are affected by water depth. This is especially true for waters less than a few hundred meters. Most of these surveys are performed in waters that are just a few tenths of meters, so this is an important effect. We have to make sure we measure at multiple depths.

The SSV measures were performed at the eastern end of ION's survey lines and two lines were surveyed: one at 50 m and 500 m water depths. The reason we do this is because the sound propagation characteristics differ with depth. At the shallow site, we deployed recorders on the seabed at three distances. The vessel towing the seismic array came along and then returned. We then moved to the deep site. The recorders were not deployed on the seabed but rather suspended from the support vessel. The seabed recorders were all at 50 m depth, so at the deep site we suspended the recorders at 50 m beneath so there was the same monitoring depth.

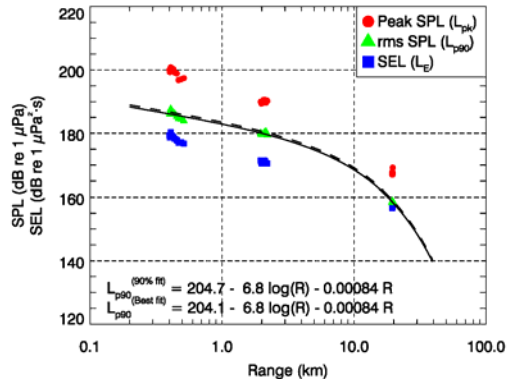
Shallow Site Measurements:



The diagram to the right shows the specific configuration of recorders at the shallow site. The approach started 79 km from the recorders and continued 20 km past them. Recorders were deployed at 400m, 1843m and 19,472m off the seismic tract. We do this because we are measuring the sound emissions in front at the array as they approach the recorders. As it passes, we measure to the side, and, when it is passed, we measure sound emissions behind the array.

When we process the data, we calculate the peak sound level, the root mean square (the sound measure that is used to assess effects) and the sound exposure level for each pulse. Even though we only use the RMS, it's important to capture other metrics as NMFS is considering different types of metrics to assess effects. The SEL is the one that is related to the effects of the parameters that NMFS presented yesterday. It is important to capture this data if we need to go back and look at the sound footprint in SEL terms at monitored sites.

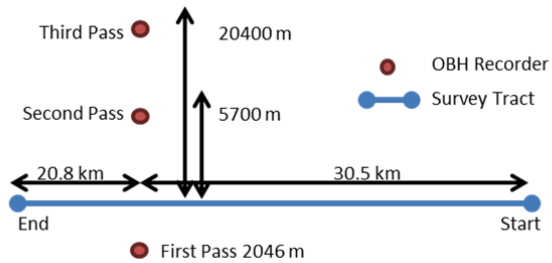
When processing the RMS levels, we start by fitting a smooth curve (the black solid line) to the sound level versus distance measurement. We then shift the black curve up and calculate the dashed curve which exceeds 90% of all the measurements to arrive at a relatively conservative measure of the general trend of sound level versus distance. We then look to see where the dashed and black curves cross the various sound level thresholds and calculate distance corresponding to each threshold.

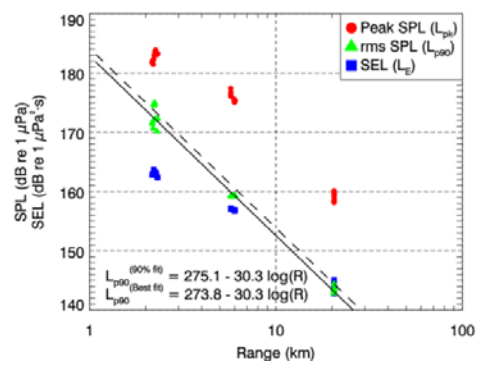


An important point is the sideway levels, the ones to the side of the array, are generally higher than the ones front/back.

Deep-Site Measurements:

The recorder geometry was different for the deep-site measurements. In this case, there was a 30 km approach and 21 km past the measurement location. The recorders were suspended from the support vessels and were 2 km for the closest, 5.7 km for the second and just over 20 km for the third. Because we were suspending from the support vessel, we could only measure one at a time, so we did the first entire run, then two shorter runs redeploying the surface hydrophones for each pass. The results were shown to the left and show more scatter at the deep site. Another point is the RMS are quite a bit lower because the pulses, especially in deep water, spread out with time. While they start out being only a few tenths of a millisecond long close to the source, when you are at long distances more than 10-15 km, they start to spread out. In this case, the duration got up to 2-3 second at longer distances.





We determined the threshold radii on the crossing of the fit curves with the sound level thresholds and the values tabulated in broadside, front and aft direction. The threshold radii distances are based on 90th percentile fits. We then take the maximum of those distances in order to create the zones over which the effects are assessed.

Measured Threshold Radii

Received Sound Level (dB re 1µPa ms)	Distance to Threshold Level (m)		
	Final Results		
	Water Depth (m)		
	< 100	100-1000	>1000
190	287	395	395
180	2,290	1,250	1,250
160	18,700	6,260	6,260
120	109,000	131,000	131,000

When we make these measurements for the SSV in the field, we have five days to prepare the reports for NMFS and at that time adjust the exclusion zones that are monitored based on SSV measurements. The data are taken back to the lab and do a further detailed analysis. In most cases, we will only see small differences in our post-field analysis and in-field analysis, but, for this program, we noticed quite a significant difference for the shallow site. In the field we had a distance of 830 m, but in the final analysis we realized the distance was substantially greater at just under 2.3 km. The problem was due to an error in the field of analyzing the hydrophone data. Two hydrophones were used, one for very high levels and the second for low levels. The mistake was that the low level hydrophone was analysed when the high level measurement should have been used. This was only noticed when the data were brought back to the lab. As soon as this was understood, this was reported and will be addressed more in the presentation.

MARINE MAMMAL MONITORING RESULTS

Darren Ireland, LGL

There were other acoustic monitoring activities that took place. One of the recommendations from the peer review panel was to do some over-winter acoustic recording to better understand propagation of seismic sound and vessel activities in ice conditions. Over-winter recorders were deployed in conjunction with Shell in the Beaufort Sea. There were five recorders placed for the over-winter period in early October 2012 and will be recovered later in July or August in 2013 when open water monitoring recorders are placed to record the bowhead migration; therefore, there are no data at this time. The recorder locations were similar to the previous year by Shell. Shell deployed them on their own the previous year and believe those data are being analyzed right now and do not have final results yet.

Another activity was noise recordings from the seismic streamer. This was done as a backup plan. ION's original plan was to use three vessels to do the seismic operation with a second ice breaker involved. If that was the case, one of the recommendations from the peer review panel was to deploy sonobuoys from the second ice breaker. The reason it had to be from a second ice breaker is because when ice is present, the first ice breaker is directly in front of the seismic source with a space of about 500m to a kilometer. If deployed from the first ice breaker, they would be crushed by the seismic boat; if deployed off the seismic vessel, they would get tangled in the gear. As an alternate and because operations were done with two vessels, this was a way to try and get information on what types of sounds are being produced by vessels moving through ice. There have been measures of ice breakers working in other locations in the Arctic and around the world, and, a

lot of times, the measures are based on very heavy ice breakers doing heavy backing and ramming-type actions on multi-year ice, pressure ridges, etc., so the sound levels we have from ice breakers is quite high. Our expectation was the sound coming from the vessels moving through this type of ice conditions would be lower than those. We wanted to document this and understand how much sound is being put into the waters by these vessels moving through lighter ice conditions. During the survey, the seismic shots would go off about every 18 seconds with a couple of times each hour when the airguns were not fired for two consecutive periods. There was about one minute when no airgun activities took place and were not fired, but the acoustic streamer continued to record. Greeneridge is working with the data now. The seismic streamer is primarily designed to record seismic sounds coming back up from the sea floor, so it is not as clean getting at the data coming from vessels operating horizontally on the water. There are some challenges to the data but being worked to help answer some questions. The report is expected in the next month or two.

There were PSO on both the vessels – five on the Geo Arctic and four on the Polar Prince. This activity was permitted on both sides of the border as some of the lines went up to Canadian border and therefore had PSOs from the Northwest Territory on board. Typical mitigation activities were performed: 30 minute watches prior to start up, start-up was not allowed unless full safety zone was visible. Ramp-up procedures were used and in the case of the Geo Arctic which took about 30 minutes to reach full array. Power down and shut down procedures were in place for the safety zones. In the end, no power downs or shut downs were called by the PSOs. No animals were observed in the water within the safety zones during seismic activity based on the safety zones that were used and known to the PSOs at that time. It is an important point that will be discussed.

Observers used big-eye binoculars on the ice breaker, the Polar Prince, out in front. They are only good in good visibility conditions with little fog, rain or snow, and used about 20% of the days due to weather limitations. During night activities, there was a lot of interest in what could be done in regards to monitoring at night because this activity took place in more night-time conditions in open water. One thing used was vessel spotlights which are high intensity beams that allow a narrow visual field. It was reasonably effective out to 1 km, and one polar bear was detected on ice. Primarily the spotlights were used by the vessel pilots to determine ice conditions immediately in front of the ship. Another tool was night vision devices. We've talked at these meetings that these are of limited value. They are not the same as doing daytime observations in good visibility, but in comparison to the spotlights they generally were less affected by precipitation and provided a wider field of view. It is difficult for PSOs to wear and watch through them for long periods. Another tool used was the Forward Looking Infrared camera (FLIR). The device was mounted above the bridge and senses infrared images which are sent by video cable to a computer where the PSOs could monitor. The PSOs could control where the camera was looking, pan back and forth and zoom in and out. As we expected, the camera was potentially good for detecting animals on ice and had one detected with the device. But as expected, marine mammals are expected to be in the water trying not to give off much heat, so this device was not a good tool for detecting animals in the water. We did have one substantial sighting event of walrus during the day. The PSOs looked at the FLIR video stream and were able to detect walruses in the water. All methods were affected in different ways including weather, etc., and not as effective as daytime observation.

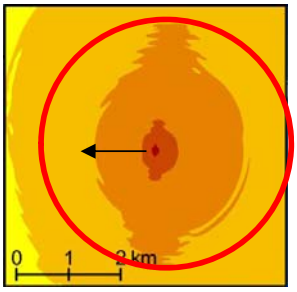
Showed map with track lines, transit, times when arrays were operating. There were scattered areas and focused areas of sighting. Ninety percent of the sightings happened in three locations over four days:

Marine Mammal Observations | All Sightings by Location

	Beaufort Sea		Chukchi Sea		Total	
Species	**Sightings**	**Individuals**	**Sightings**	**Individuals**	**Sightings**	**Individuals**
Odontocetes						
Beluga	1	125	0	0	1	125
Mysticetes						
Bowhead whale	0	0	39	86	39	86
Unidentified M. Whale	1	1	2	4	3	5
Pinnipeds						
Ringed seal	25	101	18	26	43	127
Unidentified Seal	72	81	85	140	157	221
Bearded seal	8	9	26	84	34	93
Walrus	0	0	179	1728	179	1728
Unidentified Pinniped	0	0	2	5	2	5
Fissiped						
Polar Bear	0	0	13	14	13	14

Sightings are a combination from both boats, and there were some duplicate sightings. We have removed those as best we can.

<u>Bowhead Whales Exposed to Seismic >180 dB</u>: The safety radii used by PSOs during the field season, the 180 dB shutdown zone, was 832 meters. On November 14, full airguns were operating and there were 30 bowhead whale sightings containing 64 individual whales. The distance of the sightings was 870 m to 6,000 m from the airguns. This was outside of the safety zones the PSOs were enforcing, so there were no power downs or shut downs. However, final analysis of the airgun measurements determined the 180 dB safety zone should have been 2,290 m or 2.3 km. Therefore there were seven of the 30 sightings, ten individual bowhead whales, that occurred within that 2.3 km zone. The sounds propagating from the airgun array are different strengths and different directions. If you look at the orientation of these sightings relative to the orientation of the airgun array, at the time of the sighting the estimated received levels at those sightings were between 176 and 182 dB.

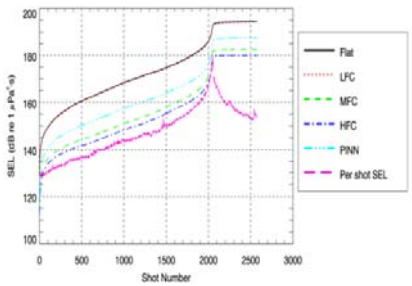


In the example at left, with a vessel travelling west, you can see that the sounds travel more to the sides of the vessel than they do port and aft. The radius that PSOs implement in the field is the largest of those regardless if the animals are out in front or to the side. It is always the distance as indicated by the red ring that would trigger a power down or shut down. There were seven sightings or ten bowhead whales observed within the radius. Some of the animals were out in front of the vessel and why our estimates, based on the final sound measurement and equation, suggests some of animals at the time of the sighting were actually outside of the 180 dB zone. There were

other sightings that were directly broadside the port or starboard side of the boat and therefore would have received greater than 180 dB. Knowing that NMFS is considering the SEL criteria, we did an analysis to determine what the exposure level the animals would have received under the cumulative SEL-type metric similar to the ones that were proposed by NMFS. We used a method based on an approach developed by an expert panel. These results were published in 2007, the Southall study, Marine Mammal Exposure Criteria. These are initial scientific recommendations for aquatic mammals. The recommendation suggests that Level A takes could be based on SEL criterion instead of RMS that we use. The new thresholds not only account for the absolute level, but the frequency distribution relative to the frequency sensitivity of different groups of marine mammal species, sometimes referred to as m-weighting. There is a related weighting scheme. There are two types of weighting: the Type 1 approach and then Navy developed a further weighting method, Type 2. The two different types are actually fairly similar but have different shaping different curves and thresholds, but are fairly similar when applied to seismic data. We look at SEL of different parts of the array and then calculate a cumulative SEL by summing up all the exposures. When the airgun array is far from the animal, there is small exposure being accumulated. As the array gets closer, there is more rapid exposure dose.

Distance off seismic survey line	Cumulative SEL (dB re 1 $\mu Pa^2 \cdot s$)				
	Flat-Weighted	Low Frequency Cetaceans	Mid-Frequency Cetaceans	High Frequency Cetaceans	Pinnipeds Underwater
400 m	194.4	194.1	182.5	180.0	187.4
1844 m	190.9	190.5	179.2	176.7	183.9
19479 m	183.1	183.0	174.8	172.0	179.4

The measurements were from our closest acoustic recorder. Imagine an animal sitting at the closest recorder, this is the type of SEL that it would encounter as the airgun array approached and past the animal. This is the type of exposure a mammal would receive if fixed at the recorder location. Energy is added to the cumulative measure through the entire track of the vessel although the ship may have actually passed an animal. Showed slide of this example with cumulative – those lines in between are frequency rated. There are different weighting functions for low, mid and high frequency mammals. Based on these weighting functions, we are interested in the cumulative sound level after the vessel and seismic array is past. What is the cumulative SEL? For low frequency cetaceans, at the 400 meter recorder, the cumulative SEL was 194 dB. The threshold level proposed by Southall was 198 dB. At this range, if an animal had been sitting at the top of the recorder it still would not have received the level associated with a Level A take. Correspondingly, the recorder at 1800 meters, the level was less at 190 dB; the one at 20 km was down to 183 dB. We then took these three numbers at different distances and extrapolated them to determine at what distance an animal fixed off the side of the vessel would be exposed above the criteria. For low frequency cetaceans, it would be the bowhead at 114 meters which is quite a bit less than what the RMS metric proposed which was 2.3 km. This approach gives a less conservative estimate of the threshold distances. If this were to be put into practice, there would also be a safety margin applied to this which may make longer distance to the threshold.



Marine Mammals Observed within Safety Radii: In the 90-day Report, we present a few alternatives to the number of animals observed near the operation and potential impacts. First we show how many animals were observed within the safety radii. With the exception of the marine mammals that were potentially exposed to >180 dB RMS, there were no other animals observed within the associated safety zones during activities. Within the disturbance zone, 160 dB, there were 64 bowhead whales observed November 14 and a couple of seals observed in the water at that time. These were the animals the observers saw, and we know they don't see them all. One of the ways we tried to determine how many animals were out there is to calculate density. The calculation involves correction for density for animals that may have been under the water or not seen because they are further away from the vessel. The densities are calculated for both seismic and non-seismic time periods. Under normal assumptions, you would assume that density would be lower during seismic activity versus non-seismic. When you multiply the densities by the areas that were exposed to 260 dB, you arrive at numbers that may reflect how many animals may have been in the area.

Estimated Numbers within Disturbance Radii | Beaufort Sea (Blue) Chukchi Sea (Red)

These numbers are density x area that could have been in the 160 dB zone

	Estimated No. Individuals							
	Seismic Densities			Non-seismic Densities			Requested Take	
Species	**Mean**	**LCL**	**UCL**	**Mean**	**LCL**	**UCL**	**Mean**	**Max**
Cetaceans								
Bowhead Whale	0 | 3,233	- | 1,365	- | 7,658	0 | 174	- | 67	- |454	285	1,136
Unid. Mysticete Whale	0 | -	- |-	- | -	36 |-	14 |-	100 |-	-	-
Total Cetaceans	0 | 3,233	-| 1,365	- | 7,658	36 | 174	**14 | 67**	**100 |454**	**5,404**	**22,435**
Seals								
Ringed Seal	0 | -	- | -	- | -	548 | 0	177 | -	1,686 | -	60,574	91,244
Bearded Seal	0 | -	- | -	- | -	131 | 0	9 | -	1,945 | -	93	377
Unid. Seal	0 | 1,053	- | 804	- | 1,380	430 | 3,257	145 | 1,422	1,261 | 7,461	-	-
Total Seals	0 | 1,053	- | 804	- | 1,380	1,110 | 3,256	**457 | 1,422**	**2,690 | 7,461**	**60,711**	**91,801**

There has been talk about confidence limits, so we have taken the lower and upper confidence limits from the density estimates and multiplied them by the area exposed and carried them through. During seismic activity in the Beaufort Sea, there were very few sightings except after the seismic was done and the boats were leaving. Therefore there were no sightings that were useable for calculating density, so the estimated density was zero, which is obviously a very low estimate. We did see animals during non-seismic periods. When you multiply them out by the area exposed, the estimates were 14-100 whales and 450-2600 seals. These are based on the density calculated by the number observed by PSOs during Beaufort Sea activities.

In the Chukchi Sea, the relationship between seismic and non-seismic is flipped. We saw whales during seismic on November 14. The densities we calculated during those days, and we narrowed it down to that specific period end up being higher than the non-seismic densities. The estimate for

bowhead whales were 1,300-7,500 animals during seismic. During non-seismic, because we did not see many whales during that period, the numbers are much lower, which is the reserve of what we see often times with densities. Usually there is some avoidance that shows up, but the nature of this activity and the way the animals were sighted during specific times means this trend does not follow what we often see. As Bill indicated, these are some big ranges in numbers, and, if they mean the animals were disturbed to the Level B or not, is a parking lot issue. ION does not plan to operate in 2013, and we are happy to take questions on the 2012 activities.

Q&A | Comments:

Patsy Aamodt, ICAS: I have two questions. For the NOAA group, would we be able to see a compilation of all activity, both seismic and drilling, per season to have a visual of the impact during one season with all the companies doing seismic and drilling activities?

Jolie Harrison, NMFS: Do you mean beyond the map that is on the table or a map like that for a multiple season?

Patsy Aamodt, ICAS: A map like that so we can see. It is overwhelming for me to see all the seismic activity and drilling going on. I know individual companies are making presentations, but I am more interested in the overall activity to visually see for myself, totaling all the statistics that are being shown to us. When you compile all of them, it isn't just what one company presented. When you put them together, it could be significant. You may have that information already.

Jolie Harrison, NMFS: I think the map out on the table may address what you are looking for. If not, let's talk off line, but I think there is a map that has the multiple activities for this season mapped out on the table.

Patsy Aamodt, ICAS: Thank you. The other is, this may have been presented, but I was curious with that incident you reported in the Beaufort area when you were doing seismic activity. The two incidents covered quite an area from what I could see on the map. I know we are taking sea mammals, but do you see any dead fish as a result of this type of activity?

Darren Ireland, LGL: Good question. Seismic killing fish isn't something we see evidence for. That said, it hasn't been looked at carefully. I know (and actually defer to Bill Streever on this) BP did work in 2008 looking at fish and sampling them after seismic work was done in that area. It isn't something we see regularly off the back of the boat. The PSOs don't look back and see a lot of dead fish, but it hasn't been well studied in the sense of having boats follow behind.

James Patkotak, AES: I was also a PSO on one of industry's ventures and afterward ended up in the Deadhorse communication center. With safety in mind, when I was at the communication center I noticed the radios didn't even reach the Geo Arctic or Polar Prince when I decided to test the radio. I believe at the time both ships were near the demarcation point, not very far from Deadhorse, and I didn't get a response back from either ship. That has been my concern, although I am told there are satellite phones aboard the ships. In case of an emergency, would anyone on board have time to locate a satellite phone to communicate with the Deadhorse communication center or have time to dial the number? That goes to safety because safety is very precious whether you are on sea or land. Can anyone answer that?

Ed Nelson, ION Geophysical: Yes, James. Good question. They do have satellite phones but when they are out of radio communication, we fall back to sending in our positions and what we are

doing via email. I know email was sometimes 15-20 minutes late, but that is what we did because of the distance we were from Deadhorse.

James Patkotak, AES: I am talking about safety now. We need to upgrade the communication systems between ships. Now one question regarding over winter recorders, are they in the water or do they have a buoy on the recorders? If so, are there signs of causing stress to migrating whales and other sea mammals? If so, do you notice if the seals using the buoys to rest on?

Darren Ireland, LGL: The term buoy is not the best although we refer to them that way, but they are mounted on the sea floor, and there is no buoy at the surface. There is nothing above the surface of the hydrophone recorders. They are mounted on the surface and a couple of methods are used to pick them up. One is to have a ground line on the sea floor and grapple for that or others have acoustic releases and can be sent a signal to break anchor and float to the surface.

Colleen Swan, Kivalina: Regarding the number of seals observed by PSOs, as my dad would say, those numbers are really low. He's an ocean man. Regarding your seismic and non-seismic activity numbers, or lack of numbers, I would think if there were no bowhead whales in vicinity I would be doing seismic activity and if there were bowhead whales, I would not be.

Jeff Denton, BOEM: When you were observing bowheads, what were their responses when you first sighted them versus when you went by them? Was there any indication they were trying to avoid, change swim direction, diving differences? I'm trying to get a handle on what their response was if you were within those ranges.

Darren Ireland, LGL: Unfortunately for the most part, these animals were seen once and not repeatedly seen again. We don't have a long track of seeing the animals multiple times; only 5-10 minutes as the vessel passed. The observers did not record behavioral reactions, noticeable changes in direction or different types of surface activity. Those types of behavioral responses were not observed during these brief sightings. In the 90-day report we do provide a paragraph on each one of these sightings that provides specific details of what the observers recorded during the event, both the position and direction of animals during these sightings.

Mari Smultea, Smultea Sciences: I was wondering since we talked about it yesterday, what is the definition of non-seismic?

Darren Ireland, LGL: Non-seismic means no airguns were firing. At times in the past with different programs, we have used the 120 dB threshold which at times is 75 km or more away. If we had multiple vessels operating in the Chukchi or Beaufort Sea, if they were outside of those zones, we wouldn't call it non-seismic, we would call it operations efforts sightings that occurred in areas less than 120 dB received sound levels. There are different distinctions, and I think you are getting at the point that there are different ways to define non-seismic. In this case, we are talking airguns on (doesn't matter how many—mitigation or full array) versus airguns completely off.

Mari Smultea, Smultea Sciences: I was wondering how long of a period before had the airguns been operating before you called it non-seismic?

Darren Ireland, LGL: Three hours was the delay we used in this case.

Megan Blees, AES: A question regarding your polar bear sighting that was observed in the spotlights. Was there any attraction to the lights noted or what the behavior of the animal was?

Darren Ireland, LGL: The vessel crew member that recorded that and told our PSOs about it said the animal was seen walking broadside to vessel. It was perpendicular to the vessel and in the spotlight for just a little bit. At night, the ice pilots were wary of scanning much around and kept the spotlight focused on the ice conditions in front of the vessel, so the animal was seen briefly walking through the point of light and kept walking. That is all the information we received.

Chris Winter, Crag Law Center: Can we go back to slide with the density estimates? In the past we read monitoring reports where companies have recorded length of observation during low visibility periods and then incorporated it into an adjustment of sorts. Is that data available and has it been incorporated into the numbers? A related question is that those are numbers, not density so how is that data going to be used to calculate densities and is that going to be intended for some future purpose in terms of regulatory function?

Darren Ireland, LGL: Both good questions, and I do apologize for not being clear on this. There could have been…in order to keep the number of slides down right before these slides, there could have been a table formatted the same that showed the actual density numbers. These numbers are density numbers multiplied by the area that could have been exposed to 160 dB. This is density times area and the result of that. The density estimate may have been in the 160 dB zone. As far as the calculation, there were lots of details I did not put into the presentation. The way we calculate density, they are only counted based on time periods when observers have good visibility. If we include when time periods when visibility was poor, but was counting all the effort, we would bias our density estimates low and underestimate. The good periods are the only thing we used to calculate density from, but we multiplied those densities during the entire length of operation during good and poor visibility conditions.

Lisanne Aerts, LAMA Ecological: Darren, I saw you had 125 beluga whale sightings, and I was wondering where they were or when you saw them?

Darren Ireland, LGL: The beluga sighting occurred right near Herschel Island in October. It was one sighting of a group of around 125 animals that were stretched out in a line as they passed the vessels.

Lisanne Aerts, LAMA Ecological: Dave, when you calculate the SEL, you said you were waiting until the airguns were past the animal. How long were you waiting because we know that airgun sounds can propagate very far out, so I was wondering how long you would wait for you to stop your SEL level?

Dave Hannay, JASCO Applied Sciences: When you are close a lot of the exposure occurs in the first few shots and the most important contributions are for shots when you are within a few km of the animals. We calculated the SEL over the entire SSV track but would have gotten similar numbers if we had stopped within about 10 km of the approach. I think especially for these high levels that correspond with these takes, that you could potentially limit the amount of the number of shots you need to consider.

Billy Adams, NSB: Did any of the recorders emit any sounds while they are underwater?

Dave Hannay, JASCO Applied Sciences: I can say that the recorders we used here do not emit noise because they don't have hard drives recorders but those that do and emit a very low level of noise that some animals might hear if they were within a few meters of the recorders.

Robert Suydam, **NSB**: I want to compliment ION for listening and working with Shell to do some joint monitoring. I wish it had gone a bit differently, but glad you worked with Shell and look forward to the results. I also want to thank you for your transparency about the problems with the shoot and the calculations of the safety radii and shooting an airgun array that was larger than permitted. My question for NMFS is how do you deal with the situation where an airgun array was too large, larger than was permitted, was used for a while? And how do you deal with a situation where the safety radii, an honest mistake, but a mistake, that maybe should have been realized earlier but where there were some shut downs or ramp downs that should have occurred and didn't? How do you deal with that?

Jolie Harrison, NMFS: It's a really good question and the simplest answer is that we are still figuring that out. I too want to thank ION for their transparency, and they let us know as soon as they were aware of what happened. As you can imagine, answering a question like this is both sensitive and complicated. It involves a lot of information gathering; it involves coordination with the MMPA program, ESA program, general counsel and potentially other groups within NOAA. I think what I can say right now is we are still figuring it out and because of the type of question, it is not a good idea to speculate. It is important to figure out the best way to deal with that and the focus here is to make sure that it doesn't happen again. There are obviously other pieces of how we deal with this, and we need to be on the same page before discussing in an open venue.

Robert Suydam, **NSB**: Thanks Jolie. That was kind of my expectation and appreciate you answering it. Ed, I know when the peer review reviewed the monitoring plan last January or whenever it was and I know in our discussions in Barrow was one of the things we talked about was for ION to shoot survey lines in the east first and then move to the west in part as a mitigation measure since the bowheads were probably to the west at that point. Still probably some in the east. I didn't catch this earlier when you presented this to us in Barrow, but I noticed that you actually shot an entire line from the Canadian border almost to Barrow then turned around and went back to the east instead of doing the east lines first and then moving west. That change in operations from what my understanding was after talking to you on various occasions may have changed and probably would have changed recommendations for monitoring for 2012. Could you comment on how that happened? I felt that operations were going to happen one way, but apparently they happened a different way.

Ed Nelson, ION Geophysical: After we completed the SSV, we sent the Polar Prince to Herschel Island to off load the data, two engineers and two technicians. Unfortunately we had some bad weather that kept them there for a week. We went ahead and shot the first line from east to west. It was open water with no ice to be seen, so we made a decision to shoot that line to the east, clear the Kulluk then come back to the west. By that time we were heading back toward the east after finishing the first line, the Polar Prince was then cleared, bundled the data and the gear and met the Geo Arctic on the second north-east west on the strike line. That was a commercial decision made at the time and why we shot that rather than sit around for a week. We didn't want to go north without the escort, so we stayed in safer water by shooting about 50-60 miles west of Barrow and turning north giving us a lot of separation from activities coming further inshore. That wasn't part of the plan because the plan was to start on October 1 in the

northeast corner and expected a lot of ice and that is what we figured we would do. You did mention to me when we start working on 2014 that we have more than one plan depending on conditions, and we will put that into place.

Robert Suydam, **NSB**: That is a lesson learned that plans do change for safety reasons, operational reasons so thanks for that.

Craig George, **NSB**: Thanks for the presentation and appreciate the transparency. Errors happen in the field so good, honest reporting is important. Jeff asked my question about the behavior of the bowhead, which I find quite interesting. We had some tagged whales in the area, and they were milling in a configuration that we think was feeding. Presumably there were feeding and that is consistent with how bowhead behave to a close approach but in that regard my request is that we get the track lines soon so we can integrate the tagging data and tract lines of the vessels. So I guess this is an official request for that. Would you like something in writing?

Ed Nelson, ION Geophysical: Please send an email.

Jessica Lefevre, AEWC: I also want to compliment you on what I see as ION's on-going efforts to become more collaborative with the community, borough and hunters. It is really important and deeply appreciated. One quick question: noticing the dates of your operations, I assume you left out through the Bering Strait following the Chukchi operations? What date did you pass through the Straits?

Ed Nelson, ION Geophysical: About November 17.

Jessica Lefevre, AEWC: Were the comm centers still operational at that time? Were you communicating as you went through?

Ed Nelson, ION Geophysical: I don't know. I can check and get back to you, but I don't recall.

Jessica Lefevre, AEWC: That's fine. I know that is right at the end of the season when St. Lawrence Island folks asked to make sure the people were out, so I just wanted to make sure our communications systems were working for you. I checked the harvest reports; there were no late season hunting, but in the event that there had been, having the ability to communicate with the hunters would be very important. I just wanted to check and that might be something to focus on in the future to make sure that is in place for you.

Ed Nelson, ION Geophysical: Thank you. I will check with Megan.

Sarah Tsoflias, IAGC: I wanted to respond to the question about seismic resulting in large fish kills. As far as I am aware, there has not been documented evidence of that occurring. Lab studies have done with fish in cages that cannot move and very close to seismic source. That does result in auditory injury. I would say in the real world, remember the fish and source vessels are moving and extremely unlikely they remain close enough to the source array to receive exposure levels that would result in death or auditory injury, but there is on-going research.

Ron Felde, Facilitator: Regarding traditional knowledge, there have been a lot of things done and to take advantage of traditional knowledge. We have asked you to please help identify some of those items. We talk about them from time to time and then they go away; we'd like to capture as much of that as possible. With the emotional responses at times around traditional knowledge that there are things that need to be done to access and take advantage of traditional knowledge, and it is important for us to capture those. If you could please take the

time to help us identify those areas so when we get to the parking lot we have a foundation to begin to build on that would be appreciated.

Shell 2013 Beaufort and Chukchi Seas Ice Gouge and Geotechnical Drilling Operations and Monitoring Plan

Michael Macrander, Shell Alaska Venture

There is no drilling program in 2013 for Shell. The remainder of what we have to talk about is what we had originally termed geophysical activities. We have an IHA currently submitted. Marine survey operations including geotechnical boring and ice gouge surveys. At this point we won't talk about geotechnical borings because we're nearly 100% sure we're not going to be doing geotechnical borings this year. There are a number of regulatory hurdles that need to be cleared as well as operational challenges like finding vessels, so it is not likely we'll do the boring. It is still our intention to do the ice gouge. Ice gouge is essentially surveying the sea bottom to look for gouges that ice fields make in the sea floor. We need several years of data in terms of the patterns of ice gouge. Looking at the same area, year after year, we can get an idea of how frequently new ice gouges are showing up in the area and the relative depth of those. So we are trying to gather several years of data. We have some data from the past, and we want to do that again this year. We are considering options that would help us continue to make progress. We have not lost our appetite for exploration in the Alaskan offshore. There are a number of operations and activities that we have been pushing off in to future years in order to focus on drilling in 2012 and 2013, so, as we speak, there are currently conversations about other activities that we might be able to do this year. We recognize those weren't included in our IHA, so we know it would require more conversations with NMFS, NSB and the villages if we decide to add components to our 2013 operations program.

The ice gouge proposed operation is in the Chukchi Sea. It does not go into state waters. It incorporates the Burger Prospect and portions to the south and east of that prospect. The main reason for looking at ice gouge is that eventually, assuming we have exploration success and have a discovery and development that may involve a pipeline to shore, we want to have a good understanding of these patterns, ice events, depths for developing infrastructure. It's like reading fingerprints to understand the patterns we see.

How do we do ice gouge? It involves several instruments a bathymetric sonar from the vessel, and we tow an instrument called a side scan sonar (these are high frequency emitters). We've done this activity at least three, maybe four, years in the past. Two years ago there was concern by the peer review panel about do we have a good understanding of the sound character from those. We went through the process of doing a sound source characterization on those, and it's been looked at pretty well. What are we going to do in terms of mitigation measures and protection measures and monitoring measures?

Doris Hugo-Shavings

I was born and raised between Barrow and Anaktuvuk Pass. I've worked for Shell since February 2006. My educational background is communication and political science and traditional

knowledge. I grew up in a subsistence lifestyle. I'm the social program advisor, and I also manage the subsistence advisor program for Shell.

We had communication centers in all the coastal communities in the North Slope region and a call center in Kivalina, Gambell, Savoonga, and Wales. The subsistence advisors program is near and dear to my heart. The reason I decided to work for Shell was because I wanted to make sure that we could not have any negative impact or we could avoid conflicts. These are my family members and friends and it matters to me that they have food on the table from the ocean and the land. This summer we had 11 subsistence advisors in the villages. The majority are experienced hunters and whalers. They also have pretty strong background in traditional knowledge and know the land and ocean area. They are people the communities trust and feel comfortable with. The program ran June to November last year because we still had vessels transiting past the Bering Strait. The most important part of the program is communication. We have a gridded map, and each grid box has a number, and throughout the day we have two daily calls set for people to call in to have a meeting. Shell plots on the gridded maps where they are going to do work, and we vet this plans with our subsistence advisors. They are prepared with cell phones, VHF radios, maps and they work with the communities to determine where people are hunting, where animals have been sighted, and we determine where we are going to go that day based on this information or whether or not it is the right time to transit a vessel. Since I've taken over the program the last two years it has been a challenge to get information about where they are happening. It is a challenge as many people don't want to share, but during the past few years more and more are recognizing that we are committed and so more are willing to share.

Crew changes are done with helicopters. Certain times of the year, beginning of summer, people are very actively hunting marine mammals, so, we made sure when we made crew changes, we would fly a developed route sometimes more inland to avoid impacting hunters along the coast. Towards later in the season when people were hunting caribou inland they flew a more coastal route. A lot of the subsistence advisors recognize that Shell values the traditional lifestyle. We are gathering traditional knowledge that's actually being integrated into our program plans.

- Committee liaison officer program in Barrow, Wainwright, Point Lay, Point Hope, Kotzebue, Nome, Nuiqsut, and Kaktovik.

Michael Macrander

- Whaling blackout for Nuiqsut and Kaktovik starting August 25
- PSO on all Shell assets including over flights
- Advanced Data Acquisition Manager (ADAM) keeps track of all vessels offshore and aviation assets
- Real time ice and weather forecasting system
- Collaboration and community with AEWC, Beluga and Seal committees, Walrus and Nanuuq Commissions and hunters.

We will be implementing our full suite of marine mammal monitoring including PSOs, aerial program (in 2013 this will be primarily a sawtooth and nearshore patterns as flown in 2006, 2007, 2008 and 2010 and to a limited extent in 2012), and acoustics programs in both seas.

Those are the activities we anticipate in 2013.

Q&A | Comments:

Colleen Swan, Kivalina: I wanted to ask about the subsistence advisors program. Who is the advisor? What is their job? Who do they talk to? What is their sampling? How many hunters do they interview? Because I go out whaling, I work on 10-15 per summer because we provide for more than eight families, and I'm wondering where this program is? Where is it at? I volunteer for search and rescue. Maybe you're talking about Barrow?

Doris Hugo-Shavings, Shell: In regards to search and rescue I was talking about Barrow. Theodore Booth was the subsistence advisor in Kivalina last year. He spoke with a number of hunters. The thing about Kivalina that is important is that we didn't have any vessel and helicopter activities out of Kivalina and most residents would not have seen any vessels from Shell, but he was there and he captured traditional knowledge. We felt it was important enough, in case of a potential impact, to have a subsistence advisor there. Another subsistence advisor out of Kivalina that we've had in the past is Betty Swan.

Jolie Harrison, NMFS: I wanted to caution about the level of changes or additions you're thinking of, but be aware of the timelines for the IHA.

Michael Macrander, Shell: We are aware of that and that is part of the conversation we're having about what can we accomplish this year and a very important piece of the dialogue is can we get the permits. Some of these discussions may die on the vine if that's the case.

Robyn Angliss, NOAA: You guys are collecting side scan sonar data. Have you thought about using that to look for walrus furrows or feeding pits for cetaceans?

Michael Macrander, Shell: Have we thought about it? Absolutely. Have we done anything about it? No. We've had some conversations with people in other parts of the world but that's as far as it has gotten. A quick reference to the data sharing agreement that we signed last year … that will be part of the third annex that I'm working on. When we get those done, the data should be available and people will have access.

Daniel (*last name and affiliation not given)*: I have two questions actually. One is for my cousin Doris. Doris, do you really think, and we're talking about the 2012 season, do you really think that Shell has oil spill response capability? Do you believe that yourself?

Doris Hugo-Shavings, Shell: I do. I believe they have oil spill response vessels; I believe we have oil spill responders; and I believe we have equipment for oil spill response. Also, in addition to oil spill response, we have several layers of prevention.

Daniel _____: I understand that. I've been asking for years now... Why doesn't Shell demonstrate that to us? Why won't they put a drill scenario and show what they can/can't do? Sorry. But my second question is on mitigation. In the event of a very large oil spill, worst case

scenario they could encap a well or something like that and our bowhead stock travels through an oil spill like that, they live for centuries. If our stock is contaminated, because they're filter feeders, and they travel through an oil spill, we'll never know which ones are contaminated. How will Shell mitigate that? And in reflection of the 2012 operating season: major vessel failure, can't even tie their rigs down. They don't have the infrastructure support up north like they did, they're lucky they had the Coast Guard. How does Shell plan to mitigate if they do a giant industrial accident and completely remove our subsistence whaling? Has that been thought about? Discussed? What is the plan there?

Michael Macrander, Shell: There are a lot of conversations … Again, this is a bit of a different discussion than we're here primarily to talk about, but I'll answer your question. We constantly learn, and we learn in a lot of ways. We learn from unfortunate events that occurred in the past. There are a lot of things that have been learned about oil spills, preventing resources from being exposed, those are all part of our drilling scenarios that we participate in and conduct drills with federal agencies. There are plans in place as to how to rapidly begin the assessment of a spill and what resources are exposed, and there are processes with federal agencies that would require the evaluation of natural resources and how they can be restored or compensated for. It is a very complex issue that would take a lot of time to delve in to in an appropriate manner. They are issues we take very seriously, and we work on plans for response, restoration and resource protection.

Daniel _____: I've seen those plans on YouTube, and the animation? It's like a calm lake in Hawaii. It's unacceptable. Where else are we going to have a forum to address this? I understand the agenda was set, but there's a big elephant in the room. There is no spill response. You need to be rigorous with your spill practices. You got to show us what you can do. We've put the cart before the horse. We need spill response, real spill response technology, and you guys need to invest in it and then demonstrate it to us. Why do you think so many people are against it? We don't know if you guys can clean up anything. Either you can or you can't. If you can, show it to us.

Johnson Eningowuk, Shishmaref: I'm interested in the PSOs and MMOs. Shishmaref is still largely a subsistence village, and we live right off the coast, and we have a lot of marine mammals that frequent our area. Our range of hunting goes to Wales, Diomede and we sometimes end up close to Kivalina and Point Hope when we are looking for game in the springtime. I would like to see Shishmaref be part of the PSOs and MMOs.

Michael Macrander, Shell: Thank you. This year, 2012, we extended our relationship in terms of corporate recruiting to NANA region and Craig can probably give you the numbers of people we got from the regions. We are constantly on the lookout for highly qualified people who can serve as PSOs.

Richard Kuzuguk, Shishmaref: I have a question on ice gouging research the sonars that will be used are high frequency. Is there going to be direct affect/impact with the belugas, and how long is that research going to take, and how much time will you be doing the sonar research with the ice gouging program? The purpose for that is possibly putting a pipeline underneath the sea bed, huh? That is a real big impact for the ocean. I think it's still in the planning stages? When

you guys go back to drill what is going to happen when you tap in to the mother lode? Cap it and leave it until your plans are approved?

Michael Macrander, Shell: Regarding the high frequency sonars, we looked at the frequencies, and they are pretty much above the assumed hearing range for belugas and other marine mammal species so it should have limited effects on that population. You mentioned the potential impacts of a pipeline. It is in the speculation phase, as opposed to the planning phase, but I would say it is in the speculation phase. If we were to have a mother lode of a discovery, we're trying to understand the environment and how we can operate in a safe and protective manner for the resources that were there. You asked how long will we be there? We are proposing to do about 600 miles of lines, depending on weather and sea state, it will be two to three weeks of work. The question about what happens if we drill in to the formation and have a discovery? All the wells proposed to drill in the next few years are exploration wells. They are not deliberately drilled to produce oil back to the surface. We may bring samples to the surface, but the well does not flow, and then they are cemented in and capped and retired in that manner. When we get to a development scenario it will be based on new wells specifically to flow oil to the surface.

Richard Kuzuguk, Shishmaref: When they use sonars, even just fish finding sonars, the beluga are so afraid of the high frequency sonars they, when in flight, they will be scared of the hunters and the boats. They think there is a killer whale in the area, and their predatory senses and defense system kicks in and pushes them away from the activity. For sea mammals to be that scared and afraid of the hunters, that is a big impact.

James (*last name and affiliation not given*): I have an ice gouging question. Northstar has been in existence for a number of years and there is a pipeline underground. Has there been any ice gouging problems along there?

Michael Macrander, Shell: I can't answer that because it is a different company.

George Edwardson, ICAS: I want to note that whales can hear 530 miles. So, in a sense, with what you're doing, you should have a 530 mile circumference as that is what you'll be affecting. Whales' eardrums are the size of your fist so you can understand how sensitive they are.

Flora Agiak, ICAS: I am currently with ICAS, and I was a past communicator up there in Barrow. Is there a way, because I've noticed there is a huge gap because we speak daily with the vessels and I noticed that the questions they asked us 'are there any whalers or hunters out in the sea right now?' and the fact that we only get information that's being brought in to the comm center ... we can only respond when they call in to the Barrow comm center and the fact that we don't have any whalers or subsistence hunters calling in to us, we're not able to provide them with any information. All we can tell them, in a nice way, without just saying 'no, we can't give you that information because we don't have any one calling in' is 'I'm sorry, the best thing I can tell you is they're out there.' There are some hunters that don't want to provide that information, and it is very challenging. When you guys have your daily meetings isn't there a way to get the Inupiat communicator and the subsistence advisor to communicate at least once because we can't provide vessels who are trying to avoid getting in the way of a subsistence lifestyle ... I mean, what's the purpose of having a comm center when we can't provide them information.

Doris Hugo-Shavings, Shell: I can't speak as to which vessels would've called in for that, but we do try to keep the Shell vessels updated with subsistence information, and we had a number of our vessel captains that would call in to our daily calls. I know there are a lot of other vessels that aren't related to Shell, and maybe they should look in to getting subsistence advisors as well and playing a part in the comm centers.

Michael Macrander, Shell: What I would add is that no system is perfect. Hopefully you're getting the flavor of the real thirst for information the industry has. We are funding call centers as one way of getting information. We have a couple of other avenues like subsistence advisors and community liaisons to try to pull as much information as we can. We are improving those programs. It is our intent and focus to continue to invest and develop those programs but one point is we take action on information we get. We are quite serious about this, and when Doris says no, there are hunters there, it gets a real big X on the operational chart. Let's work together to improve the program and get more information there.

Doris Hugo-Shavings, Shell: The information that was captured by the subsistence advisor program is shared on another call which is called the "simultaneous operations call." We were, in a sense, sharing our subsistence information with the Coast Guard and some other people. We do work hard because we don't want any impacts, but it is a two way street. We should encourage hunters and whalers to share that information. We are not going to do anything harmful with it, we're just trying to avoid harmful impacts or conflicts. Since I've started managing the program, I think it has improved in terms of having people who are willing to share information and are becoming more trusting. We have to build relationships with the people in the communities, and it's sometimes hard because people aren't supportive of offshore exploration, but I want to say there has been an increase in people being willing to share information, and I hope that trend will continue.

Flora Agiak, ICAS: Maybe you can have your subsistence advisors call in to the comm centers and give them information about where the locations of the hunters are if they're called in because I can tell you last year I just had a lot of calls from vessels from various oil and gas vessels asking where are the hunters, but we don't get any information about where the hunters are.

Robert Suydam, NSB: I would recommend the traditional knowledge section of the notes be summarized and have it presented at the meeting next year to help reinforce it. (**Recommendation)**

Shell 2012 Monitoring Results for Beaufort and Chukchi Seas Exploratory Drilling Programs

Michael Macrander, Shell Alaska Venture

On Tuesday I talked about Shell's 2012 activities. (Brief overview/recap provided)

BEAUFORT SEA AERIAL PROGRAM

John Brandon, Greeneridge Sciences, Inc.

In the Beaufort, we know there is natural variability in the fall bowhead migration through the area with pulses coming through starting late August through October. Some influences are ice and availability of prey. We have variability in our aerial survey efforts as well. We can't fly every day because of weather and/or other factors. To look for manmade impacts on migration, one of the challenges is teasing apart natural variability from human induced variability.

Some things that we might expect to observe from the air for bowheads around drilling, there were some playback experiments with drilling sounds, and those researchers observed differences in surfacing and headings, but those observations were fairly localized for those playback experiences at least. Some whales diverted around drilling at distances of 20 km or greater. Those responses have no uniformity and may depend on activity states and individual tolerance (e.g. if feeding, more tolerant).

Summary statistics on the 2012 Beaufort Sea aerial surveys: In the Beaufort, surveys were flown with cameras and with PSOs. We collected approximately 200,000 images and 82 hours of video. Surveys were flown from August 15 to November 3. There were 24 surveys flown (9,122 km total effort) and a total of 197,411 images taken with camera system and 82 hours of video. The survey grid was based on power analysis maximizing probability of detecting potential deflection. The survey area looks a bit different than previous years based on a peer review panel recommendation.

This map (displayed) shows aerial sightings pre-drilling from the middle of August through September during the peak of migration. The darker colors on the grid are a larger effort. The pre-drilling period overlapped with the whaling blackout period, so we didn't actually survey two of those lines during the blackout period to avoid disrupting the hunt. The arrows and dots represent bowhead sightings. The arrows show the estimated heading of the animals, and speed is categorized by the length of the area, the longer the arrow the faster they were moving. Around September 25th we noticed a shift in the migration. During that time we also noticed the animals' headings were more variable and were moving at a slower speed. If we look at the same map during drilling (displayed) you'll notice we didn't have as much effort during drilling. The drilling season was relative short, in October, and we didn't have as much time to survey, and there were a couple of periods of bad weather. You'll notice there were still animals pretty close to the coast.

In summary:

- Drilling season was relatively short and survey effort during drilling was limited by opportunity
- Late August through late September (peak migration) bowheads observed travelling in directed manner
- Late September into October sightings shifted more near shore, and swim speeds were slower and headings more variable
- Observed behavior consistent with foraging but also consistent with response to playback experiments

CHUKCHI SEA AERIAL PROGRAM

John Brandon, Greeneridge Sciences, Inc.

There were two survey areas in the Chukchi Sea: a saw tooth near shore survey from Barrow to Point Hope, and new this year was an offshore 40 km radius around the drill site. The offshore flights did not have any observers, only cameras; near shore flights had both observers and cameras.

Here are the results for the near shore survey with the dates on the left, the number of transects, and the sightings. You'll notice there were only five surveys, which is not surprising given that it wasn't the priority. You'll notice there were gray whale sightings early in the season, one killer whale sighting, and then, as the season progressed, there were more bowhead sightings.

Date in 2012	Survey No.	On-transect Effort	Gray Whale	Bowhead Whale	Killer Whale	Unknown Whale
23-Aug	1	1011	9 (12)	0	1 (3)	0
15-Sep	2	311	0	0	0	1 (1)
26-Sep	3	226	1 (1)	1 (1)	0	0
28-Sep	4	816	0	4 (4)	0	0
24-26 Oct	5	523	0	0	0	0
Total		**2887**	**10 (13)**	**5 (5)**	**1 (3)**	**1 (1)**

Early in the season there were some ice reconnaissance flights done, and a couple of observers would go out along the ice edge and collect opportunistic sighting data. The killer whales were down by Point Lay.

Here are the results from the near shore aerial survey effort for pinniped sightings. We have a different criteria for effort for pinnipeds, they are really hard to see from the air if you get any white caps or anything like that. You can see two surveys that didn't meet our criteria for useable effort and were probably done in high sea states. There weren't too many walrus probably because there were no observed walrus haulouts.

Date in 2012	Survey No.	On-transect Effort	Walrus	Bearded Seal	Ringed Seal	Unknown Seal	Unknown Pinniped
23-Aug	1	801	0	14 (15)	1 (1)	27 (36)	0
15-Sep	2	243	1 (2)	11 (11)	0	4 (4)	1 (1)
26-Sep	3	0	0	0	0	0	0
28-Sep	4	0	0	0	0	0	0
24-26 Oct	5	90	0	0	0	2 (3)	0
Total		**1134**	**1 (2)**	**25 (26)**	**1 (1)**	**33 (43)**	**1 (1)**

Now we're going to move offshore. These are the Burger sightings during what we call quick review (displayed). There are no observers on board here. You'll notice there were very few cetacean sightings from the early part of the season until late September; as you get into October, we got pretty good numbers of bowhead sightings in particular and some beluga as well.

There weren't too many sightings during the early season pre-drilling offshore. When we get later in the season when there was drilling you can see there were pretty good numbers of bowheads, belugas, and some unidentified whales as well. There are relatively good numbers of sightings, and they seem to be pretty randomly distributed around the survey area.

Walrus sightings offshore during pre-drilling period were associated with the ice edge. Later in the season during the drilling period we're seeing walrus in the images, and some of this cluster (shown) is consistent with the acoustic data.

In summary of the Chukchi aerial:

- Relative high numbers of bowheads were sighted during near shore surveys to the southwest of Barrow
- Walrus were observed in offshore study area throughout seasons; no haul outs observed onshore
- Photo review is ongoing, preliminary results appear very promising; for walrus hauled out on ice, images will provide better estimates of numbers than PSOs; cetaceans can be detected and appear to have been relatively abundant in offshore survey area later in the season.

Michael Macrander: We’re out of time, but we'd hope to give you more information about the photographic surveys. We're excited about that and are continuing to work on that. We also brought in four of the PSOs that participated this year to try to give people the flavor or what it’s like to be a PSO and the level of training they go through. Let's see how many questions we have, and, if we have time to hear from the PSOs, we can.

Q&A | Comments:

Richard Kuzuguk, Shishmaref: Thank you for the information on the aerial surveys. I would like to request, or maybe an idea, whether or not the oil companies can take radio footage just before seismic activities start if there are going to be any more seismic activities in the future to see if the immediate close whales are acting and how they react with their behavior.

Mari Smultea, Smultea Sciences: I was wondering when you talked about noting the deflection of the heading of the animals up in the Beaufort, did you circle them and did you do any focal follows because with the playback stuff LGL did twenty years earlier that seemed to be really helpful?

John Brandon, Greeneridge: No, we did not circle and whether we circle or not next year if any work is done is a discussion we're going to be having.

Michael Macrander, Shell: There's been a lot of dialogue over the past three to four years on circling versus not, and I think it comes down to one of the things we have to consider is the mission of the program and the limitations of time over prospect. This is one of the reasons why we're looking to try to develop and utilize other technologies like photography and unmanned aerial surveys that might allow for more time over prospects. Even with extended fuel tanks, there's a limited amount of flying time and whether you're doing a specific behavioral study or cover an area and look at a distribution ... that was the priority this year, look at distribution over a fairly large area which requires a lot of flying time. Every time we take out to circle takes away from getting a broad area picture of distribution. I don't want to get in to a debate, but it is a dialogue we're participating in, and we welcome that dialogue and ultimately some decisions will need to be made on priorities.

Robert Suydam, NSB: I think you are right, Michael, in considering the objectives but given how few calves are seen if you don't circle, the data are biased if you don't circle, so that is an important consideration. I'm excited to see what the aerial and photographic results will provide in the future. I want to reiterate some of the peer review panel recommendations from the past, combining aerial survey data with acoustics data and during different activities, these types of things will be helpful and insightful for making decisions. John, you put up images of pre drilling and during drilling. I'd like to know what the definition of drilling is ... is it the presence of the drill rig or just when the turntable was operating? The reason I'm asking is that Bill Ellison and others have suggested that maybe it is not necessarily received levels of sound but the physical presence of equipment.

John Brandon, Greeneridge Sciences: Pre-drilling was mostly during the whaling blackout so there weren't any vessels in the area. What was there was an array of anchors and buoys. These sightings were mostly about September 25th, so there were vessels in the area at the time. The rest of them were mostly just whales and buoys and whalers out at Cross Island and Kaktovik I assume. It is an interesting point. You can't help but notice there's an area there when there are just buoys and no sightings. Now whether that's just a false positive in our data given just random sampling error, I don't know. I think we need to integrate all these acoustics and everything and take a look at it more. As far as drilling and pre-drilling, drilling was when they were actively in the ground. So these sightings down here, there were support vessels, and the Kulluk was anchored.

Michael Macrander, Shell: That is part of the conversation we're having as well as have we been barking up the wrong tree in terms of looking for sound levels that are the key or whether it is actually detectable presence in a particular offset that they choose to have from pretty much any activity. I think there are a lot of questions to be asked and information to be teased out of these data.

SHELL 2012 PROTECTED SPECIES OBSERVER (PSO) PROGRAM PARTICIPANTS

Wendy Hodges – NANA (NMS)

I was fortunate enough to be given the opportunity to represent NANA Management Services this season for the Northwest region. I was aboard two different vessels, the drill rig Discoverer, which mainly stayed in the Chukchi Sea, and then Affinity tanker, which went between both the Beaufort and the Chukchi servicing all the vessels in the fleet with fuel. This video was taken when my team arrived in Dutch Harbor where we joined the Fennica where I met up with Ernestine and Lauren, and, although we went through an intensive training in the classroom, we got some hands on field training work before we entered the drill site. This shows a small percentage of the humpback whales and other marine mammal species we saw in Dutch Harbor. For my first PSO experience, I was aboard the Discoverer, and one thing that became very apparent is that safety came first. It was a good introduction to a different safety culture. These photos show the PPE (personal protective equipment) we were to wear at all times aboard the rig. The man basket was the way we were transported on to the Affinity since it didn't have a helicopter pad. I felt very safe with all the processes and procedures that I learned. This photo shows me and some of my team members.

Ernestine Ahgeak – ASRC Energy Services

I'm from Barrow and was a PSO from ASRC Energy Services. Before the PSO experience my only experience on boats was with the Gulf of Alaska Bottom Trawl Survey with the Alaska Fisheries Science Center. Last summer I was on three different vessels: the Fennica, Discoverer, and Aiviq. One of the things I noticed was the difference in sightings based on the tasks for each vessel. Since the Fennica was an ice management vessel, we were near the ice and saw ice associated marine mammals like walrus and polar bears. On the Aiviq support vessel there were fewer sightings than compared to the Fennica. There was extensive training before the season started including species identification and the importance of accuracy. When species characteristics were not distinguishable they were listed as unidentified seal or whale. During training it was stressed to do this so we had accurate data for the season. The other important thing about identifying species was knowing when to mitigate, so we had to know what kind of animals they were for each sighting and knowing if we had to reduce speed for the vessels or change course to avoid getting too close to marine mammals. As PSOs, we observe more than just mammals. We did weather reports for NWS and reported bird strikes. We also reported to the comm centers in Barrow and Wainwright and other coastal villages letting them know where we were and what we were doing.

Lauren Ackein, LGL

I am a PSO with LGL, and I spent last season aboard the ice breaker Fennica. My previous experience was as a fisheries observer in the North Pacific for the past three years before jumping over to be a PSO. Being on an ice breaker we were more likely to see ice associated marine mammals. Throughout the season, with a pretty high powered camera, we saw a bunch of different animals. We used the Big Eyes mostly for sighting like the polar bear. But a typical sighting, as Craig mentioned on Tuesday, was from a much greater distance, and we were able to use the Big Eyes to sight animals much further away, so we could slow down and mitigate as appropriate. A lot of times with these sightings they didn't even notice we were there. They may have heard us, but there was no visible reaction. In order to reduce the number of vessels in the theater, several vessels were

used as a multi-use platform, which meant we did a whole lot of things. We brought a lot of people together with this program.

Minne Nashookpuk, ASRC

I am from Point Hope, but I currently reside in Kivalina. 2012 was my first year as a PSO. It was a great and awesome experience. I grew up in Point Hope and was adopted to my grandparents and was raised on traditional food. My parents were successful whaling captains. They landed about 16-20 whales in their whaling career, so a subsistence lifestyle is very important to me. I worked in Deadhorse on the over flight crew. The plane that flew us to the prospect area called the Delta Hotel. When we are up in the air there are these bubble windows that we can look out. They give us the capability of surveying the whole area and the underneath of the plane. We have two bubble windows on each side for the primary observers. We had a great team in Deadhorse including Dr. John Brandon. There are two primary observers, left and right, constantly surveying the area. There's a crew of six: two primary observers, a data collector, ice observer and primary observer, and we continually rotate to avoid fatigue. Every time we have a sighting, we let the data recorder know to hit that button to record where the sighting was. We have to identify the animal and let them know how we know what the animal is and identify the species. I have a story of my first bowhead sighting. We all communicate in the plane, and we have earphones. It is important that we communicate. My first sighting ... I was anxious to see my first whale. It was my first year, and I was anxious. I was in the primary observer position, and my eyes were bigger than anything; I wanted to see the whole ocean. On my first sighting the whale came up, and I was excited. The proper way I should've told the data recorder was "I have a sighting …" and let them know the inclinometer and ... it was crazy. I yelled "I see the whale, I see the whale, I know it's a bowhead because I eat them!" and I told the recorder "it's almost lunchtime and I'm hungry. Can we go back?" We had an awesome Deadhorse crew, and I am looking forward to working with them in the near future.

Nanuuq Commission Harvest Reporting

Rhonda Sparks

My name is Rhonda Sparks. I'm with the Alaska Nanuuq Commission (ANC) and am the regional coordinator. Half Siberian Yupik, half Caucasian, born and raised in Nome, Alaska. I grew up in a subsistence lifestyle. I graduated in Nome and went to school and got an anthropology degree and was hired on with the Alaska Nanuuq Commission to do a traditional ecological knowledge (TEK) study. I was the primary investigator for that. We did seven communities from Point Hope, Point Lay, Wales, Shishmaref, Savoonga, Gambell, and King Island. The goal was to get an update to a 1997 Suzy Miller study on polar bear habitat use. More recently we have an agreement with Russia to follow a quota, so the TEK study is being used to help form how we will manage under that agreement.

We interviewed older hunters in the seven communities to get that snapshot from history and what's changed. You interview younger hunters for what's on the ground now, what do you see now, and what are the changes. We worked a lot with Henry Huntington. It's very important to

consult with experts on TEK. You talk to other people who have done it and been successful at it. So we're working with Henry now. The report was complete in December. We are working with Henry to publish a summary of that report, and we're in the beginning stages of that. From those trips and travels we heard a lot of information on polar bears coming in to towns and causing trouble. In the North Slope Borough they have formal deterrent patrollers, but the other communities in the Bering Strait and the Chukchi Sea don't have that. Given the quota, we're going to really watch our harvest of bear and defense of life and property. We want to provide those tools to our stakeholders on how to avoid those negative conflicts with bears. I met with six Russian counterparts in a two day meeting, one of the first of its kind. There's hope for another meeting in the future. We work with a lot of different entities: North Slope Borough, World Wildlife Fund, Defenders of Wildlife, Fish and Wildlife (we're full co-management partners). We are the Alaska Native representation for the Joint Commission who makes decisions on the quotas, the seasons, etc. And, there is a scientific working group comprised of U.S., Russia, and social scientists, so we bring everybody to the table, similar to this, and talk about studies that have been done in each place and combine them. Where are the holes and how do we move forward? The deterrence workshop was very successful, and we hope to do another. Recently one of our staff members was able to attend a deterrence workshop in Norway. We do a lot of international work as well.

Recommendations for future OWM meetings is to add TEK presentations to this agenda. It sounds like it has been a recurring theme. How does TEK work in management decisions? How do you bring it back home? How do you share that information back to the stakeholders in a way they can understand and in a way that affects them as subsistence users? Chris made a comment about using JAS and standardizing studies in TEK. Definitely talk to Henry Huntington; he has a lot of experience.

Q&A | Comments:

Jolene F_____, White Mountain Native Corp and with Bering Sea Alliance committee: (unable to hear)

Rhonda Sparks, Alaska Nanuuq Commission: I got it. She is making a recommendation to acknowledge the late Charlie Johnson who formed the Nanuuq Commission. He also served on many other commissions. He formed it in 1994. He stood his ground and did a lot of good work and laid down a lot of the foundation for the things we are doing today. TEK is traditional ecological knowledge. It is blended with local ecological knowledge. TEK implies past history and knowledge that is gone or is threatened to be gone. Local TEK is what is happening now, what are locals seeing, hearing on a daily basis. Often used interchangeably.

Jolene F_____, White Mountain Native Corp and with Bering Sea Alliance committee: I also wanted to ask you to define TEK?

Rhonda Sparks, Alaska Nanuuq Commission: So TEK is Traditional Ecological Knowledge. I want to thank you for that. Also, it is kind of blended with local ecological knowledge. Traditional ecological knowledge that term traditional implies past history and knowledge that is gone or threatens to be gone. The local ecological knowledge is more on what is happening now; what is seen and heard on a daily basis now. Both terms are used interchangeably and they are related.

Daniel (*did not identify last name or affiliation*): My friend in Nunivak. Last week he found a polar bear and it had a collar embedded in it and it died. Are we doing that in Alaska, and do they remove those?

Rhonda Sparks, Alaska Nanuuq Commission: The U.S. Geological Survey does radio collaring. I think Canada also does radio collaring. USFWS does radio collaring for research. There is a certain amount of time the radio collar stays on, and it should pop off after that period of time elapsed. I'm not too familiar with it, but I thank you for raising the question. I plan on participating on some of that field work, so I can get an understanding and share some of what they are doing with our stakeholders and community members.

Colleen Swan, Kivalina: I applaud your work. I thought our ways were going; that we were going to lose them, but we're not. We use our traditional knowledge all the time. It is handed down from generation to generation. It is really important to realize that every community is different, so there is no one size fits all.

Craig George, NSB: Just a comment ... typically traditional knowledge was not recorded in a written form. In my experience in Barrow, you learn it through experience. In that regard, when we were struggling trying to figure out how to count bowheads, is we moved to Barrow and went out on the ice with the whaling crews and over a number of years, it took a decade, we learned to operate in an efficient and appropriate manner, understood the timing of the migration, and all these sorts of things. I know there's a lot of scientists struggling on how to incorporate local knowledge into studies, but I think a lot of it, and in our case, it was simply living in the community.

Rhonda Sparks, Alaska Nanuuq Commission: What I meant yesterday was that it is a lot of work. I'm from the region, but yes, it's a lot of work, and every village is different. You know I'm from the region and grew up in the subsistence lifestyle. It's well accepted to (*unable to understand*) and who the heck are you and why are you seeking this knowledge, so to those future TEK studies, be prepared for that. It is not a walk in the park, and it is very different. I was lucky with such a successful product because I grew up with that lifestyle and it was second nature for me to hear these stories and information. I could remember everything. My colleague grew up in Eagle River area, and she had problems listening and recording information, but we met after each interview and ironed out those problems.

Candace Nachman, NMFS: Thank you so much for being here and sharing. Jessica, thank you for bringing Rhonda to my attention. As everyone in the room probably knows, walrus and polar bear are not managed by NMFS, they're managed by USFWS, but we've worked hard to try to make this meeting all encompassing of marine mammals in the area, and I hope we see you here in the future Rhonda.

Mysticetus Observation Software

Dave Steckler

My name is Dave Steckler. I'm a professional computer programmer; I've been that way my whole life. I've worked at small companies. I founded a company in the 1990's that did navigation software for boats. I spent a lot of time at Microsoft in Microsoft research. Video game musician; I wrote songs for video games for a while. I am going to talk about the software and use it as an example of some of the things I want to talk about to this crowd. This is a talk I've given to similar crowds in different industries. My main point is that computers, technology, high tech stuff, very frequently ends up serving the people who created it instead of the people who need to use that technology, and it takes all of us (the creators and you) some effort to make sure you only select things, systems, software that helps you out. Put the effort on us, the technology creators, to do so in a way that helps you. Some software is created to help out your GIS department, but it leaves your observers clicking too many buttons to get through their observations. Other software might have been created because it was easy to write the code, but the end result is that it isn't very easy to use. I spent my life trying hard to create software that might be hard for me to create but which works well in the environment it is to be used for.

About three years ago I was working in Microsoft Research, and I ended up dating a marine mammal biologist. I tagged along on some of the trips. The number one thing marine mammal biologists like to do is look at whales and dolphins and seals. The number two thing that marine mammal biologists like to do is whine about technology. So I spent about a year tagging along listening to my girlfriend complain about the system she was using. I listened to the other biologists and managers and clients complain. About two years I decided to do something about it. I left Microsoft and started my own company and decided to try to solve some of these problems especially with respect to observational recording software. I created Mysticetus. There were two problems I was trying to solve and this took about six months to really address and solve. One of the main problems was that the recording systems being used ... things would pop up in your face at random times, buttons were hard to push especially in a moving airplane or boat. I decided one of the best models for this type of software was actually a spreadsheet and I created a little grid you can enter data in to, but it is an intelligent spreadsheet. This spreadsheet knows about your GPS position, it knows about what you are observing and gives you hints, it knows who your observers are. It becomes very easy. It plots sighting on the map for you easily. That was one problem and it was solved pretty well. The other problem was every time they went out they would like to make a change to the software. Maybe one survey they learned something new and wanted to apply that to the next survey. Maybe, due to climate change a new species appears, and they wanted to make a change. Configurability was really hard and they kept having to go back to the software authors. That was the failure of those software authors to make the system easy for the end user. They made it easy for the authors. All this information you see up here (the list of species, the observers, all these fields) are controlled by your lead scientist or program manager. You don't have to come talk to me. I created a really easy entry system analogous to using Excel, you can drag and drop fields around and you can define these fields and that solved the two fundamental problems of observational recording.

This is an example showing the configurability (displayed). In this example, the lead scientists didn't want his observers typing just anything, and in fact wanted them to use Latin. The software does that. It makes it easy for the scientist to define without having to come talk to me about it.

Along the way the intelligence of the system came through. I didn't want you guys to have to send it back to your GIS department to correlate where your airplane or boat was at a particular time, find the declination angle, plot it on a map and have it calculate where the sighting was. The software should do that. The font size is configurable.

The next thing was that it was taking forever to take the data and recordings and it took weeks/months to send the data off to be analyzed. So I started looking at what would it take to get reports and summary statistics with one click of a button. Side note: if your software ever pops up and asks you to enter what connection or com ports it's on, it's wrong. The software should be able to figure that out. Taking this one more step, planning. So, not only reports, high quality maps, you want to plan your transects? Great. Do it ... you don't need to send it off to have it done, your lead scientist can do it. It offers track line coloring, survey leg type, and bathymetry. It supports ESRI shapefiles.

If you look at what your pilots, either aerial or vessel, are looking it, it's knots. They're not looking at metric. In Mysticetus everything is metric, stored in km or meters, but you can display it any way you want.

Another thing is interoperability. Whatever system you're using, any other software or hardware you have, what do they talk with? What do they communicate with? What does Mysticetus talk with? It talks with Google Earth, Excel, Garmin GPS protocol, ESRI Shapefiles, etc.

Why do you have to send stuff off and wait for reports? The data's all there. Why can't we, with one click of the button, tell you what's there or what you saw? There it is (displayed). Who saw what, when they saw it, species counts, effort reports, what legs were flown. It calculates it all automatically for you.

One of the companies that's using my software came to me and said, you know, we really like your software, but it doesn't do feature x. We'd sure like to track a scout vessel and have instantaneous communication of the sightings seen on the scout vessel back on our seismic vessel and we'd also like to have ensonification regions calculated by depth. How long will that take you do? I knew that was a really important feature and I cranked it out pretty quickly. Another example: on Tuesday we saw Shell and LGL give a neat presentation about the software they were using, and I saw a feature in there that I didn't have. I didn't have audit logging. So over the past two days I went and cranked it out. I have completely encrypted, secured, audit logging of all changes in Mysticetus.

One last point: giving back to the community. If you are a student doing academic research, I provide my software for free. Companies that do that sort of thing, giving back to the world, support them.

The future ... I've got a team working on acoustics - towed arrays, sonobuoys, sound localizations. It's almost done and should be deployed in about a week. The next future one: total received sound modeling. One of my expertise is taking complex systems distilling them down to what you need. I would love to take that total received sound and with a couple easy to use controls and inputs and give it away so researchers don't have to spend six months learning to use it.

Computers and technology should serve the end user, not the technology creator. Support the technology creators that do it right.

Parking Lot Issues

Lisa O'Brien | Ron Felde

There are three issues in the parking lot: invasive species, traditional knowledge, and isopleth.

We'll focus first on traditional knowledge. Lisa mentioned earlier that we'll be capturing a lot of traditional knowledge comments that came up through the minutes of the meeting. Robert mentioned an idea to take that information and not only summarize it electronically but also consider bringing it back in summary to the next meeting. Many of you were kind enough to give us your perspective on what was working and where we could do better on accessing and taking advantage of traditional knowledge. Here's what we've captured:

TRADITIONAL KNOWLEDGE - WHAT WORKS WELL

- Continue doing what we have been doing. It can be improved, but it is better than what is being done in many regions.
- Many collections of writings by local people and about local ways of life are available, though seldom read.
- Continue to hold meetings in villages to hear concerns.
- Protected Species Observers\Marine Mammal Observers
- Be sure to include elders, women, and younger active hunters to your study on Traditional Knowledge
    - Have elders present to get past knowledge
    - Women have additional input and information to share
    - Younger active hunters may have a "what's happening now" perspective on the region/location.
- Knowledge passed on for generations about:
    - Environment
    - Conservation
    - Use of animals for determining weather patterns
    - Every animal has a season to harvest and not to harvest
    - Important land and ocean use areas
    - Preservation of a way of life
- People are more aware of the need to solicit and include TK and are trying to do so.
- Look at where TK has been successfully used for guidance and lessons learned.

- Models
    - Northwest Arctic Borough
    - Kawerak and EWC's Ice Seal and Walrus Project
    - Alaska Nanuuq Commission IEK Polar bear
    - Noongwook, et.al. Bowhead Study
    - Huntington, et.al. 1999 Beluga Study
    - Quakenbush, et.al. Bowhead Study with communities
    - NSB Wildlife Department intra-staff collaborative approach
    - Barrow Arctic Science Consortium

TRADITIONAL KNOWLEDGE - IDEAS FOR IMPROVEMENTS

- Take TK comments from NMFS Open Water meeting summaries.
- Summarize TK from 2013 Open Water Meeting and present at 2014 meeting; will help to reintroduce what was said in 2013.
- Recommend that a portion of future agendas be dedicated to TK presentation from other stakeholders in addition to the AEWC, EWC, ISC, ABWC, and ANC.
- Schedule a day long TK workshop associated with this meeting to focus on engagement, application, and results of using TK.
- Industry and agencies are not getting back to the communities on how TK was used and what it resulted in.
- Show Alaska native communities how TK is used and incorporated in development plans.
- Some in industry and agencies are uncomfortable with the topic, don't know how to acquire it or use it.
- Agencies need to archive, organize and share TK from the multiple public meetings, comment letters and research. A lot is out there, but isn't being tracked and used.
- It would be interesting to compile all data of activities going on in one season, so the total decibels (sound impacting sea mammals) are added. Each company is reporting their results individually, which makes it appear as though the noise level is at the acceptable level.
- Every federal agency has a Tribal Consultation Policy - use them.
- NEPA/EIS Process has provisions for federal agency to unite the Tribes (federally recognized) to engage as Cooperating Agencies. Establish a protocol.
- TK is routinely used in describing the affected environment, but less so in assessing impacts and designing mitigation.
- Have a clearing house for species specific traditional local knowledge and habitat use.
- Have one source of information for all subsistence resources in Alaska.
- Make a movie about TK specific to oil industry interactions and concerns. Then make everyone watch it. (AK Sea Grant did something like this on climate change.)
- TK is a sensitive sense of unity between nature and humans.
- More effort to combine TK along with scientific knowledge in reports and presentations.
- Western science should accept or prove or have proven what we have known for thousands of years.

- TK or local knowledge is typically not recorded in written language, but rather learned through experience over a lifetime. So, if a group is interested in TK, move to the community (for a long period of time)!
- Interview hunters to document specific and general concerns (as Michael Galginaitis does for Cross Island).
- Set up "cultural seminars" for westerners to learn about subsistence lifestyle.
- Set up a well-organized meeting with specific focus on TK, targeting education of outsiders.
- Project specific work program for TK
    - Community identifies a group of key elders/hunters to participate
    - Address affected environment, observed trends in environment and animal behavior
    - Present key information and work group results to the community at large for feedback and revisions
    - Agree on how TK will be incorporated
    - Report back to the community on how TK was used, influenced decisions made

ISOPLETH

Because I volunteered to put this issue in the parking lot, I was asked to write a summary of what I meant by close consideration of sound isopleths. We have three issues: protecting marine mammals from direct harm, protecting marine mammals from unacceptable behavioral changes, and the issue of protecting the subsistence hunt. They all seem to get bundled up in to understanding the sound isopleths and using the sound isopleths as a surrogate for almost everything else, and, even with the new criteria coming out, it seems like we're still doing that.

Experience over the past decade or more suggests that:

1. Acoustic models cannot reliably predict sound isopleths with the meter accuracy often used in mitigation.
2. Likewise, measurements show that the distance to isopleths used for mitigation purposes often vary in time and space, especially in shallow water.
3. Marine mammal behavioral response cannot be reliably predicted based on sound exposure levels alone.
4. Observers may not be able to reliably assess distances with meaningful accuracy beyond a few hundred meters—that is, marine mammal observers cannot reliably assess distances within a few meters of accuracy to, for example, a seal that appears for a few moments, even though reliable distance estimates are needed to implement required mitigation.

Despite these possibilities, we continue to expend substantial resources on mitigation that is based on sound isopleths.

A short discussion recognizing these possibilities could lead to a systematic effort to assess each of them, eventually contributing to an improved understanding of the usefulness of what has become a routinely accepted approach to mitigation and monitoring.

Q&A | Comments:

Bill Koski, LGL: Bill was asking has anyone actually done experiments or trials to see how well the observers were estimating distance from vessels. There have been some experiments like that, as well as experiments with night vision devices. There have been some, and we agree that it is accurate that when the animals are quite close we are quite good at estimating how far away they are but the further away they are the less precise those estimates are.

Dave Hannay, JASCO: I thought I'd also respond to that. You bring up some good points. The issues you raise that support the arguments you're making...with regards to acoustic models not being able to reliably predict distances, that's true. There is some uncertainty associated with acoustic modeling, and I think that's recognized. The use of models is supported by the fact that there really isn't a way to predict the levels. The alternatives are to make educated guesses, but the models take that guesswork out. Another point related to that is that some of the metrics we've been trying to model, the root mean square (RMS) model, for example, that is just a difficult thing to measure because it's not very stable. Some of the proposals from NMFS to use SEL are good also for modeling because the models are much better at predicting SEL than RMS levels, so I think there's opportunities for improvements in modeling capabilities for this purpose.

Bill Streever, BP: I agree with what you're saying, but my point is if we look at these things one point at a time I agree with you that SEL is maybe going to be easier to estimate, but the sensible thing to me to do is to start compiling as soon as we can comparisons of modeled SELs with measured SELs so we can actually see a demonstration of how accurate it is. The other problem is because we translate these things in to mitigation circles, that's not what your model is showing. So some of the accuracy doesn't have anything to do with the model it has to do with how we apply the model.

Dave Hannay, JASCO: We always have to build in some level of conservatism, so typically that's done by drawing a circle that exceeds the maximum level, and Jolie talked about that yesterday, but we do that just to be sure we encompass the maximum the animal might receive. We do that also in depth so when we predict these levels we predict at all levels.

Jolie Harrison, NMFS: In the discussion of the isopleths I'd like to understand whether your problem with isopleth is in your need to measure them or in the use of them at all. I do need to point out some differences in the things we use isopleths for. With the 180 and 190 isopleths, we are using them to inform actual mitigation choices. With the 160, it is used as a predictor of where harassment occurs; it's not really used in the mitigation to prevent harassment typically. The requirement to have numbers of takes is in the statute and regulation. We do it because we have to. The mitigation zones for trying to avoid actual injury, I understand what you're saying about the variability and imprecision, but if the alternative to measuring them and trying to come up with a case specific one and we're not going to do that we could pick a one size fits all, but it's going to be big because we need to be cautious. What we haven't talked a whole lot about is the requirement for SSVs, and I think that doesn't mean that they have to be required for all times. If there were some sort of systematic process to populate the bounds of source types, environments, at some point I would argue it wouldn't be necessary to continually measure thing that have the same primary factors. Are you suggesting that the use of a shutdown does not actually save animals from injury because I think that we think it does and if it does we need to keep doing it in some form.

Bill Streever, BP: I think from your questions that I have been dramatically misunderstood. My concern is not about do I or don't I have to do measurements, my concern is that it seems to have become a religion to us, that we do a model or measurement and draw a line on a map and say holy cow, an animal is two meters inside of that, everybody stop and call the police. It doesn't make sense to me based on what we know about this stuff. We go out to the 120 in some cases, but we know behavioral response go beyond that at times. I'm not trying to shrink or grow anything, I'm trying to have a rational conversation about the observations that I've been making over the past few years.

Sheyna Wisdom, Fairweather: A lot of you know I'm the one that makes a lot of the work out in the Arctic happen. I'd like to pose to the group, especially the PSOs, that we're talking about two different things. Mitigation monitoring, which is to be able to give a PSO at a certain distance where we know they can reliably see, and maybe it shouldn't be as important that we know what the species is that we know it's an animal, let's shut down and go from there in to more monitoring. Australia does that pretty good with a 500 meter zone and from an industry point of view or a PSO point of view it might be easier to just have a set zone of this is what we know we monitor and then look at some of the acoustic pieces of it later to come up with actual takes.

Bill Streever, BP: So just to be clear you're talking about setting a harm level at 500 meters?

Sheyna Wisdom, Fairweather: Something like that. Just something from a pure mitigation Level A type of take, and I don't know that that number is the right one to pull in this injury zone but something from a purely practical point of view from a boat, train different people on how to see out to a certain point of view of certain animals; just something that is a little more practical for everyone to use.

Melanie Austin, JASCO: Just a comment or thought that I had. We just had this great presentation about software and incorporating GIS capabilities with the visual observations and maybe instead of drawing a circle we could look at these noise footprints that we model and accepting that there are some uncertainties but perhaps there are ways we can upload those on to GIS systems and plot the observations as they're happening and get a real time sense for whether or not animals are inside areas of concern.

Michael Macrander, Shell: Thank you, Bill, for bringing this up. I agree with every one of your points here. I go back to graduate school and the discussions between the biochemists and the ecologists and the claim was you're not doing science because you can't measure to the nth significant number. In my mind we are kind of pushed by regulation and stakeholder view to a pretense to a level of accuracy that doesn't exist. Whether our models are predictive of all factors or conditions or whether you can see in all conditions it comes down to a certain extent to doing the best you can. You can make some kind of comments about the accuracy of a shotgun but it ends up being a pretty effective tool for killing things. So, I think that we have a regulatory construct that leads us in certain directions, but we all have to grasp and realize the constraints on the system and not have a pretense that they are more than what they are.

Bill Streever, BP: That's part of the point I brought up. The other part is that we are trying to do three things: harm, behavior and protect the subsistence hunt and we keep focusing on these isopleths to the point of ignoring at least one of those three things at least in my view.

George Edwardson, ICAS: I went to have my hearing tested and found a small chart on what hearing does just to humans. 90 dB - prolonged exposure to any noise above 90 dB can cause gradual

hearing loss; 100 dB - no more than 15 minutes unprotected exposure recommended; 110 dB - exposure for more than one minute risks permanent hearing loss. These are things the group needs to know, but a recommendation for the next Open Water Meeting if it hasn't been done already is we have someone tell us how much hearing loss will hurt exposure to our marine mammals.

Bill Streever, BP: Just for clarity, those units they use for human exposure are an entirely different unit than what's used underwater for what that's worth.

Robert Suydam, NSB: Bill, the issues you bring up are obviously important. We've been struggling with them for a long time, but you said two or three times that you don't know what the next steps are. Maybe it is worthwhile to think about what the steps are that we need to go through to solve the problem. I'm not sure what they are either but maybe revising the acoustic criteria, the process NMFS is going through, maybe that's a way to help move towards a discussion of what areas are appropriate to try to monitor. We know monitoring is imperfect but trying to maybe develop a map, a plan, of how we can solve these things in a practical way. Some of the questions you asked I think are really theoretical but don't really help. We need to have people on the boats to try to mitigate and reduce Level A impacts. We need to figure out what zones we need to deal with for estimating behavioral takes. In my view, isopleths aren't really used for subsistence issues at all but the mitigation of area closures and those types of things are being used successfully for protecting subsistence or availability of marine mammals for subsistence. I guess my recommendation is maybe coming up with a map of how to deal with these would be the next best step.

Bill Streever, BP: I guess that's what I was hoping for was a systematic effort to approach this, and, if I can, I would suggest we set up some kind of subcommittee and come back next year with a report on how we might address some of this.

Jolie Harrison, NMFS: I just wanted to add that my first response was oh gosh I have to respond directly to this thing about (unable to hear) but I would actually like to take a step back to the three things you said, I think there are actually four: we are concerned about harm to marine mammals, we are concerned about behavioral impacts, but we're also concerned about a more chronic long term impact of combined noise from both sources that we regulate and those that we don't. I think that gets lost sometimes, and, as an agency, we are trying to figure out how to better characterize quantitatively and deal with in the decision making process those sorts of impacts. I wanted to add that. I don't have the answers but would be excited and glad to help people think about it and work on it. I think we do get caught up in things that I think create a picture of accuracy that's not there especially when you have an equation that includes propagation and density, and we know so little about where animals are that any precision you think you have in a model is obliterated by the fact that (unable to hear) involving the animals that are there. I think there are probably some spatial and temporal tools out there that could maybe affect changes on the ground a little bit more than from some of the other calculations that we do. Well, not more but could help. Another way of looking at things. I don't have the answers but I agree with you that there are probably better ways we could do things.

Bill Streever, BP: Is there a way forward to start looking at this systematically that we can do between meetings? Is there something that would work within the framework of the way you guys regulate?

Jolie Harrison, NMFS: The framework within which we regulate is pretty flexible and open to input. I would randomly say yes within fiscal constraints, but we are open to talking about things.

Bill Streever, BP: So my recommendation to the group is that we take four or five volunteers and work through some of this and bring it back, unfortunately next year.

Ron Felde, Facilitator: Michael said yes and Robert said yes.

Robert Suydam, NSB: I actually want to add a bit to what Bill has suggested and that's having a group come up with some questions and solutions is maybe worthwhile, but I think having the Peer Review Panel take a look at it and make some recommendations would be valuable as well, but if there's just four or five of us that maybe that's not enough people to really kind of evaluate things as well as they need to be.

Jessica Lefevre, AEWC: I want to highlight a point you keep making Bill, and I really appreciate it, and that is we seem to have different goals going and one is the harm and the important behavioral changes and how do you observe, report, and mitigate it and the other one is the subsistence use, and I think what you're suggesting is a good direction to go, but I want to encourage everyone that when you come back to the meeting, one of the things I'm observing in this meeting is, that we are getting a lot of input from the subsistence users but it keeps coming back to this highly technical question of the isopleths, the received sound levels, SELs, and I think those are important but they're not going to help us with subsistence impacts. It's too esoteric and what we really need for subsistence impacts is an understanding of what's happening on the ground in the nearshore area. I just encourage everyone in going in to these very fascinating acoustic issues, let's not lose sight of the critical issue covered by statute.

George Edwardson, ICAS: When you look at the Arctic Ocean you are talking about my home, you're going in to my house. When you go in to my house there are certain rules you are going to follow. You are not going to affect my ability to feed myself. Whatever your goals are, whether it be making more money from oil or learning from science, it does not matter. You are in my house, and these are the rules. You do not endanger the ecosystem. You don't change the way it is. That's the only way you can come in.

MEETING STRUCTURE

Ron Felde, Facilitator: The last topic was on meeting structure. The statement was concise. It says: consider changing the meeting structure to add break out topic groups to take more input or report out afterwards.

(Unidentified): unable to hear

Ron Felde, Facilitator: It was Sudie?

Lisa O'Brien, Facilitator: She did talk to me about it. What she suggested was to have half a day focused on traditional knowledge and have break out groups.

Closing Remarks | Adjourn

Lisa O'Brien & Ron Felde, Facilitators

We thank you for having us to support your meeting. There will be a meeting summary expected within a month. I want to acknowledge Tara Bellion and Erin Dunable of URS. Here's my observation: we did not do a purpose and intended results for this year's agenda. I think it is time to come back to that discussion. What is the purpose and the intended results? My thought is that it is probably time to sit down once more, get some input and define purpose and intended results with the following caveat: this is a regulatory meeting. I think there is a change in the cast of characters. I'm thinking in the near future you're going to have to have Oil Industry 101, you will have to literally translate some of the knowledge that so many of you have in your brains because many people don't track with it because they don't have the experience. There are a lot of people here who weren't here last year; there's a passing of the torch, and it may be time to review why and what and how. I want to quote something Bill said. He said to me this meeting has really evolved over time and it's become a meeting where people show up because they get answers to questions and information and communication happens. That's a huge compliment.

Jolie Harrison, NMFS

I couldn't agree more. The two main reasons we started having this meeting is because 1) there is a regulatory requirement to have a peer review of monitoring plans, and 2) we have to make a no unmitigable adverse impact finding for subsistence use, and we cannot do that without input from native communities. Since we started the meeting, we've divorced the peer review meeting in to a separate one which leaves the primary purpose of this one to get input from the communities. Having said that, I think the audience has grown and it's become a venue to discuss regulatory processes and other interesting science things that are related to our permits and everyone has varied interests, and we get recommendations for topics, and I think we get distracted. I think we need to refocus on the primary purpose for this meeting.

Colleen Swan, Kivalina

Based on the work that I've been doing for over twenty years, traditional knowledge covers several different things. It begins with the history, it talks about the economics of a subsistence lifestyle, the spirituality, the cultural aspects, and a host of other things. We need to define what it means to you and what it means to us and compare notes because all of the work that's going on it could be helping us because if there's development it is going to affect us. The thing that we do when there are changes to our lifestyle is we adapt. We've been adapting ever since the first ship came. With the work that's going on we will adapt but we can't do that without your information.

Johnny Aiken, AEWC

Thank you. I think last year I brought this issue up last year, and I think it needs to be brought up again. The requirement NOAA has placed on the oil companies - the plan of cooperation. The AEWC

does not really recognize the plan of cooperation. The reason is that the plan of cooperation as we see it is just a community meeting between oil industry and the community. All the oil industry needs to do is hold an informational meeting with the community and the requirement is taken care of. I think the agencies need to replace the requirement for the plan of cooperation with the Conflict Avoidance Agreement. The 160 whaling captains and the oil industry work together to come up with a Conflict Avoidance Agreement that is acceptable. I think the CAA needs to be considered part of the permits for the IHA's that are issued each year. The CAA is really the only tool that the captains and the oil industry have to work with and it works. I think the CAA is working very well and most, if not all, of the oil companies agree to it. The reason for this request is not all hunters, not all whaling captains, attend the plan of cooperation meetings. Many of them attend the Conflict Avoidance meeting because they recognize the CAA as being a very important document for both the whalers and the industry. Whaling captains are more assured that their hunt will not be interfered with. I have to thank the oil industry and the federal government for being willing to work with the whaling captains on this. We appreciate the cooperation we've been getting. We will need more cooperation from them as we move forward with this request. I want to thank all of the meeting participants. It was very informative and educational, and I sense the science is getting better and better. Having said that, I think it can only get better if we recognize and acknowledge the traditional knowledge part of it and figure out how to use it. I propose that you allow the AEWC and North Slope Borough to write a section on that for you for the Environmental Impact Statement. I think we can come up with some good language that is acceptable to NOAA, the oil industry and especially the people who use the Arctic Ocean. It would only be practical for us to write it for your consideration. I would also like to make sure that someone from the whaling captains is a member of the peer review panel. I would nominate Harry Brower. I think Harry is more than capable of representing the whaling captains and would give you a good perspective whenever you discuss subsistence hunting in the Arctic. We've also heard comments in this meeting about vessel traffic. Very rapidly this is becoming a big concern in our villages. We are seeing that with more industry operations in our waters we have more vessel traffic. There were approximately 100 vessels that we do not even know about and if it wasn't for the Coast Guard we wouldn't have known. Our whaling captains are starting to address this through our CAA and encourage NMFS to take our concerns about vessel traffic seriously and include our CAA measures in your IHAs. Again, I thank you Jolie, Candace, Jim and Mark for all the work you have done thus far and thank you to all the presenters for sharing important information during this meeting.

Jim Kendall, BOEM

I've said before how much I enjoy this meeting, and I want to thank NOAA, NMFS, Lisa, Ron, and the team and everyone who participated in making this meeting a success. I want to express the apology of Mark Fesmire from BSEE, my counterpart, he was called away and couldn't make it. Everyone is welcome here. The presentations were excellent and followed by real good discussion and sharing. These discussions were sometimes rather feisty and spirited, but they were never nasty. There was a lot of respect in the room and that's because there is a lot of trust. What do you call a meeting where you have the involvement of everybody, good discussion, respect and trust? You call that transparency. This is a great meeting, and this is the way it should be done.

Jolie Harrison, NMFS

I want to take just a few moments to respond to a couple of things that Johnny said. I want to say that regarding the CAA and POC we totally understand how much work you've put in to working through issues with the CAA process. We do transfer some of those in to our IHAs, but we also recognize we haven't figured out how to fix the fact that we don't use the CAA as a POC. We have this requirement that folks don't necessarily think is working well under the POC, and we have this other process that is working well under the CAA, and, so one of our goals is to work through that and figure out how to use the positive things that are in the CAA and still make sure we're meeting the requirements of the regulations. Also, I welcome and please do help us with the EIS, and if you're interested in drafting things we'd be happy to talk with you offline and figure out how to do that and where you think it would fit best. Lastly, regarding the peer review panel. We welcome Harry. He's been with us before, and I agree that input from whaling captains is invaluable. Regarding my closing remarks, I want to thank everyone for their willingness to actively engage with us. Specifically to help us ensure industry activities are able to do so avoiding interference with the hunts and preserving your way of life. We've gotten some clear input, and we intend to take back what we've heard and use it in our decision making. I would like to thank the native community representatives and organizations. I thank the companies for their good presentations on activities and monitoring and having the right people in the room to answer questions. Thanks to the NSB and the AEWC and other presenters. Ron and Lisa, you do an amazing job. I thank Tara and Erin, the logistic queens, and Brenda and Anneliese for taking great notes. And lastly I want to thank Candace because you may think that both of us do all the work in preparing for the meeting, but Candace does the vast majority, and I thank her, and I'm going to miss her for two months.

NMFS Open Water Meeting Web Page
http://www.nmfs.noaa.gov/pr/permits/openwater.htm

NMFS Office of Protected Resources Incidental Take Authorization Web Page
http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications

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