SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

HABITAT PROTECTION AND ECOSYSTEM-BASED MANAGEMENT ADVISORY PANEL

Hilton Garden Inn
North Charleston, SC

May 11-12, 2016

Summary Minutes

Habitat AP:

Pat Geer, Chair
John Ellis
Kevin Hart
Wilbur Vitols
David Harter
Tom Jones
Mark Carter
Dr. Amber Whittle
Dr. Patrick Halpin
Dr. Steve Ross
Scott Chappell
David Bush, Jr.
Dr. Christopher Elkins
Tim Sartwell
Priscilla Wendt
Pace Wilber
Alice Lawrence
Bill Kelly
Dr. Clark Alexander
Brian Hooker
Dr. George Sedberry

Council Members:

Zack Bowen
Doug Haymans
Mel Bell

Council Staff:

Gregg Waugh
Chip Collier
Roger Pugliese
Julie O'Dell

Observers/Participants:

Brett Boston
Dr. Aaron Rice
Louise Vaughan
Lora Clarke
Dr. David Zeddies

Additional Attendees Attached

The Habitat Protection and Ecosystem-Based Management Advisory Panel of the South Atlantic Fishery Management Council convened in the Hilton Garden Inn, North Charleston, South Carolina, May 11, 2016, and was called to order at 9:00 o'clock a.m. by Chairman Pat Geer.

MR. GEER: I want to welcome everybody to the spring Habitat Protection and Ecosystem-Based Management Advisory Panel meeting. My name is Pat Geer. I am the Chairman, and please, if you've got your phone on, please just put it on silent. Name tags are up there. If you haven't picked one up, pick it up when you get a chance. I don't know if I can see to the end of the table, and so I will do my best. If I just point at you, I can't read your tag, or whatever the case may be.

Just real quickly, can we just go around the table and just introduce yourself and say what your affiliation is? We'll go through that really quickly, and we'll start with Brett. At least initially, when you speak, say your name, so that they have it for the minutes. We have a new stenographer that will be taking over, and so they will have to go through that process as well. When you speak, say your name and then start speaking.

MR. BOSTON: Brett Boston, Group Solutions, working on the FEP II with Roger.

MR. HARTER: I'm David Harter. I'm a recreational fisher from Hilton Head Island.

MR. HART: Kevin Hart with the North Carolina Division of Coastal Management.

MR. ELLIS: John Ellis, U.S. Fish and Wildlife Service, Raleigh.

MR. CARTER: Mark Carter, recreational representative from Florida.

DR. ELKINS: Chris Elkins, representative from North Carolina, outgoing.

MS. LAWRENCE: Alice Lawrence, U.S. Fish and Wildlife Service, Athens.

DR. SEDBERRY: George Sedberry, NOAA Office of National Marine Sanctuaries.

MR. PARKER: Captain Bill Parker, Runaway Charters, Hilton Head Island, South Carolina.

MR. KELLY: Bill Kelly, representing Florida Keys Commercial Fishermen's Association, Florida Keys.

MR. BUSH: David Bush, North Carolina Fisheries Association.

MR. PRATT: Terry Pratt, commercial fisherman from North Carolina.

MR. JONES: Tom Jones, recreational fisherman from St. Simons Island, Georgia.

MR. VITOLS: Wilbur Vitols from New Bern, North Carolina, recreational fisherman, East Carolina Saltwater Fishing Club.

DR. ROSS: Steve Ross, and I'm a research professor with the University of North Carolina in Wilmington.

DR. ALEXANDER: Clark Alexander from Skidaway Institute of Oceanography.

MR. SARTWELL: Tim Sartwell, recreational fisherman, North Carolina.

MS. WENDT: Priscilla Wendt, South Carolina DNR.

MR. CHAPPELL: Scott Chappell, U.S. Navy, filling in for Carter Watterson.

DR. WHITTLE: Amber Whittle with the Florida Fish and Wildlife Commission.

MR. HOOKER: Brian Hooker, Bureau of Ocean Energy Management.

MR. WILBER: Pace Wilber, NOAA Fisheries.

MR. PUGLIESE: Roger Pugliese, South Atlantic Fishery Management Council.

MS. CLARKE: Lora Clarke, Pew Charitable Trusts.

MR. WAUGH: Gregg Waugh, South Atlantic Council staff.

DR. HALPIN: Pat Halpin, Duke University.

MR. GEER: Thank you very much and welcome again, everybody. The first item is the Approval of the Agenda. Are there any additions or any changes to the agenda?

DR. SEDBERRY: Somewhere, maybe towards the end or under New Business, but, somewhere along the line, I would to just say a few things about sargassum and what's going on with that.

MR. GEER: Okay. We will add that. Anything else? Hearing none, we will accept the agenda as modified. The minutes from our November meeting in St. Petersburg were 124 pages, I believe. Any comments or any additions to those? I know you've read them all in great detail. What I would suggest is if you look through it and you see anything that's in there that is attributed to you that you might want to change or modify or it wasn't written down right, just let Roger or I know and we will make sure those minutes get modified. Any changes to the minutes at all? Hearing none, we will consider them approved by consensus.

We are supposed to say opening statements, but you know me. Keep it short and keep it sweet and keep the gavel out of my hand. We have a pretty ambitious agenda with a lot of presentations and a lot of good information coming out, and so we're moving forward with a lot of things in the group. This is a large group. This is a large group. This is probably one of the biggest committees I sit on besides the commission. Even the council isn't this big, and so this is a very big group to get together twice a year and have meetings. That's a good thing though, because it's a very cross -- It's a very diverse group of people in this room.

What I would suggest is if you've got something to say, say it. The more people that speak, the more interaction we have, the more lively the meeting is. You certainly don't want to listen to three or four of us speak the entire time. That's what I tell people. You're here for a purpose and be engaging. That's my suggestion. I have nothing else.

MR. PUGLIESE: Let me just -- I will try to be short and sweet too, although I've been challenged with that over the years. What I would like to say is that, especially for some of the new members, is the importance of the Habitat Protection and Ecosystem-Based Management Advisory Panel, and it was renamed specifically to really highlight the fact that this body provide the council with a long-term view on conservation, habitat conservation, essential fish habitat, and any environmental activities in the region as well as really providing the foundation for our move toward ecosystem-based management.

A lot of this -- The conservation of habitat is absolutely at the foundation of that, but, going beyond that, the opportunity to engage and enhance and move forward our Fishery Ecosystem Plan activities and any of our collaborations with partners. We really extend the reach, the range, and the expertise flowing into the council process through this advisory panel, and I think it continues to expand and be refined, for very specific reasons.

The needs are greater. The opportunity to go beyond what some of the original activities the council has been involved in for conservation and for management are really approaching quickly. Technology is changing and things are advancing, and so this group really does provide the foundation for the council's activities into the future.

With that said, I think, as indicated, we do have a pretty extensive agenda with a number of different presentations. There will be a little bit of adjustment on the lunch session, timing-wise. Technology is always great, but hopefully some of you had a chance to possibly participate in that webinar. We're probably going to look at one of the earlier webinars through that Discovery of Science, because of some of the complications of making seamless web presentations of presentation and individuals.

We will deal with that, but, again, we have significant activities that are addressing policy and conservation. One of the first ones, and I guess I can just at least put a note, is to -- The morning session is addressing some issues relative to the advances on the ecosystem activities. We're going to move into that first, and I will bounce that back to Pat, and we'll start the show.

MR. GEER: Thank you, Roger. We are already three minutes ahead of schedule, and so that's great. The first item on the agenda is the Update on the FEP, the development. We're going to have several presentations by Roger, Brett, and Lora. Roger, you're up first, giving us an update.

MR. PUGLIESE: Actually, what I've done is I've got Brett Boston with us, who is with Group Solutions, our collaborator. They're working with a number of different technologies to advance team efforts and development. What I will do is weigh in after Brett starts the process with the initial presentation.

MR. GEER: Okay. Brett, you have the floor.

MR. BOSTON: I have the floor? Good. Our team has the distinct honor of trying to manage seventeen teams rewriting the FEP II section-by-section. Those of you that are working on those sections, my condolences, and thank you for your time. It's quite a challenge. I mean there is no peer review. There is no payment, and so the people that are helping us out in getting these seventeen sections rewritten essentially are all volunteers who had nothing else to do with their

spare time other than reread the old sections and rip in and provide us some new updates and information, and many of the teams are well along the way.

The overall view of the process is it's really challenging for folks. They have certain times in their schedules that they can participate and can't. I fully understand that, and we try to schedule meetings and find times where people can actually work on the document. It's been a challenging process, but the distributed stuff is working for most of the teams, but not all. Many challenges happen to us when we lose our team leaders, who are generally -- If I've got a good team leader that can put some time in, they can structure the meetings really well, structure the outlines really well, and make sure that we're making progress.

We do lose critical team members along the way, through job change or assignment change, and so that's been a challenge, but I think the teams are doing, in general, pretty well, and you're going to hear from George some more updates on what their teams are up to today as we go through. I thought I would just give you just a quick overview of the project as we see it.

We're using basically three tools, plus conference call, to get it done. WebEx, which I'm sure you all are familiar with as a tool, we use that quite a bit, and conference calling through that, but we've been using a tool called Basecamp and Google Docs. For some of our members -- Scott, for example, can't use Google Docs, just for security reasons or otherwise, and so we're kind of shut out of using that tool, but the Basecamp tool has proven to be pretty interesting.

It is essentially a portal that allows everybody to share their documents and information. What this tends to give us is people can upload documents or background information. They can send notes to the whole team. You can see over on the -- Perhaps you can see over on the right side, and this is our food web and connectivity team. They've already got their dates coming up for when their current drafts are due, summaries, internal review.

It just helps us have one place to dump everything and keep track. There are links to the Google Docs that we're working on, et cetera, and so that's proven to be an okay tool for some folks, and they seem to like it quite a bit, and so that's been helpful with trying to keep up, as I said, with about seventeen teams. Then Roger throws one over the bow about once a week.

Then Google Docs is a tool that, if you haven't used it, it's a really super way to do collaborative writing. If you haven't used Google Docs, I recommend you check it out. Not everybody, again, can get to Google Docs with their security that some folks have, but it's pretty cool. It allows everybody to work on the same document and comment and mark it up. It's Word with track changes, but on steroids, and it's a pretty cool tool. It allows us to really keep up with version control and where documents are, and so we've been using that quite a bit and getting a lot done. The teams that have done their work with Google Docs are way ahead of the teams that are trying to do independently and then try to merge it. If you haven't used it, it's a great tool. I will go through food webs and connectivity, and I believe, George, are you doing that today?

DR. SEDBERRY: Yes.

MR. BOSTON: Great. The team is almost done. We're really in that final edit stage. This is a brand-new section for FEP II, and George is going to give us an overview today of where they are, but they're pretty much done. They've got a few things to do. Most teams, what they did is they

took their sections out of the existing ecosystem plan. They took their sections and they restructured them a little bit and the final thing is they're going to write the intro and the recommendations at the end, once they've gotten all their writing done, and most teams are pretty much right up against writing their recommendations.

Then they will go out for external review, and those will be posted and available for everybody to look at and comment on, et cetera, and so they're way down the road, and this was a brand-new section. We tried to keep it short and sweet, and George will tell us more about that.

Coral reefs and shallow corals, moving along, Margaret Miller has got that, and they're pretty much in their final stages as well. They've got -- We have had some team change here, but, I think, with one more meeting, they should be able to get it done and we're trying to get that scheduled now.

The artificial reefs are finished. They're pretty much ready for external review. Bob and the team had an opportunity to meet and they're working on policy, actually, artificial reef policy for the council. Roger will talk more about that. They were lucky. They got a face-to-face in there and really did a state-by-state update, and that's pretty much ready to go, and so that piece is done, and they're moving on to actually drafting a policy piece from that.

Threats to the habitat was a late-starter getting going, and we're -- I think Pace is going to get us, one of these days, when he has nothing else to do, kind of an outline there, but that's just getting going. I think there's some stuff we can rely on, but this is heavily linked, obviously, to food webs and some of the other things that we have been talking about, climate variability, et cetera, and so that team is moving along. They did get a late start on that piece.

Mangroves is -- You would think it would be easier, because of their scope. I mean it's pretty much one state, but they're moving along. I think they're pretty close to being done. They may need one or two more members to join that team to help out, and we're working on expanding the membership for those folks.

Seagrasses are -- This is one of those we were moving along really great and then lost our team leader to reassignment, and so we're trying to get this piece back up there, and I think Roger is going to help me draft a new leader eventually, so I have someone to help coordinate with. Oyster reefs and shell banks, again, we lost the team lead there. Again, we're just kind of floundering along, and I talked to Scott earlier. He's got some stuff, and there's some things moving on this, but we definitely need to get this team back and engaged.

I think this is another one of those teams where I need some help on, estuarine and emergent marsh. They definitely could use some help. We've got water column, deepwater corals, and some other teams in there. I don't want to go through all seventeen, but, in essence, and I will put a report in the minutes, it just shows all of our teams and where they are, so you have a chance to peek at that.

If you have an opportunity and want to participate in any of these, it's actually pretty darned easy. We send you the link to the Google Doc, you mark it up, and you say sayonara. The team lead will have a chance to pull all of that together, and you will -- Everybody in here will get a chance for a final edit, and so it really is -- If you have forty-five minutes, you can mark up any one of these documents that's up there. My information will be in the minutes, I hope, and you can

certainly email me and say, I would love to see that document and mark it up. I think the teams would be happy to have folks in there. We will have external review for all of the docs coming up.

We're going to be ramping up the support for those teams that need to get their stuff in and done. We probably will be reaching out to some new folks to help us out, if they can, and I think, more importantly now, many of you that have participated in other groups and want to see what all the connectivity, we're going to start that crosswalk process, so you can start looking at other teams. I will set that up for everybody here that wants to see what's being written and where it is. We will set up documents that can be marked up that will be a different version from the ones that are coming in for a landing, but we can get comments from everybody.

I think you will start seeing some external review requests going out from the teams, like artificial reefs and others, saying, hey, here's what we've got and does anybody want to mark this up and give us some of what did we miss and any connectivity that's not here?

The good news with the external walk is I think, with everybody doing the sections independently, we will see that we can probably reduce the document probably another third. The sections have been pretty short. I think the teams have taken it onto themselves to keep it short and sweet and not try to do a literature review, to create a set of recommendations that can actually be part of policy and useful for people to manage with, as opposed to a literature review. Not everybody has gotten there, but a bunch of teams have, have taken that seriously, and so it would be nice to have a short and useful document.

We found out pretty quickly on that the document that was there on the website, the first FEP document, clearly had never been downloaded, because it didn't actually work. The link actually didn't work, and so that's how useful that document apparently appeared to be, and so we got that fixed, but we want to make it a shorter and more useful document that can actually guide some policy this go-round. I will take questions, but I think Roger has got some updates around any of the teams and some of the stuff going on.

MR. GEER: Go ahead, Roger.

MR. PUGLIESE: Let me touch on just a couple of related activities. As a number of you know, many of the participants came from recommendations from our group. A lot of the state team leads were provided directly with input from our advisory panel members, and this is really a partnership.

One of the things I think that Brett continues to identify is the intent here was to really provide a more concise and focused document, moving more toward policy directions and the real focus on some of the newer sections, on food web, and we're going to get into, in a minute, food web and connectivity and climate and variability are really going to provide some advancing into the future.

As other parts of the ecosystem plan, one of the things that we're -- This has been an evolving process, but we're also going to be drawing on other partnership discussions, such as on research and the opportunity to collaborate with our SEAMAP efforts and how they've built a five-year planning that talks about all the fishery-dependent research and the opportunity to draw on the latest iterations of those. Some of the habitat planning activities that are going through our

partnership with the Southeast Aquatic Resources Partnership, SARP activities, are going to be drawn on. It used to be an appendix of the original Fishery Ecosystem Plan, and we'll advance that. That also leads further to connectivity issues and other things, such as instream flow.

One thing we'll get an update on is the connection to our partnership with the South Atlantic Landscape Conservation Cooperative and the Blueprint Version 2.1 and advancing a real opportunity to integrate essential habitat and conservation policy directly in collaboration with that effort to advance the intent of essential fish habitat far beyond what the original activities were. Those are all occurring.

One of the other activities that we are engaged in and are going to have a meeting coming up very shortly on is advancing some online connectivity for species information versus just creating a bunch of information that's going to be in a document that gets put somewhere and set aside and then not used until we look at it again, but have advancing what is called an Ecospecies Online Information System that will provide species-specific information for all our managed species as well as the food web in the entire Atlantic. Its origin was based on a lot of activity and work that was provided on life history through Florida, about ninety species was the foundation. It expanded to all council-managed species and beyond.

The opportunity now is to expand and integrate that, and so what we're trying to do is use the FEP as the foundation, with its core habitat and with its core bigger-picture policy, but then take advantage of new technologies and new activities and make it a living, real activity, and this is one of the things that is going to evolve to do that, relative to the individual species.

That's just something I wanted to touch on. One of the other things that I think Brett also noted is we keep throwing things out. With this Basecamp and Google Doc capability, it really opens the opportunity to take some of the discussions and advance them immediately into some of the next steps. For example, with the artificial reef group, we have created another Basecamp specifically for the development of what this group had identified as the core members to participate in artificial reef policy for the council.

Some of the members know that -- You know that's one of the other big functions of the advisory panel, is to create policy statements, essential habitat policy statements for the council, which are advanced and used and have been refined over the last couple of years as part of the Fishery Ecosystem Plan also, very specifically to be more useful, while this is also another opportunity we have, was to take that and provide the foundation. That will come back to the advisory panel as being a standing artificial reef policy for the council and so that's in process and taking advantage of the technologies.

One of the other cross-walked opportunities is with climate. As part of the National Climate Science Strategy, National Marine Fisheries Service was required to develop a strategic plan document for each of the regions, and what we've done is we've got the beginnings of the foundation coming out of the Southeast Fisheries Science Center, in collaboration with the Regional Office, and engaging our climate -- We're going to pull in either key members of the entire climate group to provide the foundation for what will be a South Atlantic research action plan. I will touch on that at the end, and probably not too much further than that, at the end of the entire process, but it is related very specifically to the opportunity to the Fishery Ecosystem Plan advanced policy activity and science needs, et cetera, and so here is, again, another spinoff,

connection partnership that comes directly out of our FEP activities. With that said, I wanted to get into the two presentations that we're going to have.

MR. GEER: Does anybody have any questions?

MR. PUGLIESE: Yes, questions before we go on?

MR. CARTER: All of these groups that I see, except for like maybe the reef group, but there are oysters, mangroves, marshes. They're all coastal things that are controlled by the states, to me. Is there a group discussing the effects of storm water runoff and septic discharges and things like that into the waters that adversely affect the oysters and the erosion of marshes? I didn't really see that, and so that's my question.

MR. PUGLIESE: Yes, and I think what you're doing is probably seeing a crosswalk between some of these, because some of those threat discussions will be -- Some of it is being discussed within the individual habitat, but there is an entire threat section. If go back to the original FEP, it's fairly extensive, talking about everything from inshore impacts and near-shore shelf and all different cross impacts on any of the essential habitat, because we have it designated all the way from off the edge of the continental shelf up into the estuaries and the water column itself.

MR. BOSTON: Yes, and they're going -- For example, the estuarine group is actually talking about those sediments that are coming down, the contaminants, et cetera, and so those are in there, and so the groups are actually looking at threats by group. With the modeling, there is a team that is actually building a set of models for us, and you will see a presentation on the South Atlantic Blueprint, which we're connecting to. That's got all the riverine systems in it, and we're going to connect right at the shoreline. Not only are we going to connect saltwater environment, but we're going to go upstream, the riverine environments, and that's actually being done with some computer modeling that we'll talk a little bit about, but the answer is yes.

MR. PUGLIESE: So it's going to get even further beyond just even identifying it. It's opportunities to advance some of those discussions in more realistic presentations of what those threats and impacts may be. Are there any other questions?

MR. GEER: Any other questions? I just want to make a comment about I'm glad the artificial reef one got done, because my staff was involved in that. It's also that having the ability to meet face-to-face, because they have a committee through the Atlantic States Marine Fisheries Commission, and I'm assuming that's where a lot of that work got done.

I can see the problems in trying to go through this process and trying to do it when everyone has a chance, and it's difficult, because everybody is busy, but when you're dedicated to going to a meeting, you're there for the day and you can pound some things out. I'm assuming that they were successful at finishing because of having that face-to-face.

MR. BOSTON: Yes, and I would say the same probably for Lora's team, food webs and connectivity. They actually got to have a two-day meeting to kick off, which makes a difference. Now, they also didn't have a starting point document, and so it's kind of a tradeoff, but I think the face-to-face does help. It's just this is a very busy group of people, and trying to find face-to-face time in meetings like this, that are already completely booked, it's going to be offline over wine

and not here over beer. It's not going to be here in this meeting itself, and so where do you carve it out even at our meetings?

MR. GEER: Can you give me an estimate of approximately how many people are involved?

MR. BOSTON: A quick estimate would be 130. It's about 130, and we're inviting anyone else who wants to participate.

MR. PUGLIESE: That's the power, I think, of what we have. The groups, while they have their core, have been reaching out as they evolve and realize that maybe they don't have the expertise that this area needs to be addressed within here. They have reached out and brought other members into the groups.

I guess a point I was going to make is that as we evolve the process -- Before, we did it and we created the partners and the participants and created the document and then put it aside. There is an opportunity to maybe identify some of these core experts as part of the process somewhere, where maybe it could be connected through the online system and that would be a group that would be looking at seagrass issues into the future or something, and that could be a collaboration that we could build from this effort.

I think there is things to think outside the box, because of what we are doing, and here is an opportunity to maybe advance that, not only the information, the opportunity to do advance it online, but even the expertise and maybe more active potential involvement, or at least identifying those as references to go to.

MR. CHAPPELL: I guess this is kind of a back-up question, but is the intent of the FEP to provide like guidance for how to evaluate EFH assessments and provide recommendations and stuff like that? Is that kind of one aspect of the usefulness?

MR. PUGLIESE: We've got Pace here, and so I will go to Pace afterwards, but I think the idea is that one of the most important things is to provide the foundation of information and the refined information we know about the individual habitats that have been identified as essential fish habitat or areas of particular concern that provide its connection to species use of those habitats that provide what the threats potentially are and policies that the council have adopted to address these that would enhance the essential fish habitat review process, to the degree it can.

We're building additional tools to take that a step further with more of the more recent things that's going to be highlighted on our site, a tool that you can look at every single EFH letter that has been written, the location, and all the recommendations. To a great degree, it's serving -- The FEP, as it did before, is serving multiple needs, one being the mandates under essential fish habitat for the council and how we can better advance those policy recommendations, and that's one of the reasons that we also refined those policy statements further, to make those more concise and useable, but I will go back to Pace on how we advance that collaboratively.

MR. WILBER: Every EFH letter we sent out references the Fishery Ecosystem Plan, and it references it because it's a source of information that describes essential fish habitat and how it supports federally-managed fishery species in much greater detail than we can concisely summarize in an EFH consultation letter.

In addition to serving as that sort of massive reference document that we can cite, it also provides what I will call some guideposts for what are widely viewed as the impacts and the potential avoidance and minimization and mitigation measures for impacts. I won't sort of say that they're policy statements, from the perspective of the Fisheries Service, but they are guideposts for what we should be looking at and some demonstration that when we identify those issues in our comment letter that it's not just the personal opinion of the folks in the Fisheries Service writing the letters, but it actually draws from a much larger group that's gone through a fairly deliberative process to identify the things that should be discussed.

DR. WHITTLE: I just had a comment about the communication with the FEP. I'm on one of the teams, and a couple of my staff are on the other ones, and we have no idea what is going on. Like I didn't know that about what was going on with threats, and so it might just be good to send them an update, because this thing has been going on for a year, and I know we've done like one revision, but I had no idea what was happening, and my staff has been asking me too and I didn't know, and so it might just be good to send out a quick email to the team.

MR. GEER: Okay. Thanks, Amber. Any other questions?

MR. BOSTON: Thanks, Amber, and check your spam filters, because we are regularly inviting people to meetings and sending out polls, trying to get things together, and so if we're not getting through, but I will try to send a full --

DR. WHITTLE: Yes, and they're not in my spam.

MR. PUGLIESE: We will make sure that any of these disconnects are sorted out, because we really need to make sure that we keep on target, so that these advance further, and there are critical roles that you play in this whole process, and so we want to make sure that the members are getting what they need to and we're able to advance this.

MR. GEER: All right. Moving on to the next agenda item, we have Lora Clarke. She's going to give a presentation on Climate Variability and Fisheries Section Development. I have not been to a fisheries management meeting in the last three or four years were climate variability or change has not come up. In fact, at NOAA's State Directors Meeting in New Orleans this year, they spent almost the entire day talking about these changes and how it's impacting fisheries management.

They are seeing it pretty strongly especially in the New England states and how it's affecting fishing quotas, because we're having shifts in populations, and Jon Hare and his group up at the Northeast Center have been -- You should go to their website. It's pretty impressive, what they show and some of the videos they show, especially species like lobster that have been moving out of traditional areas. Now they're seeing them in deeper waters and much further north, and how does that affect state quotas for a fishery that's managed by quotas?

At the Atlantic States Marine Fisheries Commission, the Northeast and the Mid-Atlantic are pulling their hair out with this, with quotas, because some states can't catch black sea bass, but the have a large quota. Other states are catching their quota in two days, because there are so many of them, and so there is real -- They are really trying to deal with this and how to address it, and so I'm really interested in seeing your talk.

MS. CLARKE: Great. This is just going to be a quick overview of sort of where the climate group is and sort of what sort of components we're thinking are developing for the chapter. As Roger and Brett mentioned, this is one of the new sections being developed for the FEP, and so we've had to start from scratch, which is also a sort of nice opportunity to shape the chapter, but it's one of the things the council felt was important and should be added to the FEP.

This is the team. I'm a co-chair. I won't go through everybody, but I think it's nice mix of agency folks, academics, and NOAA, covering everything from physical oceanographers to fishery managers or fishery biologists.

This is sort of our rough timeline that we've been working with. We had our first in-person meeting here in Charleston in December. During that meeting, we developed our outline, goals for the chapter, and then we divided up writing assignments. We've had a series of webinars to check in on those writing assignments throughout the spring and sort of modified the outline as we go along.

Writing assignments are due this month. I think we're on track to meet that deadline. I think it's a hard time of the year, with the end of the academic season and people sort of also kicking up field season, and so we're trying very hard to stick to the May deadline. Then the goal of the final review of the chapter would be in June. At that time, I understand we'll also get to the see the other chapters, so we can see if there's any redundancies or anything missing when we do a comparison.

This is just a draft outline. This is what we're going with now, but it is modified as we have our team calls, and so it could be subject to change, but I think these are the overall components we feel are important for the climate chapter. Sort of introduction of role of climate considerations in ecosystem-based fisheries management, sort of why is this even going in the FEP, why is this important to consider, and then historical and current conditions for the South Atlantic ecosystem. What are the predicted future changes, and then impacts on fish, fish habitats, and fisheries and knowledge gaps related to management needs, research priorities, and then how do those things link to council management decisions?

Roger asked me to sort of highlight which of those sections could be used as a basis for a policy statement, and so I think the three here, the impact of the habitat in the fisheries, knowledge gaps for management needs, and then directly linking to management decisions, if this is a policy statement for the council. I will give you a little bit more information on each of those three sections, just briefly.

For climate impacts on fish, fish habitat, and fisheries, these are the topics or the subsections we're considering. Some of these, we actually don't have a lot of information on, and so they could be very short, a few sentences, where others could be a few paragraphs, if we know more on what's available for information for the South Atlantic.

Habitat distribution, productivity, spawning, connectivity, we're looking at predator/prey interactions or species interactions, invasive species, catchability and fishing operations and how those things can all be impacted by climate change and variability.

Then the group has identified some knowledge gaps, things that need to be of focus, and so there's so a desire to develop climate indicators. There is also some observation gaps in both time and space and then regional scenarios for future change. A lot of the climate models are on a global or large scale, but there's a need to downscale them to the regional scale for this region and then species and habitat vulnerability.

We were just mentioning that I think Jon Hare was involved in looking at species vulnerability for the Northeast, but that hasn't been done yet for the South Atlantic. There is a need there too, and then also looking at social impacts. There was a slide here that was supposed to show the links to management decisions. It was there this morning.

MR. PUGLIESE: Maybe you had a different version?

MS. CLARKE: I don't know, but I can tell you that we talked about -- For links to management decisions, it was stock assessments, how it affects allocation, ACL. There is a need to coordinate with other councils as species possibly shift. Those are all things that need to be considered. Using that information so far, the group, or a subset of the group, developed some possible policy recommendations. These are just sort of meant to kick the conversation off. These aren't meant to be the final recommendations.

I will say probably half the group has reviewed these. It hasn't been out for the whole group yet, but some possible things to consider would be, due to changing ocean conditions necessitating managing for higher-level uncertainty. We don't know exactly what climate variability will look like in this region, and so that could include providing adequate buffers that foster ecological resilience when determining optimum yield. That would be one policy recommendation.

Another would be, as species expand or shift their distributions, due to changing conditions, a careful scientific management evaluation must be undertaken prior to the initiation of new fisheries, and so there is -- As things shift, as species move north, there will be some losses for the region, but there could also be new species coming in, which would create new opportunities. The recommendation would just be to have the proper information in place before those new fisheries begin, so they are managed appropriately from the start.

Then, finally, the top climate, which I mentioned a few minutes ago on the other slide, the top climate indictors should also be developed. These indicators could track ecological, social, and economic status and trends. Then the council could request an update annually on those indicators.

Also some key research needs. That has sort of been an overwhelming feeling by the group, I think, is that it's hard to know exactly what policy recommendations to make, because there hasn't been a lot of climate research in this region. This region isn't experiencing the same dramatic climate changes as some of the other regions, such as the Northeast, which is having to tackle this quickly, but that doesn't mean that there isn't a need for more research and for management policies to be in place now for when changes do occur.

Some of the research needs identified by the group have been to just prioritize research. This could include unfished productivity. It could include species distribution, habitat, reproduction, growth, survival, predator/prey interactions, and vulnerability. Also, how to incorporate climate data and

susceptibility to climate variability into stock assessments, and so one idea here is -- So I don't know if people are familiar, but NOAA is proposing a change to their current stock assessments.

One of those is they want to replace the current benchmark assessment with sort of this research cycle, research track, and so it would be able to sort of zone in on specific research questions, and so climate might fit into one of those research tracks. It might be a way to incorporate it into stock assessments.

Then we could do management strategy evaluations to look at different regional climate scenarios and look at whether current strategies are robust to those changes. Then, also, there is a need for greater understanding of social impacts and fisheries responses. That's it. That's where we are so far, and so, again, this is still a work in progress. This is not meant to be final, but these are the ideas of the group. I am happy to take any questions.

MR. GEER: Any questions for Lora? I have one. Can you give me an example of a climate indicator? Are you talking about like the oscillations or --

MS. CLARKE: Yes, I think that could be --

MR. GEER: It could be almost anything.

MS. CLARKE: Yes, and so, for example, Lipinski and Morley have been doing some work in this region, and they're showing that winter temperatures are able to predict sort of species composition in the summer, and so winter temperature could be an indictor, the severity of winter.

DR. ELKINS: This is probably not the perfect place for it, but I didn't want it to fall between the cracks, between committees and so forth, but your point about shifting stocks and getting management as those stocks shift -- Several stocks have shifted, and we're running into a problem right now with cobia. We don't know whether -- It's probably some stock shifting and some angler changes in behavior, but, right now, it's handled by the South Atlantic, as you know, the northern stock is, yet Virginia last year caught forty-some percent of the harvest.

Additionally, the majority of the fish are not caught in federal waters. They are caught in state waters, and it may be time for us to jointly co-managing cobia. I hate to say this, but with the ASMFC, to better -- Because of the geography and where those fish are caught, to get a better handle on it. I know that sometimes other stocks, Mid-Atlantic stocks, and ASMFC co-manage those stocks, summer flounder and bluefish, and so something that's in the back of our minds and something we may need to go forward on, and I'm sure Gregg has probably heard this, but I wanted the rest of the team to hear it.

MR. WAUGH: Thank you, and good morning. That's a good point, Chris, and just to clarify, the cobia are in the Mackerel, or Coastal Migratory Pelagics, FMP that is joint between the South Atlantic and the Gulf. When we extended the management up through New York, the Mid-Atlantic Council's area, we gave them two voting seats on our Mackerel Committee.

That's the avenue for those states north of North Carolina to participate, and this has become really a bone of contention, particularly in Virginia, where they feel they have no voice. I think what has happened is cobia have shifted. There is not a lot of other species available in Virginia right now,

and so a lot of the effort has focused on cobia, and now they're discovering there is a South Atlantic Council and there is management and there is an ASMFC, and they know nothing about any of them.

We are working to correct that. We have also requested the ASMFC look into joint or complementary management, and, at their meeting last week, they agreed to look at this, and they're going to look at joint, which means they have to approve everything complementary, where the council could set the ACLs and each state could then do their own management to keep catches below that, or even doing sole management through ASMFC. All of those things are being looked at.

MR. HARTER: Is there any DNA research, genetic research, that backs up the idea that cobia stocks are shifting? Not that I'm aware of.

MR. WAUGH: I don't know about the genetic information showing there is shifting, but there are sub-populations. There is one in southern South Carolina that you're very familiar with, and the state just implemented a May catch-and-release fishery to help rebuild that sub-population. There is also a sub-population in the Chesapeake Bay, and then there appears to be an offshore population. There is a lot of debate about where that boundary is.

Right now, it's set at the Georgia/Florida line, but there is obviously mixing, based on the genetic information and the tagging studies, and that is something that we are going to request that be reexamined, the stock structure, and to get an updated stock assessment, but I don't know that the genetic information is showing a shift, but we're having catches show up farther north.

MR. CARTER: I would just like to pile on to Chris's comment about co-management. Red snapper would be another example. I don't necessarily think that it's always climate change, because as councils close fisheries, there is laws of unintended consequences, where anglers shift their target species like to cobia or other species, and I think there has to be a philosophical thinking about even ceding some federally-managed species management to the states, because I am pretty proud to say that I think in Florida that we've done a very good job of managing inshore species, and I think that that experience could be segued to federally-controlled species.

MR. GEER: Don't cede it to North Carolina.

MR. PUGLIESE: I am going to do early, and Pace will appreciate this, but one of the things that, whenever any of these discussions are occurring, especially with regard to relinquishing management to Atlantic States or outside of the council process, what needs to be considered is that when that happens that you remove the essential fish habitat designations, and we did do that with red drum, when that went, and so technically those are not identified in the comment letters, and that was a fairly big hammer back when that was used.

We want to make sure, as any of these discussions are occurring, that that at least is being considered in the background, what some of the ramifications could be for the longer term, because any of those types of designations are no longer in force if they are actually formally removed from the fishery management plan.

MR. CARTER: That's why I did say a philosophical discussion.

MR. GEER: I was in attendance at the commission meeting last week, and, at the Policy Board, we had probably a good hour discussion on this, on the cobia issue, and they're taking it seriously, and I think they're coming back at the August meeting with the pros and cons of all those scenarios. Now, is there anything that could be done for this year, this fishing season? Probably not, and, to let you know, the transition from council management to commission management for red drum was a long, drawn-out process, and so it's not -- I'm assuming, whatever we decide, it's not going to happen overnight.

When Connecticut is involved in cobia -- Connecticut sat in that room, and they had concerns of what was happening, because they're seeing cobia up there now, and so any other questions on this?

MR. BUSH: A couple of comments. Lora, good presentation. A couple of things I guess I would like to mention. In my limited delve into fisheries management here, I've noticed a recurring trend that a lot of documents and policies that are used in managed fisheries are either static and inflexible, which everybody is always talking about needing more adaptability, or they're ratcheting, they tighten down and then they tighten down and they tighten down.

Some of the points that you brought up, such as new fisheries that might be developing and things of that nature, a fishery that doesn't exist isn't going to get much pressure at any one of the councils or commissions. The one guy is trying to catch those fish or happens to be throwing them overboard every day, I mean he's not going to get anybody pushing for them until that fishery develops, and if it can't develop -- I mean there needs to be a mechanism to get into that or an entry level or -- I don't know what would be the best phrase for that.

One of the other things that I wanted to mention was, again, they're static. They don't evolve with the fishery, and whether that means that they're moving out of area and we need to back down -- We see a lot of information come in, data, and the analysis occurs. By the time we actually implement the regulation, the fish have moved on at this point, and I don't know how we can get ever to real time, in such a way that at least when we do react -- If it goes up, we can react with up as well as down, and so I guess just keeping the industries and the recreational guys in mind when we do that, and that's all.

MR. GEER: Those are good points.

MR. PUGLIESE: I guess, to that, one of the things that I think is going to be most important as we go into the future is the better we can monitor the fishery operations and catch and a lot of the advances in logbooks and collection and location I think are going to be critical to make those type of things -- Really understanding the entire complexity of the systems and how they're related -- That's what I think all of these things are trying to do.

I think that's the intent, is to advance us further, and so take advantage of the technologies and capabilities and information as we can. That's the intent of, I think, all of these different efforts right now, is to make that more efficient and more useful and, especially in these discussions, not static.

MR. GEER: Anything else on this?

MR. WILBER: I would just urge the team, if they're not doing it already, to also try to focus on how climate change and variability affects the amount, location, and quality of nursery habitat and not just focus on the fished population in offshore waters.

AP MEMBER: I would add forage species as well, the importance of those forage species and maybe the shift in those.

MS. CLARKE: We are considering both of those things. I didn't go through every possible section, but yes, both of those are good points and things that the team has discussed.

MR. GEER: Which is a good segue into our next topic. George is going to be talking about the food webs and the connectivity section.

DR. SEDBERRY: Thank you. I am George Sedberry, and I am representing the food webs and connectivity working group, or writing group, here today. This is the group, and Tracey Smart is one of the co-chairs, or co-leads, and she put this presentation together for me today, and so I appreciate that. As you can see, we have representatives from all the states and various agencies as well.

When we first started talking about this, we looked at the 3,000-plus-page habitat plan that exists now and we really wanted to focus in on, in the food webs and connectivity part, we really wanted to focus in on the mandates of Magnuson-Stevens and how this document can be dynamic and actually be used for management, rather than just a reference that people refer to occasionally.

We are definitely looking at shortening it and getting to the point and emphasizing the major features of the food webs and connectivity that relates to what we can do in developing amendments to fishery management plans and additional fishery management plans.

The design of the document is to be used by managers, and so it's going to have an overview of South Atlantic food webs and, with that, implications for and use in management, and then to connect food webs to the other Fishery Ecosystem Plan elements, particularly habitat, where these things feed, what they're feeding on, what's the habitat of the prey organisms, but really all the other parts of the Fishery Ecosystem Plan.

The emphasis is, of course, on species interactions, and we want to highlight what we know and then what we don't know, what needs additional work, and so the themes to be addressed -- Right now, we have a draft document. We started with an outline, and these themes are in that outline, and various members of the writing team have been addressing these subjects that you see here.

Food webs in the South Atlantic, we're looking at oceanic, near-shore, and estuarine and the connections between those, which includes the energy pathways, what are the energy flow rates and which directions they're going in. Connectivity among these food webs, including benthic and pelagic coupling, which I think is going to be really important as we look at spatial management plans and marine protected areas and the like.

Inshore and offshore connections, this gets back to the juvenile habitat and nursery habitat issues. It's not just the offshore adults that we're catching, but the early life history stages that depend on other habitats and feed differently when they're in those other habitats, and so what are those

connections? Latitudinal and migratory routes, we know that a lot of these species undertake migrations that are related to spawning, but they also undertake ontogenetic migrations. As they grow, they move north or south or inshore and offshore, and we want to look at all of those connections as well.

We want to look at the impacts of food webs and what are the impacts that are happening to food webs, environmental and climate change. We talked a lot about climate change, and that's certainly going to affect the abundance and distribution of prey organisms. The levels of contaminants in the prey and how that gets biomagnified up the food chain, diseases, invasive species, particularly lionfish, that are competitors for prey for some of our economically-valuable species, the effects of human activities and fisheries habitat alteration, and then the combined impacts. Some of these things may act synergistically or independently, and we need to look at those things as well.

We're going to look at available food web models, and there are some that have been done for the South Atlantic that were included in the original plan, and we want to look at those and see if they're still valid. There's probably more data that can be used to update them and tweak them, and so we'll be looking at particular case studies to see how well the models work.

Again, we also want to look for food web indicators, or the things in the food web, abundance of prey species or distribution of forage species, that might be kind of the canary in the coal mine that might indicate something happening in the ecosystem that can affect fishery landings, and so we want to examine the food web for those kinds of indicators.

Then, really, we want to be able to make this plan and this document applicable to management. We want it to be able to inform stock assessments and evaluate policy options and to be able to project biomass landings, whatever we need to project and predict and forecast, so that we can develop good management plans, and I think this will be particularly useful in spatial management.

For example, the existing marine protected areas are Type II MPAs that really only manage bottom fishing, but there might be benthic/pelagic coupling that indicates that the pelagic species in those MPAs are important as well and might need some kind of additional protection. We don't know those things, but there is some evidence that indicates that, and so we want to look at that in some detail too, and then, finally, some overall general summary recommendations.

The timeline is -- Here we are in May of 2016, and we have a draft document. It's forty-something pages, I think, and the team was supposed to have reviewed that draft as of this past Friday. I can say at least one member of the team is behind on that, but we're getting there. As Brett mentioned, we're looking pretty good on this timeline, and so we're going to have the big internal review done by May 13 and then a draft available for external review on June 15, and I think also, as Brett mentioned, he can give you access to this. If you have any expertise or you just want to see what's going on in that, I think he can give you read access for sure, and maybe -- I don't know if you want to give them write access or not, but there is a lot of expertise in the room and on this advisory panel, and it would be great if you all could take a chance to look at it.

As I said, it's only forty-something pages now, and so it's considerably reduced from what it was before, and I think -- To me, it's looking really good. It really gets to the point quickly and it has

updated literature citations and some of the latest technology and research that have been done in this field. That's all I have, and I would be happy to answer any questions.

MR. GEER: Any questions for George? I am not hearing any.

DR. SEDBERRY: I must have said it all.

MR. GEER: You said it all, but I have a question. Are all the documents due on June 15?

MR. PUGLIESE: I think we were originally trying to target some of those, but with some of the lags in preparation, it's going to be probably extended further. I think the ones that we've seen, I think we've identified which ones are getting there, and so as many of those can be brought into the next stage, I think will be.

MR. GEER: For external review, we're talking who?

MR. PUGLIESE: There is going to be a cross -- I think Brett may touch on it again, but I think one of the things we want to do is have a crosswalk between teams, to be able to look at how some of these things connect, and we may be able to update, refine, or enhance the different information between the sections.

Then there's going to be -- Actually, I have been, in the background, assembling more of an editorial review group that, again, with partnerships already discussed, having partners at ASMFC, the SEAMAP program, and potentially some of the other state -- Maybe an individual from each of the states to be kind of a broader editorial group, as we get further down the road, and so there's a couple of stages of review that we're talking about at this stage, and it's evolving, too, because how that connection to some of the species discussions is still an evolving discussion, but your first question is yes, some of them have that same timeline. Some have slipped some, because we need to rally the troops and get that done and advance it and keep on track.

MR. HOOKER: I guess I just have one question regarding the human dimensions aspect. I assume that's going to just mirror the non-fishing impacts to EFH, but are there additional things that might be in there that aren't in the non-fishing impacts to EFH policy that the council currently has?

DR. SEDBERRY: That's a good question. I can't answer it, though. I'm not a non-human person.

MR. HOOKER: The non-fishing impacts. Your slide had the human dimensions part, and then there was the non-fishing impacts to EFH section. Sorry for chopping up my words there.

DR. SEDBERRY: I'm sorry, but I still don't --

MR. HOOKER: In your slide, one of your sections, you have the human dimensions aspects to impacts from -- Human activities affecting food web connectivity. My assumption is that a lot of that will mirror the non-fishing impacts to EFH policies of the council currently. I'm just checking in on that.

DR. SEDBERRY: Yes, you're exactly right. I'm sorry. For some reason, it just didn't -- I couldn't get my head wrapped around that.

MR. HOOKER: If I said non-human, that would definitely throw you off.

DR. SEDBERRY: I was immediately thinking socioeconomic, which I'm in a fog on that. Yes, it will reflect the EFH kind of activities that are going on there as well.

MR. HART: There's going to be a lot of overlap between all of these chapters. At the end of the process, is there going to be some type of committee or something to look at it to narrow it down? I mean that's something that -- I worked on the Coastal Habitat Protection Plan in North Carolina, and what we had to do was go back afterwards and try to figure out where it was the main priority and then kind of cross-reference to those other sections.

DR. SEDBERRY: The good thing is that many of us are on different writing teams. I am also on the live bottom/hard bottom habitat team and on the species team, and so we'll be able to see -- There's overlap, I think, probably within every pair of teams. There is some overlap, so that people -- There will be people on there that can see that we've already done this in another section and maybe can pull those things out that would go into an overall introduction or an overall summary at the end. That's a Roger question, really. I'm not sure why I'm answering it.

MR. PUGLIESE: I think he's hit the nail on the head already, and some of that already has happened between the food web and climate and not reinventing the wheel between the two. There has even been that discussion across those two, because there is a crosswalk between that, and I think it extends to virtually all of those. If that's not enough, then there may be another iteration before kind of the just pure editorial, to make sure, again, this is functional.

I think the other side of this is that it's not only just going to be -- It's not going to be just purely a document. There is opportunities to enhance some of the online access to the way it functions, and that's something that we're working with Brett on, on how that evolves as an interactive, online capability, which is very different than before.

MR. BOSTON: There will be tremendous amount of that. I think we'll squeeze some air out of this and it will probably reduce at least by a third. We do have people on different teams with different expertise, and so they at least are looking across and saying, hey, we've got that covered in food webs or whatever, but every team can say, golly, that's a food webs issue and climate variability and are our threats overlapping? The answer is it really doesn't matter. I told everybody to just move forward with what you have. That final edit, I think, will really reduce the document and make those cross-connections, and I think probably even provide some additional enlightenment, by linking all the sections together.

We were hoping to actually have a crosswalk well in advance of June and we just couldn't do it, but I think that exercise itself will be very enlightening for everybody, to say, look, they did cover that, and it's just really difficult, when you break a document down like that, to know if you're not going to get duplication. You are in a lot of it.

DR. SEDBERRY: We're seeing that even within a writing team that -- We're all assigned sections and that we're seeing overlap within sections of things that can be moved to a general introduction

or moved to general conclusions, and so it's happening within each writing team and it will certainly happen among the writing teams as well.

MR. PUGLIESE: One last point is that I think one of the most important things here is last time, when we did the FEP, it was tied to advancing the Comprehensive Amendment, and we were under timelines and basically taking shortcuts to get as much as we could as fast as we could.

The intent here is to get this as effective as we can and as useful to the process, the council, as well as the partners in the region, and so whatever it's going to take to make sure that that happens and be as useful a document and advances things, I think that's what we're going to -- We'll work within the timelines, but I think not having that congressional mandate, in terms of having to have it done by tomorrow, allows us latitude to ensure it's done right.

MR. CHAPPELL: For your online tool that you mentioned, are there plans to be able to search by say threat category, like threats to shell bottom from this stressor, so it can be taken and put into EAs and EISs and stuff like that?

MR. PUGLIESE: Yes, and I think those are the types of discussions we're having. One of the capabilities, I think, goes to some of the species based with the ecospecies, that opportunity to query that type, because I think one of the things that I was trying to do was vulnerability for individual species information, as well as all the EFH designations, et cetera, but, as we evolve it to do something like that for the document itself, I think that's something that we're discussing, exactly how to make that function and provide those kinds of capabilities.

If there are recommendations on what those types of things need to be or can be and be most useful, especially, like you said, for development of EAs and EISs, that's -- The next stage is that we're specifically going to be discussing about how to advance that. That's something that I'm relying on our partners, both in this room as well as with Group Solutions and some of the technology, online technology, they've advanced in the past.

MR. GEER: Roger, this may be thinking too far in advance, but there is no set timeline, like you said, but when would you see this going in front of the council?

MR. PUGLIESE: The set time that we were really shooting to have this completed is by the end of this year, because of its connection to -- One of the ties was to our EFH five-year review that is being worked on simultaneously, and so, technically, we were trying to accomplish that all through the end of 2016. That is really what we're shooting for, and I think it's reasonable to say that we should have the lion's share of this, because, again, it's a little different in terms of its functionality and how it operates, especially with connections to species and different things, very different than before, and so how to make all these kinds of online capabilities and different types of things I think are going to be extremely important to make sure that they work right and how we do it.

Right now, the timeline is to be the end of this year, and I think we've had some of the issues, which we were trying to get a lot of the lion's share of the habitat and food web and that done in the first part of this and then really expand into some of the other sections, and so the idea would be that some of this more refined level would be able to be discussed at the November advisory panel meeting in a more complete form. At least that would be the target, which would provide

the opportunity that the council could see a more complete overview of the whole thing in December.

Now, that's what we're shooting for. We'll adjust if we really have to. Like I said, I think the most important thing is to make sure that we take this as far as we can in terms of flexibility, capability, and that the council really needs into the future.

MR. GEER: Anything else? Any other questions? What recommendations are we looking for here?

MR. PUGLIESE: I think there's been a lot of the discussion as we go, in terms of where we're going. Are there other thoughts about any of the areas that we've discussed, aspects of what's being addressed or functionality? I mean we've been kind of hitting it, on a lot of different levels, already, in terms of operations, functionality, information context. Are there ones beyond ones that individuals have already said that need to be addressed or should be addressed or that individuals would like to see this kind of capability that would be available either to your individual operations with this or how the council addresses it? That's kind of what we were looking at.

MR. BUSH: Just a quick question, and excuse my ignorance. I don't know if this is being done already or not, but I know that the Mid-Atlantic just put out their forage fish stuff, with giving folks the opportunity for public comment and whatnot. As far as grounding this with other similar activities that are going on throughout the different councils and commissions -- We obviously don't want to have like forage fish that we've determined down here, but, once you cross this line, it's no longer forage fish and catch as much as you want. I'm just using that for an example, but do we have any mechanism in place to sort of ground these with the other programs that we're working on simultaneously?

MR. PUGLIESE: I think the fact that many of those species you're talking about -- Truthfully, some of those species really aren't under -- I was going to say many of the species being managed are through Atlantic States or other partners, and we're going to have to be deferring to those. One of the things I think that does provide a crosswalk is the fact that we're developing a next-generation ecosystem modeling effort that's going to be integrating information from assessments from other areas, to be able to begin to look at how some of those types of information feed into what the South Atlantic area is doing.

I think that's going to be one avenue. The council will be addressing this. Already -- I think we've already talked about it in the sections, in terms of advancing it within the food web and connectivity, as well as in climate. I think there's a number of areas that is advancing and we have fairly close, and we'll probably have closer, communications with our partners in the Mid-Atlantic, because of activities on cobia and on blueline tile and all these other things that are advancing.

I think it will be available. We can address these, to the degree we can, especially with species that are being managed outside the bounds of the South Atlantic Council, and so I think some of that is going to be automatically connected. I think it's more complicated when we have some of those species that are not managed, and don't have necessarily the detailed information that are probably critical to our snapper grouper populations, that are going to be a challenge to advance that discussion on forage, which will be very unique to the South Atlantic versus say the Mid-Atlantic region.

MR. GEER: There is interactions. This group typically has somebody from the Mid-Atlantic who attends. There is a representative from the Habitat Committee for the Atlantic States Marine Fisheries Commission who is usually here, but they're having their meeting this week, and so it was just bad timing. We were trying to have a joint meeting, and Lisa Havel sent out the email. As soon as she sent it out, she said, I'm sorry. She realized it was the same dates as we were meeting, and so I think one of our members, Wilson, is at that meeting instead of here today, and so there are some interactions, and I have talked to Lisa several times about we probably need to sit down and make sure you're not reinventing the wheel and we're not reinventing the wheel.

In most cases, the state rep, and correct me if I'm wrong, but the state rep on the commission's Habitat Committee is different than the state rep that is sitting in this room. In every case, I think it's someone different. Hopefully you're in the same group and at least -- You're not? Okay. That makes it a little bit confounding, when groups can be doing the same things and they're working for the same agency, but not even in the same workgroup within their agency.

I would like to see us, at some point, if we could try to have a joint meeting. They had already had theirs set up. They wanted to have it in New Jersey, for some reason, but, moving forward, we're going to really try to have a meeting -- Try to schedule that meeting where maybe we're in the same building. They may meet for two days on their own and we meet for two days and then we come together for one day to meet, so we can talk about issues that are similar to each group. Is there anything else, any other discussion on this? We're way ahead of schedule.

MR. PRATT: One thing that all these distinguished panel members -- I'm hearing a lot of emphasis on interspecies management, interspecies interaction, fisheries management. I will remind you that we don't manage fish. We manage fishermen, whether it's commercial or recreational, and one thing I'm not hearing is a physical way to address habitat loss or alteration.

If we can't -- Dr. John Cossolu used to say if you can't hatch them, you can't catch them, and if we are not going to address physically -- Kevin knows what I'm addressing in North Carolina. When we, in that state, adopted a coastal habitat protection plan that provides less protection than we had before we adopted the plan. We're not moving in the right direction on that, and I think, Tom, it's like you just planted twenty-four acres of blueberries. If you ain't got enough bees to pollinate those blueberries, you're going to be in a world of trouble.

If we don't physically make a way to provide for habitat protection, it doesn't matter what the species does or what the food web does. It moves faster than we do. In North Carolina, in the western Albemarle Sound system and all the tributaries leading to it, the blue catfish has come in there in the last eight or ten years, and that food web is going to be drastically changed. There is no longer could be bream and sunfish and juvenile fish, because that catfish is going to eat them all, but we cannot catch that blue catfish up by fishing, because we catch something else that they don't want us to catch.

You have got to admit that the natural system is ahead of you. We have got to concentrate on making that natural system the best we can, and that's true of physical rules and regulations and not recommendations. Simply because you've got a coastal beach that's eroding, you don't go just offshore on that offshore bar and pump that sand back onto the beach and say, oh, well, the next storm will put it back on the bar. That sand on the bar is not what's on the beach. You change that whole system.

Climate change is so far ahead of us. It is a fact, whether you agree or not. In my part of the world, I can stand with my feet in the river and look at an eighty-foot bluff that represents, according to Dr. Stan Riggs, a plus or minus three-million-year physical picture of climate change. Ten feet about the water level is an ocean bottom that's roughly two-million years old. At that point in time, the ocean, at that place, was about 300 or 400 deep. At the bottom of that layer of blue clay, it was 400 miles offshore. Climate is going to change. Our job is to accept that, accept what the Lord puts out there for us to catch, and make sure that we do the best job we can in looking after the habitat that he gave us.

MR. GEER: Good point, Terry. Very good point.

MR. PUGLIESE: I really appreciate those comments, Terry, and I think -- You know I think this council has been at least trying to stay ahead and be at the forefront of habitat conservation in the country, really, and I think one of the keys that we have and the opportunities that we have right now is we have partners where we can begin to, at a regional basis, understand what some of these changes may mean in terms of habitat changes for the entire region.

Some of the modeling capabilities we're going to be able to access with our partnership with the Landscape Conservation Cooperatives really can emphasize how important those habitats in North Carolina are, not just for those species there, but for the entire region, for the forage base, for the managed species, for the migratory species, and how that connectivity -- Hopefully that ability to really emphasize that can provide policy foundation for not only what we're working on, but also feed back into that two-way communication and discussion with our state partners. That is critical to make this, because a lot of those, as you know, the habitats are being managed at a different level than the fish are.

They're in a different organization, a different agency, of which we do have many of the partners at the table, but I think we have some real opportunities to advance that, with ongoing activities right now, and reemphasize that connection of all those and the importance.

MR. GEER: Anything else? I am baffled by the blue cats, because I dealt with those in Chesapeake Bay, and I want to talk to you about that. Hearing nothing, why don't we take a break now and meet back at 10:45 and then Brian can start his presentation then. We're about fifteen minutes ahead of schedule. We will take a break now, and we will come back at 10:45.

MR. GEER: All right. We are back, a little bit later, but that's okay. We're way ahead of schedule. The next item on the agenda is Brian Hooker from BOEM is going to give us some updates on the BOEM North Carolina Energy Task Force meeting, and then we'll have some discussion about that, and this is in your meeting notes as Attachment Number 2.

MR. HOOKER: Thanks, Pat. Again, my name is Brian Hooker. I am with the Office of Renewable Energy Programs at BOEM, and what I'm going to give you today is just kind of a recap of last week's North Carolina task force meeting. It was done via webinar, and so this kind of consolidates two different presentations that were given at that meeting.

Quickly, I'm going to give you a quick rundown of where we are with North Carolina and South Carolina, the identification of some regional issues that came out in the South Carolina process,

and then next steps in leasing. Lastly, I'm going to give you a quick update on BOEM's Environmental Studies Program.

If you recall, not too long ago, we published a South Carolina call for information and nominations for the area that you see up on your screen there. That was published in November of 2015. They just scheduled a task force meeting, another webinar task force meeting, for next week, to discuss the results of that, of the nominations process and any comments that were received on these areas. Here is some of them right now. We have the orange there, the Grand Strand call area, that had two nominations. The pinkish area, this area here, received two nominations. These lighter colors each received one nomination. The nominated are Fishermen's and U.S. Wind.

As part of that call for information and nominations and call for interest, we received several comments, and, as a lot of folks are aware, there is new right whale critical habitat that's been designated, which does overlap with these areas, and so that's something that was just raised in the comments, and it's something that will have to be considered in any future development.

Also raised during that comment period was having the wake effect of the two areas. I will back up here, and you can see -- This is what we call Wilmington West, and so it's technically a North Carolina call area which we've analyzed and had a call for information on and done a complete environmental assessment regarding the issuance of a lease. This is Wilmington East, Wilmington West and Wilmington East, and so you can see they're congruous with or pretty close to the South Carolina areas that are now under consideration.

As a result, one of the issues that came up was understanding the wake effect from having two contiguous leaseholds, one downwind from the other. Again, I will just go back to the slide for these two areas. Having them as a separate lease process was thought to be perhaps not advantageous for this, because you may have someone who wants to be able to bid on both of these areas at the same time versus having a time difference between these two areas. They have the same relative geography and it might be more suitable for developing both areas at the same time.

Anyway, so that was one of the other issues, and also they wanted -- There were some comments regarding potential viewshed issues associated with the Wilmington West area and the Grand Strand area. As a result of some of those comments, it was decided that for the North Carolina areas that are south of Cape Hatteras -- They thought it would be best to address those in a regional and holistic manner, because of the things I just identified, the North Atlantic right whale critical habitat, the potential for wake effects, and some viewshed concerns for those areas as well.

What that means is that only the Kitty Hawk Wind Energy Area, this area up at the top, is being considered now for a potential proposed sale notice and request for interest moving forward, and that Wilmington East and Wilmington West Wind Energy Areas are going to be integrated into the South Carolina leasing process.

This is just a quick rundown for where we are for South Carolina. We have just completed the area identification. The next step is to conduct -- We just published the call for information and nominations and notice of intent for an environmental assessment. The next step area that we're going to do is the area identification, and then there will be the environmental compliance reviews and then leasing.

For North Carolina, where we are is, last week, there was a draft proposed sale notice -- PSN is proposed sale notice. They held the task force webinar on April 19, and they will consider the feedback. The next step is to then publish the proposed sale notice. Again, this is just for the Kitty Hawk area. There will be an auction seminar. They will check for the request for information feedback and finalize any new company qualifications.

I think, if you go back to that first slide, there were a few, quite a few, nominations for the North Carolina area, but it's been a few years since that, and so new companies have the opportunity to come in and say, hey, I'm actually interested in bidding for that area as well, and so that's going to happen next, or is still to happen, and then also considering the feedback and response to the PSN and then final sale notice, if necessary, and I think the target -- The earliest of that final sale notice or the auction would be in early 2017.

Again, here is where we show the number of nominations in the current area. This green was the area that was initially offered, but the -- We're going down in size, and so like the purple area received five nominations, and so five different companies expressed an interest in that purple area there. That was greater than three years ago, and so that's another reason just to double check with folks, to see who is still interested in bidding on that area.

What's in a proposed sale notice? There is a lot of stuff, and so we have the -- The proposed sale notice, this is, again, just talking about the Kitty Hawk area. You've got the areas for leasing, the fiscal terms and financial assurance, you've got auction details, critical steps for bidders, and then performance requirements, and I am highlighting this one because this is where I do most of my work, is in some of these environmental stipulations that go into leases, which really cover the period between the time that a lease is issued and any plans are submitted to BOEM.

The first plans that we would anticipate receiving would be a site assessment plan and then followed by a construction and operations plan. In each of those plans, we have the ability to attach terms and conditions of approval for those plans, and so we don't often include environmental stipulations in the lease that would cover activities that we would anticipate to see in a plan, and so the environmental stipulations in the lease are usually just covering the period between lease issuance and prior to when we receive an actual plan.

Again, here is the context. This is the area that's actually being offered for leasing in yellow here. You can see it's not too far away from the Virginia Wind Energy Area, which Dominion Power is the leaseholder there. We also have a research lease. You can't really see it on this slide, but it's this small strip right here, which is a -- It's a lease by Virginia's Department of Mines, Minerals, and Energy. It's operated by Dominion, and so it's a partnership between Virginia DMME and Dominion Power.

On that project, we actually have approved a research activities plan for two test turbines, but, anyway, back to the Kitty Hawk area here, that's the area that's going to be offered for lease. As I said, there were initially, three years ago, five nominations in response to the North Carolina call, and here's just some other metrics on the area. It's twenty-seven to forty-one meters in depth.

I am not going to really spend too much time on the lease and diligence terms. These kind of get into just other lease terms that are actually in the leases that would be issued. One thing is I will

just go down here to the duration. You don't have to necessarily use the full period that you're allowed for each of these, and so there is a preliminary term of one year.

The site assessment term of five years, and so, basically, you have up to five years to submit your construction and operations plan, and so that's the time to go out and conduct any wind resource assessments and do any other site characterization that you need to do, biological surveys that you need to do, to support your construction and operations plan. That's how much time you have. If a lot of that data already exists, if it's done, you may not need to use that whole five years and you can submit it earlier than five years, but, the way the lease is written, you have up to five years and then an operations term of twenty-five years. Lastly, there is a decommissioning plan for any commercial projects that is required two years before a lease expiration or ninety days after activity completion.

A lot of things that we have in there, from an environmental point of view, are in what we call Addendum C. That has the environmental lease stipulations that primarily cover things like vessel strike avoidance measures, primarily targeting endangered species. There is archeological survey requirements and HRG, which is High-Resolution Geophysical and Geotechnical survey requirements. That's how to operate that equipment so that it has minimal impacts to marine life, which we'll hear from Dave and Aaron later today, I think, on sound in the environment, and so a lot of these HRG and geotechnical survey requirements reflect minimizing sound inputs and potential impacts to marine life.

Then, lastly, there is reporting requirements in that Addendum C as well, such as observer reports and that type of thing, where we want to know exactly what you saw in the field when you were doing your surveys. Here again, just a quick rundown of what packages are in there. Addendum C, as I said, is where a lot of the environmental stipulations are located.

This kind of gets into a little bit more details than the previous slide did on the timeline. It's just kind of a blown-up version of some of that leasing process and timeline, and so there's the final sale notice, which I said earlier has a target of early 2017, and then you get into technical details, such as the bidder's financial forms. You have bid deposits. In this case, I think it's $450,000 per lease area. Then there's a process for a mock auction and then an actual auction for the North Carolina Wind Energy Area. In your briefing packets, you have a fuller breakdown, if you're really interested in some of this. There is a deeper slide deck on some of these details, if you're so inclined.

Again, then you have the auction concluded. You have to send the auction results to the Department of Justice for a thirty-day antitrust review, and then, following that, then you have the -- You send the lease to the winner of the auction and then you execute the lease, and so it's not even immediately after the auction. There is some processes that occur after the auction before the lease could actually be executed.

Again, I think I did kind of cover this in the other slide. The things I just wanted to highlight here is we have to finalize any new company qualifications and consider feedback and response to the proposed sale notice and then publish a final sale notice, and so there are still two public notice and comment documents that are -- The proposed sale notice and the notice and comment document that will be published for the North Carolina area.

Lastly, I am moving away now from North Carolina, and I just wanted to update you on BOEM's environmental studies program. Roger mentioned earlier the importance of the research action plan in FEP II. We have our own research action plan. It's called our Studies Development Plan, and we just posted the new Studies Development Plan for 2017 through 2019 at the link there.

I do encourage folks to check it out. We do try to do -- I am always trying to improve how we communicate and what our priorities are for that time period. I added a section specific to marine fish and fish habitat. It could probably be more detailed. I would like to be able to tie some of our priorities in with priorities for the council, not just the South Atlantic Council, but for the Mid-Atlantic and New England Councils as well, and so the more we have on what each other's priorities are, I think the more often we can find synergies on what we can work on together.

I definitely encourage you to check that out. We also included in there some study profiles. These are just one-page profiles of studies that we would like to do in the 2017 through 2019 period, and there are definitely some fish ones in there.

I put under "Completed" that we should have -- This year, we should have what I'm terming AMAPPS 1, which is the first five years of the Atlantic Marine Assessment Program for Protected Species Interagency Agreement with NMFS, both regions. That report should be finishing up in the next couple of months.

Also, although more focused in the Mid-Atlantic, there is a benthic habitat mapping -- That one is later. This one, the benthic habitat mapping assessment in the Wilmington East Wind Energy Area, that final report was finished in January and is now posted on our website. This is the one that Chris Taylor worked on with NOS and really doing a lot of benthic habitat work in the Wilmington East Area, trying to find hard bottoms and that sort of thing, and there was an archeological component.

Ongoing, we have some continued fish telemetry work in the Mid-Atlantic. We have a partnership with the Navy to extend into the Virginia area, to add fish telemetry VEMCO receivers for tagged fish, primarily targeting sturgeon, but obviously we're picking up a lot of other tagged species as well. We hope to execute -- We actually just executed another agreement with the State of New York for another fish telemetry array, and I hope in the next month that we'll have two more awards in the Mid-Atlantic for fish telemetry.

Future work in the South Atlantic, we do have a South Atlantic Ecological Baseline Study that should be awarded this year. This is going to be primarily aerial surveys, high-definition photo surveys, targeting basically anything they see. The principal species will probably be birds, but it picks up large pelagics. They pick up sea turtles and some cetaceans as well.

As I mentioned, in the Studies Development Plan, we also have some new studies. I'm hoping to try to work on establishing some more acoustic thresholds for priority marine fish, and so fish that have a commercial importance and that may be impacted by some sound-producing activities that BOEM could be conducting in the Atlantic, and so that's in the 2017 Studies Development Plan. With that, I will take questions.

MR. JONES: On the revenue coming in from the lease, the deposit and the lease payments, is there any oversight of mitigation costs that comes out of that or is budgeted back into that area where the wind lease fees would be?

MR. HOOKER: That's a great question. For oil and gas, there is the Land and Water Conservation Fund, where there is a portion of that money that does go into that fund. We don't have that in the renewable energy side, and so it just goes to the Treasury. I think we get credit for it in our budget, but we don't receive the money and the money is not earmarked for any specific purpose like the Land and Water Conservation Fund that specifically has a whole program associated with it.

MR. JONES: This is not on the side of the committee, but is there something that we as a citizen should be more concerned about or pushing that we have dollars going back in for oversight of this?

MR. HOOKER: I think the Land and Water Conservation Fund is up for reauthorization. It's past due. Actually, I think it's expired. I mean it's always within a citizen's prerogative to -- If you think there should be some things changed for that or some kind of different fund set up, that's entirely up to you. We don't necessarily have a stance on that.

MR. JONES: Good political answer. Thank you.

MS. LAWRENCE: I know that kind of the wind energy potential is greater in North Carolina and South Carolina versus Georgia and Florida. Do you foresee folks eventually moving down into those areas as well or do you think it's kind of economically unfeasible for folks with the wind speeds there?

MR. HOOKER: I am not going to really comment on whether it's economically feasible or not, but I will just tell you what the interest seems to be. Off of Florida, the Florida Task Force, I think, is looking at primarily just marine hydrokinetic, like what could be done for there. I think it's also an issue of how quickly the water drops off off of Florida. There are potential floating devices that could be available in the future, where you could go further off a coast, and so technology is always changing and the markets are always changing. I am sure that -- There's a lot of talk about the U.S.'s energy portfolio and where is the demand for this type of energy in some markets versus others, and so all of these things factor into where developers choose to develop and try to sell their energy. That's all I will say on that, really.

MS. LAWRENCE: So those other technologies would be under you all's management as well?

MR. HOOKER: Yes, and basically if it's producing energy, we have a lead on it. Let me take that back a little bit. For marine hydrokinetic, FERC takes a stronger lead, but for basically anything generating power above the water or oil and gas, for that matter, BOEM has the lead, but we're a partner with FERC on marine hydrokinetic, but, because of their hydrokinetic experience on land, I think they divided that up that way.

AP MEMBER: Brian, I have a question. You said that there is fisheries acoustic work on sturgeon in New York and what other state?

MR. HOOKER: Right now, it's off of New York and Virginia. Those are the ones that we've had awarded, and I'm anticipating -- I'm hoping in the next month or so that I will be able to announce two more awards in the Mid-Atlantic.

AP MEMBER: Okay, because we partner with South Carolina DNR on an acoustic array for sturgeon, and I was under the assumption that we were trying to put one in there with BOEM as well.

MR. HOOKER: Yes, we've been in touch on that. I think, if you look in our Studies Development Plan, I think, looking at where we are in South Carolina, I think we identified some higher priority areas to target first, and it's not that we won't eventually go there, but we will get the other ones off the ground first and then look at other areas.

AP MEMBER: So it's on the map?

MR. HOOKER: It's definitely on the map.

MR. BUSH: I think ECU, East Carolina University, is one of the ones that either has the grant request in process, or may be about to be awarded it, for the water gliders out there and tracking sturgeon as well as other important species, but I guess the question that brings up is either how might that alter the course if you all run into an endangered species issue or, further on, things get started and then you realize there is unintended consequences? I'm not sure what planning or what wiggle room you have once you put a big piece of equipment in the ground out there in the water. I don't know if there's anything that you could kind of explain on that.

MR. HOOKER: I mean I think with any project that you try to gather the best science that you have at that time, and so we'll try to gather as much information about the area prior to any construction occurring, so that we can address that at the time that we actually receive a construction and operations plan, so there aren't any surprises.

If this is something identified, let's say sturgeon, for instance, and they're overwintering off that area, you may have a seasonal prohibition on some activities that could affect that sturgeon habitat, and so there's mitigation. For a lot of things, they can be mitigated. Now, if there's something that cannot be mitigated, then there could be some impact on project viability, and that's something that I think any developer understands going in, that there could be unforeseen circumstances that were unknown about an area before beginning, but I think the idea is to try to collect as much information before you get down the road to a full construction and operations plan about the area, so you know full well what you're going into.

MR. PUGLIESE: That was getting to something I guess I was going to ask about. To that, and I think the understanding is, before you actually get like an entire wind field built, that a lot of this work is going to be done. I mean it's good to see -- I'm really happy to see, number one, the willingness of BOEM to have you directly involved in our discussions and participation and how open and available the information is being and addressing issues from the beginning, as well as setting the research that needs to be done in the process.

That said, I would assume that, as you get further down to the placement or creation of the areas, that there would be latitude for placement, and I think that's where this gets really interesting and

innovative in terms of the opportunity to work with BOEM here, is that you can take in the way the wind field is laid out, things such as movement patterns, fishing opportunity, different things that you could actually either enhance or work with that, and so I would hope that that's still going to continue on as you move down the road. While you may have a big block area, there may be latitude to really adjust and fine-tune the way that evolves.

MR. HOOKER: Roger, you're completely correct. I think a lot of the areas that we've identified -- Some people think they're so big, but, in a lot of cases, I don't think the developers necessarily have the intention to develop it wall-to-wall. They like the large area so that they can microsite and be able to move things around, because they invariably will find obstructions, hazards, important habitat that they need to avoid, whether it's the cable routes or the foundations themselves.

Having that flexibility in these areas to microsite and move things around as conditions warrant is important to the developers, and, as we've identified in some our best management practices, that early design and trying to identify things like transit corridors through the facility and marking of the facility and these type of things are definitely important considerations for how they eventually do the final layout for any commercial facilities.

MR. PUGLIESE: One of the other things I think that was really key, I think the last item that you identified, is moving toward understanding sound thresholds for fish. It's really good to see that actually get there, because I remember in some of the first workshops that were held, those were kind of some of the down-the-road that we're ultimately going to get to that point, but having that in the queue, that's going to be really good, to be able to understand that as these get refined and that question in the background, so that wouldn't be a -- That gets to that point of unanticipated or unintended consequences, that a lot of those things would be understood early on, so that maybe we could avoid placement that would have a sound system that would be preventing settlement in a certain area or something like that, and so those could be addressed early in the stages of development creation and everything, and so it's good to see a kind of end-to-end review of what that's going to mean for the South Atlantic.

MR. HOOKER: Thanks, and, of course, when you guys figure out where all the fish are spawning, let us know, so we can identify those areas and mark them on a map, because it's the same place every year, right? Anyway, there are data gaps, and we do our best with the science available to be able to mitigate, where appropriate.

AP MEMBER: (The comment is not audible on the recording.)

MR. HOOKER: We did some. It wasn't as intensive as the Wilmington East Area. We partnered with the Northeast Fisheries Science Center at Sandy Hook, and they did some benthic habitat mapping in that area, but it wasn't -- I don't think they actually did any side scan work in that area. I think it was primarily beam trawls and benthic grabs, to try to do some quick calculations of the area. They might have done some photographic work as well. Again, that report is -- I am anticipating that report to be out this in this fall time period, and so there will be more information than is currently available on the North Carolina area, but it wasn't a full what we call HRG, high-resolution geophysical, survey in that area.

MR. PUGLIESE: The last connection, and it really ties all the way back to and kind of picks up on this last statement, is I talked about the willingness to provide, and I think it's going to be really important to make sure that we continue, as some of these refined mapping and characterization areas are accomplished through BOEM's efforts, as we have in the past with the Navy, integrated that into the bigger picture of what we're looking at in the Southeast in terms of prioritization as part of the FEP process.

We're looking at developing a mapping strategy that ties back to our managed fish and habitats, and I think making sure that that becomes part of the overall repository of distribution of mapped areas, so that you can kind of fit in where the priorities are and different things -- I think getting what is available, as it is developed, is going to be critical, plus also engaging BOEM even further into that process I think is going to be good, and so I need to touch bases on how we -- Because we're more formalizing some of those discussions, so that it feeds right into the Fishery Ecosystem Plan and becomes something live online that you can go and look at priority areas and get the things like you're talking about, key spawning locations, marine protected areas, different things that play a role in any of BOEM's activities, too.

DR. ALEXANDER: I just wanted to say that I think we're missing an opportunity if we don't have some sort of an agreed-upon list of kinds of measurements that we think belongs in a habitat assessment, because he just mentioned they did an assessment of one area and no side scan, but some grab samples and dragging some trawls through the area and maybe some video. Is that good enough? Does that really characterize to the level that we're interested in in terms of understanding the distribution of habitat?

To the extent that we can work with other agencies to develop what we think a minimum mapping activity looks like, I think that we could be developing, from a number of different directions, a better understanding of the habitat that's out there.

MR. GEER: That's a good point.

MR. HOOKER: That is a good point, and I will just point out that that study is preliminary work. The developer has obligations as well, and a lot of the side scan multibeam work will be borne by the developer, although we're seeing more and more of an interest in some of the states, and in BOEM itself, to look at some of these areas independently as well, so it's easier to get all the data and share it.

The bottom line is that work will be done, at least on the bottom mapping. The entire area that's to be built upon will eventually be fully mapped, but what you're saying about getting into something like the number of grabs you want to see in a certain habitat type or some of these more specific things that you would like to see are always welcome. We always like to have that feedback, but, as far as like the actual mapping of the area that will be developed, that will occur. That's a requirement for not only for a habitat review, in looking at bottom hardness and topography, but also from our engineering branch's point of view, where they want to make sure that it's a stable environment for putting the particular foundation type that's being proposed in that area, and so that information will be collected in the long term.

DR. ALEXANDER: I guess what I was advocating is I was advocating that the preliminary surveys might have some baseline requirement -- Not requirement, but you know what I'm talking

about, desired characteristics, because we know that when they go in and really map the area that they're going to be working in, that's a very much smaller area, a postage stamp, if you will, compared to the whole area that might be leased, which I assume that's what was being mapped initially. It would be nice if we could use those initial survey efforts in a broader sense.

MR. HOOKER: I guess, not to belabor it too much, but we also do have a good partnership with NOAA, the Office of Coastal Resource Mapping. They're trying to maximize the use of their survey vessels in certain areas, and so we participate in regional mapping and trying to identify our priority areas and they're looking at their priority areas, and so we're taking advantage of situations where the vessel is out there and let's go ahead and map a bunch of these potential lease areas as well. It may seem hard to grasp all the different parts that are kind of moving, but they are working actually fairly well, but, again, I do see your point in trying to identify and set some preliminary data requirements for your consideration.

MR. WILBER: What I think this conversation is getting at is that the habitat mapping that seems to be required is really for establishing the baseline to determine the effects of the project at the location. What I hope BOEM is understanding is that there's a much more earlier interest to have adequate habitat mapping when determining the actual site where the facility is going to be located. Right now, the availability of adequate information for exact site determination is really what's lacking.

DR. ROSS: This mapping, whoever it is that does it, it sounds like it's not standardized, necessarily. Whatever is meant by mapping, it can be a fairly vague term.

MR. HOOKER: The data standards are set. We have guidance on what our minimum standards are and how to meet those standards. That is a set level.

DR. ROSS: What are you talking about there, I mean just multibeam or the sonar mapping or across a variety of data?

MR. HOOKER: All of it. We have guidelines on the geophysical survey requirements. We have guidelines for fisheries surveys and we have guidelines for benthic habitat surveys. All that is available on our website.

DR. ROSS: I guess my question to the committee would be, given that, and I'm not sure how familiar the committee is with those guidelines, would it be appropriate for us to take a look at those and see if there are places where we should suggest additions or changes, with the goal towards standardization and providing the kind of data that we would like to see? That question would be to the committee. Is that an appropriate activity?

MR. GEER: Don't look at me. You guys are the committee.

DR. ALEXANDER: I would like to clarify. Are those guidelines for the site where a project is going to be built or are those guidelines for a broader scale, a whole lease area?

MR. HOOKER: Those are guidelines to the lessees for the build site and not the --

MR. CHAPPELL: I am just reminded of Chris Taylor with NOAA's recent meeting about trying to bring together various bottom-mapping efforts, and it sounds like this would be a good way to maybe bring those two things together, because they were talking about standards as well, because whenever you're trying to combine datasets, you need to have some kind of standard, so you're working from a common denominator, and so it sounds like a great opportunity to maybe look at the criteria that BOEM has and look at what Chris's group is coming up with.

MR. PUGLIESE: I will jump in, because I have mentioned the developing map strategy for the South Atlantic, and the intent there is we're actually going to have some preliminary meetings on looking at kind of key core managed species, snapper grouper species, in terms of prioritization, two weeks from now, for looking at kind of broad prioritization discussions.

However, the intent is then to go draw on our partners, SEAMAP Bottom Mapping and Species Characterization Workgroup, and with expanded expertise, primarily bringing in individuals like Chris and Carter and others that are key players in active mapping efforts to address specifically some of the discussions I think we're having, to look at what the types of assets that are available in the region and to look at the different types of technologies that are available and the processing capabilities that we have in the region and then align them with some of the priorities.

I think the idea of them looking at what the guidelines are for different components could be part of that whole discussion for different uses for what we're doing, to ultimately provide what we're looking at as the entire regional distribution of habitats and then at different layers and different levels and for different uses, and so that's exactly what I think we're all discussing right now, and that's in process to be advanced.

I think what I want to do right now is some of the partners in there -- I think BOEM needs to be brought back into that discussion, because, I think, while we've been discussing it, I don't think I had you in that group, because I chair that group, and we want to advance that and connect it directly to the map strategy, and Clark has been directly involved in that in the past. That was the one that provided essentially the foundation for our essential fish habitat and bottom mapping information in the past, and we want to advance that with active efforts that are ongoing.

MR. HOOKER: I will just add that Chris Taylor is definitely aware of what our needs are, and through the Wilmington East mapping process -- That was done on, I believe, the Nancy Foster, and so it was using a NOAA crew, which has its specifications, and we had our own specifications, and so it's an interesting -- That was a real test on how to meet each other's data needs and how they wanted to collect the data and how I think some of our folks wanted to collect the data, and I think it has helped some of these conversations to understand what each other's standards and priorities are.

MR. PUGLIESE: Yes, and to really kind of advance this discussion even further at a higher level, we are going to have a technology session at the upcoming council meeting to look at all different types of advancing technologies to meet council needs, and one of the key discussions that we're going to have a representative from Teledyne talk about is the whole scope of different types of multibeam capabilities, or mapping capabilities, from the small vessels up to the most recent ones, which are essentially going to be able to be unmanned units of vessels, be able to send them up and then just collect the information, so that opens the door for citizen science incorporation on other vessels, on fishery-independent survey vessels, and then figure out how to post process.

The other side of that is then the translation of that into the newest, high-end mapping capabilities, because now some of the backscatter can create distributions of water column level partitions and species distributions. I mean the advances on both the hardware and the software are moving at full force, and we've got some rep from -- Some of the people that are right in the middle of that with Teledyne, because they just bought one of the biggest processing groups, CARIS, to advance that even further, and so there is real -- That discussion between all the different partners to advance what can be done, minimums, and the highest end. I mean some of the stuff the Navy has done, in terms of characterization, is the highest end, using all different assets. It's something that is going to be a teaser for the council session at the Habitat and Ecosystem Committee, on where do we go from here, from AUVs, ROVs, drones, and all types of aspects of that.

MS. WENDT: I was wondering how much of the mapping data, if any, that the developer collects if proprietary, or will it be generally available to anybody who is interested in seeing it?

MR. HOOKER: Some will be proprietary, but, generally, let's say like the side scan and multibeam, I don't see any reason that that would need to be proprietary. We have been discussing, for quite some time, like how best to share that data and make it available, and that's an ongoing conversation within our group on how to do that.

MR. PUGLIESE: To that specifically, I think one of the keys is definitely in this discussion, because we don't want to get in the box that there's been on the seismic side of the world, where all of that is done and essentially nothing is available to anybody, because of the proprietary nature, and I think BOEM has been so much more open on how this advances and providing it. Hopefully we can integrate it, so it becomes part as -- I mean that's all we really need, is you get those types of information, that that be integrated into the system, so we have baselines from which to really understand the whole system.

MR. HOOKER: Right, and part of that discussion too is regarding what product do you need? Do you want the raw data? I mean, a lot of times, some researchers do want raw data, but, a lot of times, you want the product of, okay, what does this tell me about the habitat, whether it's bathymetry or bottom hardness or something like that, and those products, that is something that should be easily available. It will definitely be part of an EIS, but how best to share those products I think is where we're going, rather than perhaps trying to serve up raw data regularly.

DR. WHITTLE: In Florida, we have been working just on this, and what we've started with is just trying -- Especially on the Gulf Coast, because people are getting a lot of oil spill funding, and they're starting to hard-bottom map, but no one has a sort of master map, and so we're kind of afraid, with this limited money, that people are going to start overlapping where they're actually spending their money, and so we're trying to just do sort of project boundaries with metadata, so who to go to, and it sounds like that's what you're doing for the Atlantic coast. Is that true?

MR. PUGLIESE: It's actually beyond that, because we actually have the -- It's funny, because it is actually through FWRI that we're doing all the Atlas, and so I mean we do have -- I think the metadata is tied to the -- What's the program that we're trying to replicate on the South Atlantic side for the research information? I think we are essentially going to advance that same type of thing, but we already have the entire distribution of at least what we've been able to compile on multibeam and other mapping in the Atlas, the online Atlas, that we do serve and work collaboratively with the FWRI.

DR. WHITTLE: But now you're going to be adding, if you can, BOEM and -- Is FWRI going to be the ones maintaining that information?

MR. PUGLIESE: Yes, that's the Atlas. That's our partner. We serve it through FWRI.

DR. WHITTLE: Okay, and so you will -- You, Roger, will be kind of the head person to kind of make sure that stays updated and everything?

MR. PUGLIESE: Yes, working with staff.

DR. WHITTLE: Great. Thank you.

MR. CHAPPELL: That just reminded me that I've been working on the Atlantic fleet training and testing EIS, the phase two, which was completed in 2013, I believe. As part of that, we had to take all these various mapping compilation efforts, because the study area of AFTTE included basically the whole western Atlantic and Gulf of Mexico, and so I had to compile -- I focused it on just the benthic habitat classifications, because there was lots of backscatter data out there that's not classified by substrate type. It's just backscatter, and if they're not -- When you have two swaths of backscatter data together, they can look quite a bit different, even though they're looking at much the same thing.

We have the Gulf of Mexico compilation, and that's part of the reason why we wanted to do it. We wanted to find out what's the best data on the -- We wanted to see the best data on the top, so that if there was a phase two -- I actually just merged everything, and it wound up that some poor-quality datasets overrode some higher-quality datasets, and, this time, we're trying not to do that, and so this may be something -- Just hopefully all these things can come together and we're not all just working separately.

MR. GEER: Any other questions? Steve, did you get an answer to your --

DR. ROSS: No.

MR. GEER: I didn't think so. Does the panel want to have Brian come back at the next meeting and maybe provide some of that information on what they require on their surveys? Is that something the panel would like to see? I am seeing nodding yeses. Then the next thing is we have to ask Mr. Hooker if he would be available to provide that information at the next meeting.

MR. HOOKER: Roger has got me as a member now, and so -- Is it November? I think it's on my calendar.

MR. GEER: I think it would be useful to see. I mean a lot of these exercises, it's, like you said, trying to bring things together and have them on the same scale and everything. The more we can do to work together, the better. We just talked about that this morning, between the commissions and the council and the different groups. It's like the more we can cooperate -- You don't want to have a whole lot of overlap. You want to try to make sure everybody is doing things that's going to benefit the most possible.

Brian, I was looking through the presentation, and I got very intrigued with the fiscal part of it. I thought, boy, this is kind of a neat process they go through with the bidding process and how they did that. Are the lease fees the same for every project? I saw like three-dollars per acre or something like that. I was just kind of curious. Does BOEM have a standard lease fee?

MR. HOOKER: We have a standard process. It's evaluated for each auction, and that's kind of getting outside of my area of expertise, but I think they have been about the same, but they are evaluated for each area, to see what the appropriate fees should be. That's something that goes in the proposed sale notice and something that people can comment on, whether or not the fees are appropriate and that kind of thing, and so I guess that's all I can answer.

MR. GEER: Some of the numbers, it was like it was a hard, cold -- It said three-dollars per acre. I didn't know if that was a BOEM standard or was it something that -- That's as a result of the auction or was it something they put out in advance, that's the fee that they're going to charge?

MR. HOOKER: I think that's the floor, three-dollars per acre, and then, through the auction process, it ramps up. I will say that's the part that is -- Part of the proposed sale notice is what the starting bid should be, and that's what our leasing division looks at, to try to figure out what the appropriate starting bid should be, and then it just goes from there, through the auction.

The other slides do go into a lot more detail on what happens between each round and how you can drop out after each round and all that kind of thing. It's kind of an interesting process. I think it was adopted, in large part, from what the FCC does, the Federal Communications Commission, on auctioning spectrum for wireless and broadband.

DR. ALEXANDER: I just have a comment. I was at Chris Taylor's mapping coordination workshop, and I just wanted to mention that there is a web mapping tool that they're putting together, I guess that NOAA runs. I can't remember what it's called. I was looking and I couldn't see it, but, basically, it has footprints for everything that's ever been mapped and everything that's proposed to be mapped, and that's another tool that I think, we as a council, as we're bringing our data together, need to be aware of, because it operates across the federal government.

MR. HOOKER: I will just say, for the record, I think that was the SeaSketch application.

MR. PUGLIESE: I just want to express appreciation to Brian for continued input and engagement. As I said, we definitely are a different world with the renewable energy discussions. If we keep the dialogue and keep advancing, it's going to support a lot of our work on FEP and activities that are going to be critical in the next six months to a year, for sure. Thank you.

MR. HOOKER: Not a problem. Of course, there is always an open invitation, if anybody has any questions in the interim, between now and November, you can feel free to reach out.

MR. GEER: Okay. We have about fifteen minutes before lunch, and so what I am going to propose is, since George had something that he wanted to talk about, I am going to stick that in here, to be as efficient as possible. George, you have the floor for the next fifteen minutes.

DR. SEDBERRY: I will only need a few of those fifteen minutes, but I just wanted to mention that the Sargasso Sea Commission, which is a thing, has -- I'm not sure how official this is, but

Billy Causey, who is the Southeast Regional Director for the Office of National Marine Sanctuaries, is one of the commissioners. They meet periodically, at least once a year, and then by telephone conference at various other times.

During one of their recent meetings, they heaped much praise on the South Atlantic Council for having a sargassum fishery management plan, and they would like to look into the possibility of expanding that plan, and perhaps altering it. I haven't looked at the plan recently, but altering the plan to include a zero total allowable catch. I think that's the way the plan is written, is with a TAC, which is now set at 5,000 pounds, I think.

They would like to see that reduced to zero, particularly in light of the fact that there is no one in the fishery, and to look into the possibility of extending that management plan beyond the EEZ, something similar to what is done in cooperation with ICCAT and other international management bodies, and so I just wanted to bring that up as something that they're interested in working with the South Atlantic Council or any other fishery management councils on, is expanding the protection that the South Atlantic Council provides into a bigger region.

The Sargasso Sea Commission has no management authority. They were chartered in Bermuda, and so they kind of looked at Bermuda's EEZ and planned around what happens in Bermuda, but they recognize that each country, and sometimes individual states, have their own jurisdictions and management plans for fisheries, but they like what the South Atlantic Council has done, and they would like to see that expanded internationally, and so I don't know where we would begin to respond to that, but I just wanted to throw it out there.

MR. PUGLIESE: To build on that, the sargassum plan is one of the two habitat plans the council does have, and the intent there was conservation of the resource. It does also serve as essential fish habitat in a number of other FMPs, but the intent of that is truly a full conservation. Prohibition is virtually everywhere in the South Atlantic, except a small portion of the area off of North Carolina, fifty miles offshore.

All the regulations were put in place to be as stringent as possible, to try to get as close to a zero allowable catch as you possibly could. That's something that could be revisited in the FMP, similar to the present Coral FMP, with an OY essentially of zero.

The connection and the value of connecting to the international has also some precedent, because in the FMP and in discussions, conservation into the Sargasso Sea and prevention of harvest outside of the region was a recommendation within the document, that it be pursued at whatever opportunities available, and so that did kind of set a precedent to go beyond what the council's boundaries are to do it.

One of the first actions that did occur in the past is, after the council's FMP did go into place with the conservation efforts, ICCAT, in understanding the value of sargassum to the pelagic highly migratory species, passed their, and it may still be the only habitat-based resolution, identifying sargassum as essential habitat to highly migratory species, and they passed that at the ICCAT level. That was signed back when Bill Hogarth was the director, which is a little ironic, because of some of the considerations there, but the bottom line is there was support in the plan for international conservation and collaboration and discussions, at least, on how that recommendation would be advanced into the future.

This organization I talked with, I think Sylvia Earle actually has direct involvement on some of that, that organization, because there was another -- It may be another effort that was involved, blue water or some type of thing, but, also, with regard to how people are really acknowledging the importance of sargassum in the bigger scope of the world, and so those are some considerations and some connections with what is being identified and potentially proposed by George, and so we can open up the discussion in how you advance -- Like I said, one of the actions would be to potentially change that ACL now, and they are considered ACLs, to acknowledge the full protection of the South Atlantic and encourage conservation outside the region.

MR. GEER: So there's been no harvest? You're saying there is no -- When is the last time there was harvest?

MR. PUGLIESE: Before the plan went into place.

MR. GEER: But there's an allowable harvest of 5,000 --

MR. PUGLIESE: 5,000 allowable wet pounds.

MR. GEER: Wet pounds.

DR. SEDBERRY: And only east of a hundred miles, I think it is, and only off of North Carolina.

MR. PUGLIESE: Yes, it's a very small area in way deep water off of North Carolina.

DR. SEDBERRY: Latitudinally, it's the boundaries of North Carolina/Virginia and North Carolina/South Carolina and the harvest has to take place further than a hundred miles offshore. It's been a hundred and 200 miles.

MR. PUGLIESE: Yes, and so it's way -- Essentially, the intent there was to, to the degree we could, is to limit it and prohibit harvest to the maximum extent possible at that point.

DR. SEDBERRY: I think the Sargasso Sea Commission just likes the idea that that is written down somewhere and would like to see something similar for -- See how that could possibly be expanded into the Sargasso Sea.

MR. GEER: It's also a proactive approach, in case someone wants to start harvesting in the future.

MR. PUGLIESE: The whole issue of connectivity of the different systems and the concern about if species are using that outside, in the Sargasso Sea, what the implications would be for the South Atlantic region and beyond. The complexity of that habitat, in terms of everything from providing benthic nutrients to everything from red porgy to juvenile billfish and everything is, I think, one of the reasons why we still have that in place and why that's an important habitat conservation effort of the council.

DR. SEDBERRY: You're right, Pat, and so it's kind of a non-issue right now, but thinking proactively. You don't know what the future is going to bring, and, since there is not a lot of interest in the fishery right now, it might be a good time to act proactively. I don't know what the next steps are, if a motion from the AP is appropriate or --

MR. PUGLIESE: Well, I mean it's something that could be a consideration that could be raised as a point of discussion, that this activity is advancing. Having anything that would document the discussion or whatever at the international level would be good to kind of open that discussion at the council level, because this would be a policy recommendation.

Then, as we advance, any specific recommendation could be addressed further once we get more information on what the consideration at the international level is and as part of the overall process we're in for the ecosystem plan and addressing essential habitat. I mean there's a lot of ways to come up with recommendations to the council as part of this bigger process.

MR. WILBER: My question, Roger, is right now, as I recall, the sargassum FEP does not designate a habitat area of particular concern.

MR. PUGLIESE: Yes, just EFH right now.

MR. WILBER: Is it possible to designate an HAPC that's outside the EEZ?

MR. PUGLIESE: We have been given guidance that, unless things have changed, that we could not go outside the bounds of the U.S. EEZ. Now, we can go into other regions, but outside the U.S. EEZ -- I don't know if any of that has changed in the past, some of the international dealings in other regions. I guess we could investigate to see if that would be of concern. I think we highlight it, but we didn't go as far as trying to do that, because the guidance from NOAA General Counsel was saying we could not designate outside the 200-meter boundary, but that boundary is not necessarily fixed. We had discussions on the Bahamian boundaries. They are still, to some degree, fluid with the State Department, and so it's a question, maybe, I guess we could even broach the State Department on what the implications are for an EFH designation.

DR. HALPIN: Just a follow-up on the international side. I've been working with the U.N. Commission on Biological Diversity and the Sargasso Sea Commission. We have actually mapped the official international boundary for the Sargasso Sea, if there is one. It's a mobile unit, and so it's something that we have classified as a mobile feature within a specific boundary, and so it has moved forward. We actually did the boundary three years ago in a meeting in Brazil.

They classified it as an ecologically or biologically significant area within the Convention on Biological Diversity, and it's actually currently being considered as a marine world heritage site by UNESCO. My lab is also a partner with the Sargasso Sea Commission, and so anytime they ask for mapping of the actual boundary of the Sargasso Sea, they come to my lab, just to let you know.

MR. PUGLIESE: To that, I think one of the first steps would be really good to be able to integrate some of that activity, and specifically some of that mapping information, even into our online atlas, et cetera, because I think identifying its connection to the South Atlantic region would be really critical. We allude to that in the FMP and other activities, but having that plus identifying some of that deliberation would be really good. I mean we did that with some of the work that was actually provided by the State Department, mapping outside the east coast of the EEZ, and so that would probably be valuable.

DR. ROSS: I just wanted to follow up a bit on what George and Pat have added. I met with the commission last year. We were trying to develop some joint sargassum functionality projects that haven't started yet, but one thing that was kind of unclear to me, despite all the work that they've done and the mapping that's been done, is how sargassum is used by fishery communities. It appears to be different in the Gulf Stream area along the U.S. east coast compared to that far offshore.

One thing the commission was interested in, within EEZ waters, is trying to get Bermuda Fisheries more interested in some protective measures, and that's been batted around a few times, but one thing I was going to suggest, maybe for one of our future meetings or even the next meeting, is to invite somebody from that group to give a presentation and we could have a discussion about what the differences are between our systems and what data are available or not available, and it would be good to see the maps that Pat is talking about as well.

MR. PUGLIESE: Maybe we could engage -- Considering he is connected to all of those, that we have an expert that's directly involved with both the commission and the group, I would think we can probably look to work with Pat, considering he's an AP member.

DR. HALPIN: I would be happy to. Just one note that came up was on the international and U.S. boundary. The kind of functional boundary of the Sargasso Sea does intrude into U.S. EEZ waters, but the international delineation of the Sargasso Sea is clipped out of the U.S. EEZ. It's clipped out of the boundary.

MR. PARKER: I know sargassum is very important to the fisheries. It's a great habitat. The harvesters are basically using it for what?

MR. PUGLIESE: Right now, there are no harvesters on the Atlantic side, but just a quick synopsis. What raised a lot of the concern at the beginning is it was being used for feed supplements, for the hog feed supplements, chicken feed supplements. It was almost like the magic bullet in some of these different things.

Some of the markets you're talking about were so great there that if it became something where you were out there doing massive surface trawling and providing this -- The other one that has been more recent, that wasn't in that discussion back then, was the potential for biofuels. I mean there are a number of different avenues that it either was used for or potentially could be used that probably still would be of some concern about markets that could be big enough to advance in.

I saw a specific presentation from a Japanese organization that was looking at creating an offshore biofuel system, where they collect and process and provide the biofuels, and so people are thinking about different opportunities for this, and so I think keeping it at the forefront in our region, and especially if there's implications -- As Pat said, if that does have a real actual boundary that sweeps into the U.S. waters, there has got to be significant connectivity with our resources. That's what they were using it for, some pretty big types of opportunities, in even fertilizer components, too.

MR. PARKER: U.S. and international discussions ought to be forthcoming on that and some kind of real standards set around the world, because we know how important it is.

MR. GEER: I guess we start in our little corner of the world and work out way out, but I agree that it's a lot easier to do things within our council than it would be international, but we can work towards that. I mean I think that would be interesting to see. Any other discussion on this topic? I told you it would take longer than two minutes, George. The good news is that it's lunch recess. The bad news is that we're eating here. I don't know how the food is, but Roger and staff arranged for us to have lunch here, and we're going to get it and come back in here. Is that the plan?

MR. PUGLIESE: Yes, it should be -- The lunch is here. What we've got is a little bit of a lag time between just getting our food and getting set up. What we're going to do is, as the agenda showed, we're going to provide a rebroadcast of the Popper and Hawkins webinar. They kind of moved mountains and have been able to provide a direct stream for us. It's not listed yet on the site, but it's provided for us. They will be loading it to the Discovery of Sound site later on, but we're able to get it operational, because usually it takes almost two weeks for them to process. I extend a lot of thanks directly to the staff that got this off the ground, and so we will be starting that probably around 12:30, once we get settled and start eating.

MR. GEER: Okay, and so there's no time limit? Like it's not a live webinar, and so we don't have to be done by --

MR. PUGLIESE: No, we can turn it off and turn it off as we want.

MR. GEER: All right, and so we will recess for lunch, folks.

MR. GEER: At our last meeting, we had a lot of discussion about the seismic testing and the impacts on fish and fish habitat. I think somebody actually in the group said, okay, if I'm diving and I'm underneath it, what's going to happen to me? It's good today that we have Aaron Rice and David Zeddies, who are going to basically present some information on the impacts of seismic testing on fish. I believe you have a presentation on that.

MR. PUGLIESE: Why don't we take five minutes and everybody get a drink and kick back while we get the presentation loaded and we will go from there.

MR. GEER: A five-minute break, guys.

MR. GEER: There we go. Let's get started. Moving on to the next section in our agenda, like I said, we're going to be talking about the impact of seismic testing on fish and fish habitat. We have Aaron Rice from my old neck of the woods, Cornell University, and David Zeddies from Silver Spring. Gentlemen, take it away.

DR. RICE: We very much appreciate the opportunity to be here. I'm going to hide behind this monitor, and I apologize in advance. I am trying to get rid of this sinus infection, and so I will hopefully not sniffle too much. The only other tongue-in-cheek comment that I would make too is that the second worst thing to speaking before lunch is having to talk after lunch and talk about acoustical physics.

David and I are going to try to highlight some of the issues that are ongoing in the field and build off of the webinar that you saw and, ideally, keep it as interesting as humanly possible. One of the themes that was recurring through certainly Art's presentation is this issue of data gaps and lack

of good science in trying to enact effective scientific management and policy and mitigate industry activities.

What we are going to do over the next half-hour or so, and into the discussion period, is really kind of try to highlight where some of these data gaps exist, what the ecological ramifications to species and populations may be, and our intention is certainly not to sound alarmist, but highlight that these are fairly serious scientific issues that do need to be addressed one way or another.

Just to provide just a quick overview of where we're going -- If you remember nothing else, these are sort of the four key issues. Sound, while we don't think about it being important in the marine environment, is really critical for many, if not most, marine species, and sound is used for a number of different behaviors, including inter or intraspecific communication, mating, feeding, predator detection, and overall just sort of listening to their surroundings.

This issue of noise impacts to ocean life has been dealt with fairly intensely over the past several decades, really focusing on marine mammals, and with the fisheries community taking concern with some of this, there is the opportunity to benefit from the previous decades of argument and thought in the marine mammal domain, and we can use the lessons from marine mammal science to inform how we might approach understanding the problem for fish and fisheries stocks.

The sounds are diverse, there is a lot of them, and, as human activity increases in the ocean, the abundance of these sounds skyrockets as well, and, lastly, the impacts of seismic surveys on fish populations, particularly in field settings, to wild populations, is not known, but has potentially harrowing consequences, and so here's what we're going to try to cover, again trying to keep it as interesting as possible. Ideally, this can be somewhat of a conversational format, and so please, if you have questions, don't be shy, and I will try to minimize the redundancy with the previous presentation.

Fish live in a world of sound. They hear their environment. The vertebrate ear is a highly conserved anatomical structure that dates back to the origins of the vertebrates in evolutionary history, and most fish have their primary hearing range between 100 and 1,000 hertz, and so relatively low frequency, and, despite our best attempts at trying to find them, we haven't found any examples of deaf fish. While there are some fish that are extremely good at hearing and have a very highly acute sense of hearing, others are worse. There are certainly functional ears in all species of fish that have been examined.

Again, communication, sounds are abundant primarily in the two behavioral contexts of spawning and reproduction and territoriality. This is something that is true for most vertebrates, is spawning or reproduction aggression is the key behavioral context.

A lot of these species produce species-specific calls that can be readily identified in passive acoustic recordings, and some of the work that I've been doing that out of the 33,000 species of fish, we estimate that as many as 10,000 to 19,000 may be producing sounds in some capacity, and so this is not an anomaly that's among one or two different species of fish. This is likely very widespread.

Again, with this sort of scientific approach to looking at fish sounds, again, we can look to the tradition of the fishing community, where you have these different families of fish that are known,

in their common name, by their ability to produce sound. You've got the croakers and the drums and the grunts, snappers, hogfish, pigfish. I mean fishermen have known this for centuries, and, in many cases, the scientists are late to the game.

AP MEMBER: I'm a geologist. How many species of fish are there? What percent is that of the number?

DR. RICE: Including both boney fishes and cartilaginous fishes, there is a total of about 33,000, and so about 3,000 species or so, maybe 32,000 species of boney fishes, and so a lot, and probably more. This is a conservative estimate, and, if you look at the environment in which many of these vocalizing species live, they are a major component of their acoustic environment. Just as right now you can go out in the woods and hear spring peepers and green frogs calling, fish are doing nearly the same thing in their own ocean habitats.

What we can do, and we'll sort of address this theme over the course of the presentation, is that we can use sounds to remotely monitor the presence and activity of many different fish species, and so we can put a hydrophone on the bottom of the ocean and figure out who is there and what are they saying and how are things changing, both over time and over space. This is the same scientific strategy and monitoring strategy that's used for certainly marine mammals, for frogs, for birds, and we can also apply it to fishes.

If we look at the three different categories of the types of sounds that exist in the ocean, it falls under sort of three key areas. You've got environmental sound, which is the natural sounds of wind, waves, water movement, the earth. These primarily produce low-frequency sounds. You have the biological sounds, dominated by snapping shrimp, certainly. You've got fishes and marine mammals. Even sea urchins, as they move across the ocean floor, will create a sound profile that's audible.

Then, since the industrial revolution, with the advent of motorized commercial shipping, we see and increasing proliferation of ship noise and, associated with that, seismic surveys, pile driving, construction sonar, and lots of different things. People like to engage in activities on the ocean. There is a natural component of anthropogenic sound in all ocean habitats around the world, but one of the things that we have found is that the marine acoustic environment around the world is not homogenous, that we have regional differences, as a function of location, of sort of the acoustic profile. That results from these different balances of the combination of environmental, biological, and anthropogenic sound sources. Again, I just want to reiterate that anthropogenic noise levels are increasing.

DR. ZEDDIES: One of the major sound sources, and I know one that you guys were asking about, were air guns. It's important to know that with any of the sound sources that we're dealing with that they can be quite complex. Their signature, in terms of frequency content -- There is the time signal. With an air gun, there's an initial bubble that's produced and then it oscillates. That's what is shown here as a function of time. Then the frequency content can be rather complicated as well.

There is also directivity. Where you are relative to the air gun itself, you may be in a high-pressure area or you might be in a lower-pressure area, and that's also a function of frequency. The overall point here is that even a source like an air gun can be very complex, but you may need to either measure or do a bunch of modeling to understand that particular source. The same thing goes with

pile driving. In fact, pile driving is -- I know Tony Hawkins mentioned it in his talk, but pile driving, there's a bit of a shock wave that is propagated downward at known angles, and it sets the substrate into motion as well, and so that's another complicated source.

Sonar is a little bit easier to understand, but it's also something that -- It also has many of these dimensions, because it can have various frequency content. It can have directivity. You have arrays that are directed in different areas to produce different waves that are beam formed to cover particular areas. I think that's about what we wanted to say about --

DR. RICE: One other point about air guns too is that if the issue of, if the sound pattern coming out of the air gun wasn't complex enough, one of the differences too is a function of scaling, and so a lot of laboratory studies or captive field experiments may use one or a handful of air guns, whereas, in different parts of the world, during a full-scale industry operation, some of these seismic survey vessels may be towing dozens to hundreds of air guns, all pounding away, potentially for months on end. While a lot of the initial studies from single air guns are extremely informative, they don't necessarily predict what would happen at the scale of actual industry operations, and so that's another data gap as well.

AP MEMBER: Wouldn't there be like a Doppler effect, as they mow the lawn with these air guns, of constructive and destructive interference of the sound waves?

DR. ZEDDIES: Generally speaking, underwater, there is not a Doppler effect, and that's because the speed of sound in water is about four-and-a-half to five times faster than it is in air, and so the tow vessels are generally at about four knots, which is pretty much incidental compared to the sound speed, but a point that I didn't really mention, but should, is that what I showed was a single air gun.

That's complicated enough, but you never find air guns single. They're always used in arrays, and so we have to go through a lot of effort to model those arrays, so that we get an accurate picture of what the sound profile is for the array also. Then, in addition, most vessels are towing multiple arrays and there is multiple vessels, and so the sound field and the sound foot that's created during a seismic survey is very complicated, and it can be very large.

Another point, in general, is that that list of topics that we put up, those are the topics that we more or less prepared for, but we're open to questions throughout, and we will try to get to those topics. If we don't get to them, we will try and get to the stuff that you have questions about, and there's a bit of overlap between what Art and Tony talked about, and so don't be too surprised about that. Does anybody else have any questions? All right.

Art and Tony talked about fish hearing, and we all accept that fish do hear, but how do they hear? How do we know that they hear and how do their ears work? This is the basic physics part that we get to do after lunch. As I'm sure you all understand, fish don't have external ears. They don't have pinna. What they have are internal structures that are not unlike our vestibular system, and that's what you find here. It's behind the eyes and just above the hind brain.

What is going on with sound, sound particularly in the water -- This applies to sound in any medium, but it's especially true when we're having to deal with sounds under the water. What's

going on here is you've got a sound projector that's creating compression of waves that are traveling away from that speaker.

If you were a molecule of water and you took a ride -- If you took a ride on one of these molecules of water, you will notice that you're oscillating back and forth, and so you actually are moving, and you will also notice that your neighbors are getting closer to you and further away from you. When they get closer to you, that's an increase in density, or an increase in pressure. When they get further away from you, that's a decrease in pressure.

When they're closer, that's a compression. When they're further away, that's a refraction. This is our basic compressional sound wave that we all tend to think of. Now the problem is that, if you're a fish, you're the same acoustic impedance as the water, and so the sound would just go right through you, and so how is it the fish actually hear?

The way that they hear is based off of the way that their ear is constructed. This is the ear of a fish. On the bottom is the sensory macula. It has hair cells, and this is attached to the rest of the fish. This part is roughly equal to water. It's roughly the same density as water. On top of that is the otolith, which I imagine many of you are familiar with, because they're used for dating and various chemical analyses.

What happens is that the fish is moving in the water with the sound going back and forth and the otolith is much more dense than the rest of the fish, and so it moves less and it moves at a different phase. When it does that, then there's a relative difference between the otolith and the rest of the fish, and that opens up these hair bundles on the hair cells, and those are the sensory cells that are the sensory hearing apparatus of the fish. That's the fish's ear.

All fish ears work this way, and this is the particle motion that Tony and Art were talking about before. When we say particle motion, we mean the movement of the medium as the sound wave travels by it, and so that's your basic fish ear and that's how it senses particle motion. Now, some fish also do sense pressure, and when you're sensing pressure, you're sensing the compression of the medium that you're in.

The way that that works is if you have a swim bladder or some sort of gas-filled bladder, that's going to compress during the acoustic wave. When the swim bladder is either close enough to the ears to where it can transmit energy to the ears or there is a -- Some fish have a specialized mechanical connection from the swim bladder to the ears. That gives some fish the ability to also sense pressure, and so all fish are capable of sensing particle motion. Some fish are, additionally, capable of sensing the pressure component of sound.

Then, just to make it really complicated, as Tony mentioned, it can be frequency dependent, and so, at low frequencies, the fish might be sensing particle motion and, at high frequencies, the fish might be sensing the pressure component.

I don't expect everybody to go home understanding exactly what all that means. What I do want people to take home though is that sound underwater is complicated and it has multiple components to it and that fish are built to sense sound underwater and they're built to sense the various components that exist there. Then, as scientists, we have the question of how do we go

about measuring pressure? How do we go about measuring particle motion? These were mentioned.

Hydrophones are sensitive to sound pressure, and the sound pressure looks something along these lines. It's pressured measured in Pascal, that's the unit that we use, and this is what the sound pressure looks like as a function of time. There is a bunch of acoustic metrics that we use. Art and Tony talked about those, and it's a good idea to have a rough -- It's good to have a rough idea of where these things come from, just so that they make some sense when we talk about the criteria that were developed.

They're done in terms of these metrics, and so you might have the peak, which is the greatest amount of pressure that the time signal has. Peak to peak would be the overall negative to overall positive. Then, as an average measure of energy, you could look at the RMS of that, the root mean square. These are metrics that are essentially one-time events for that sound, and they are measured in terms of decibels. Don't worry too much about that. It's a convenient way of compressing large numbers into smaller numbers, so it's easier to talk about.

The other big metric that we need to get to is the sound exposure level, and this is a measure of the energy in the sound, and it accumulates. The longer the sound plays, the more energy is accumulated in terms of this metric, and so that's what -- The sound exposure level is proportional to the sound energy that was put into the water, and it will keep accumulating as long as that sound is there. Again, don't worry about the math. They're both expressed in terms of decibels.

When we go to measure particle motion, you need special equipment to do that. There is two basic approaches that you can take. One of them is to look at differences in pressure. If you do have two hydrophones, you can separate them and look and check to see what is happening at one versus what is happening at the other and then calculate the particle motion that's occurring in between them. The other way is to use an inertial method, and what that is, is it's an accelerometer or a geophone. I don't think it's worth going into the details of how those work, but just know that there is specialized equipment that's required to measure particle motion.

MR. HOOKER: I just have one question. In Tony's presentation, he seemed to mention that he was able to convert some pressure levels to particle motion. Is there --

DR. ZEDDIES: Yes, absolutely. To avoid everybody falling asleep, particle motion is -- Oftentimes, we think in terms of near-field and far-field. Near the source, the propagation of the sound is a bit different and more complicated than further away from the source. Once you get to what's called the far-field, then, if you imagine the wave being plainer, like a simple wave, then that's fairly accurate, and there is a constant that tells you what -- There's a constant that allows you to go from pressure to particle motion, once you're far enough from the sound field, or once you're far enough from the sound source and you're in the far-field, and that's what Tony was talking about. In the experiments that he did, he knew that he was in the far-field, and so he could calculate what the particle motion was. If you're in the near-field, you either need to measure it or there are ways of modeling it, but it's much more complicated.

DR. RICE: One other point to add to is that, in basic physics, the wave equation predicts both the pressure wave and particle motion as important components of the sound, but I would almost say

that, probably the last decade or so, there's been re-embracing of the importance of particle motion within the fish community.

It's not an issue so much for marine mammals, because marine mammals have a cochlea, and so they don't need to be sensitive to particle motion, but, because fish lack a cochlea and their sense of hearing is not nearly as sensitive as it is for marine mammals, they have evolved to sense particle motion.

With this awareness, this increasing awareness, of the role of particle motion and that it may be a very important stimulus, the scientific community has kind of been turned on its head, so to speak, in terms of trying to figure out what in fact are particle motion components of different sound sources and how are those being perceived by fishes, and so this has been a very, very rapidly growing field, with both technological and conceptual limitations as well.

MR. HOOKER: Thanks, and that's my question, because it's in that context, where we seem to be talking about a lot of fish without swim bladders and also fish in the Magnuson definition, which includes invertebrates, and so that seems to be more of a particle motion sensitivity than a sound pressure sensitivity.

DR. ZEDDIES: That is right, yes. Most of the invertebrates would be sensing particle motion only.

DR. RICE: Now that we've gone over that there is sound in the ocean and fish can hear, then it raises the question of what I find to be some of the more fun things to talk about, which is what are fish actually listening to? One sort of larger area is what we call auditory scene analysis, and so this is the idea, if you wanted to anthropomorphize for a moment, that if you could go into a crowded space, whether it's a church or a shopping mall or a parking lot, you could close your eyes and you've got a pretty good idea of what's around you.

You're going to hear people talking, you're going to hear movement, you're going to hear weather, you're going to hear cars driving by. In your brain, you can begin to reconstruct the world around you just by listening, and so this is a set of sort of neurophysiological and anatomical adaptations that are widespread across vertebrates, and fish are no different.

They have the basic machinery to do this auditory scene analysis, and what's interesting is that, within the neural pathways of fish, they've got one component of the auditory system that's dedicated to identifying what is the sound source and then another neural pathway that is dedicated to identifying where, and so we're going to talk a little bit about those in the coming slides.

Now that we can sort of hear the surrounding world and these environmental cues may be important for fish to listen to, whether it's tidal motion or an incoming storm or water surges. You can imagine a number of sound stimuli within the environment that would be important for fish.

We talked about communication and then localization and homing. This is also another rapidly growing area of studies, looking at how important environmental cues from places like temperate and tropical reefs are for the recruitment of not only larval fish, but potentially larval coral, larval invertebrates, and with potentially wide-ranging sound propagation distances. Sharks are also well known to use sound for localization and homing as well.

I always like to point out that fish listen to each other. If we look at the first descriptions of sounds by fish in the scientific literature, it's Aristotle. This, again, is known for over 2,000 years, and some fish are better than others at producing sounds. In my lab, two of our guinea pigs, so to speak, that we tend to focus on, which is particularly relevant for this council, are the oyster toadfish, and black drum. These are two of the loudest fish that are out there.

Black drum have a source level on their calls of about 165 decibels, which, when you convert it into decibels in air, is about standing three feet away from a jackhammer going at full speed. I mean these guys are loud. Oyster toadfish have a source level of about 130 decibels. If you swim over one when they're calling away, your entire body will vibrate.

Here are the two species-specific sounds from each of them, and this is a representation of sound that we often use in the scientific community known as the spectrogram, and so, on the X-axis here, we have time. On the Y-axis, we have frequency, and you can see sort of these different harmonic components. You would this basically the same way you would read a sheet of music, going from left to right. The higher you go up, the higher pitch it is, and you can see that the oyster toadfish and black drum calls look very different. I wasn't sure about the sound quality in here. If anybody wants to hear these guys later this afternoon, I would love to play fish sounds for you.

The occurrence of these sounds and how easy they are to detect allows us to look at spawning activity across large temporal and spatial scales. While these species, particularly in the South Atlantic, aren't hugely important commercial species, and there is certainly some degree of a recreational fishery for them, but I think, scientifically, they could serve as either an indicator species or a surrogate species, where if we can go after -- I mean this is one of the trends in biology.

You study the animals that are easy and cooperative and do what you want them to do, and these guys are two examples of that. There may be things that we can learn from focal studies on these species that we can them more broadly apply to other fish groups.

If we take thirty seconds of sound -- These data are recorded about twenty miles off the coast of Jacksonville, Florida. In the upper left is thirty seconds of sound, as you can see on this X-axis, and we see these characteristic three bands that represent what's happening with the black drum chorus, and here is a little thumbnail of what that individual call looks like. Similarly, here is another thirty seconds of sound, a couple weeks later, of an oyster toadfish chorus, where here is the fundamental frequency going like that, and then you can see the harmonic component there.

That's thirty seconds. If we zoom out in time, this is what it looks like over the course of twenty-four hours, and so we have the onset of black drum spawning activity, and I should have mentioned that these sounds are used in the reproductive context for both species, but we have the onset of spawning activity just after about six o'clock, where it picks up again after it had gone all night, and dropped off at about five in the morning.

Then, with the oyster toadfish, they call all day long. Within these field recordings, you can see ships. You can see other different instances of noise, and so this is twenty-four hours of sound. For both of these two species, it would literally take you forty-eight hours to listen to if you stopped and listened to the whole thing.

Now let's zoom back yet again, and here is six months of sound. Again, it's the same location, off the coast of Jacksonville. From January to about the end of May, what we can do is take these acoustic survey data, and here is the onset of the black drum spawning aggregation, and we can track their spawning season as it goes from March to April.

You can see, with these breaks in the sound, this is indicative of the fact that this is chorusing activity that has a very strong nocturnal signature and they're quiet during the day, whereas, with toadfish, you can see these stripes here. They call all day long, and one of the things that's interesting that we see is that we have black drum -- Really, they call sort of mid-spring. They drop off and then the toadfish start up for the remainder of the spring season and into the early summer.

Here is five years of data from that same site. What we can see is, and I will label it, but you can see the onset and duration of black drum and toadfish spawning activity from year to year, and there is several different take-home components of this. One is the pattern is the same across years. It's always black drum that start in late winter or early spring. They drop off and then the toadfish pick up again, but you're also noticing differences in the onset of that spawning activity as well as its duration.

One thing that we can talk about later too is that, with these five years of data, or these five seasons of data over five years, we can also start to look at potentially climate-driven variability. Once we start to understand the natural cycle of what spawning activity looks like in these populations of fish, we can begin to then understand, if you were to have a seismic survey go through here, how would this pattern be disrupted?

In order to avoid falsely implicating one particular source over another, there is a strong climatic signature, or at least a temperature signature, to this behavior as well, and so that needs to be taken into account when looking at any impacts from industry activity.

AP MEMBER: Why is the toadfish frequencies increasing over time?

DR. RICE: That's one of my favorite things to talk about, and I didn't want to get too into the weeds, but we can just go through it really quickly.

AP MEMBER: We can do it later if you want.

DR. RICE: No, it's a really quick explanation. It's something that I get excited about. Within these fish, they have dedicated muscles on their swim bladder that are responsible for producing the sounds. Since the fish are cold-blooded and influenced strongly by the water temperature around them, the warmer the water temperature, the faster these muscles contract. The faster the muscles contract, the higher the frequency goes, and so what you can see here is this warming. This definitely corresponds to warming over the spring season, as evidenced by this increase in frequency.

When you correlate the frequency of these calls with sea surface temperature, it's about a 95 percent R squared value, and it's about eleven hertz increase in sound per one-degree Celsius increase in water temperature. Black drum also have a temperature-dependent response, but it's not nearly as visible.

This is a temporal reconstruction for one particular location, and here is a spatial location. These are from two surveys that we did. I would just like to point out that this survey up here was graciously funded by the people at BOEM, and this one down here was a NOAA-funded study. What we wanted to do was be able to take a much broader picture of what's happening in these different areas.

I should also point out that these surveys were originally being designed for right whales, and so, for me being a fish biologist who makes a living having to study whales, you get the whales out of the way and then you can study the fun stuff, and so I get really excited when -- The whales are primarily here and then they go away and then fish start up. It's like, okay, good, let's get them out the way and let's focus on the fish.

Going from -- This is what we call our Florida South Unit. Here is the Florida border right there. This is about Jacksonville. This is just at the intersection of Georgia and Florida, and then we've got these three sensors going northward. This is centered around a Georgia wind planning area and so this study was -- The Georgia component of the study was done as a baseline characterization for the wind site.

What we see here is that in this most southerly geographical areas of the South Atlantic Bight, we've got an early onset of black drum calling. It starts a little bit later in the Florida North Site, and then even later at the two Georgia sites, and you see varying degrees of toadfish activity. There's a little bit of toadfish here. It's not nearly as pronounced as it is in other areas, possibly because it's so far offshore, and so, again, within about two minutes of me rambling on and on, I have now shown you, collectively, ten years of survey data for these different locations, and so these passive acoustic surveys provide an extremely data-intensive, but cost-efficient way, to look at spawning way to look at spawning activity at the population level.

If we take this aspect of fish acoustic communication and we sort of look at it holistically, both from the perspective of the animal all the way up to the ecosystem, we start with it at the organismal level. Here is our toadfish with the swim bladder exposed. I should just note these are the fastest contracting skeletal muscles among vertebrates, and so it's been studied intensively because of that.

We start with physiology and we scale up to behavior. Here is a cartoon showing a midshipman fish calling, male midshipman, calling to attract females. Then we can go from behavior to population ecology, and so, by just putting a hydrophone in the water and listening for a particular area or fish group, we can basically go from organism to population or community level and being able to sort of have different scientific aspects that we can understand all within this single data type.

DR. ZEDDIES: So, Aaron has just told you what they are listening to and talked about how do we put this in the context of scene analysis, and so a couple of the things that fish are doing is they are localizing the sound sources. They are trying to determine where they are, and there is a few things that happen with that.

We have known for quite a long time that sharks are attracted to low-frequency sounds, and this comes from research in the 1960s, and the thinking is that the sharks are sensing fish that are injured and struggling and they are producing the low-frequency sounds. There's been a lot of

interest in exploiting and avoiding attracting sharks. Another research topic that has become very prominent lately is the attraction of larval fish to reef sounds.

Larval fish are attracted to reef sounds, with apparently pretty high fidelity, and then coral larvae are also attracted to reef sounds, and that's another recent study. In addition to identifying what is out there, the fish need to identify where it is, because there is no point in knowing what it is if you don't know where it is, and these seem to be an underlying theme of the way acoustic information is processed in the brain and conserved throughout the vertebrates.

Not only are fish listening to large objects like reefs, but they are capable of finding small objects, and so this comes from a series of experiments on the midshipmen fish. The male midshipmen will build a next under rocks on the beach, and they will hum to attract the females. What this is showing is that they will do this in a captive environment as well, and so the females will respond to playback of the males call on a speaker. What we did was we included the speaker. The female fish could not see the speaker, but they would still go to the speaker when we played the male call. When the sound is on, they go. When the sound is off, they do not, and so I believe that's it for sound listening.

Then now we get into the questions of criteria or acoustic exposure, what happens when you're exposing the animals to sound, and this is a bunch of the stuff that Art talked about, but, basically, the acoustic exposure, at least the analysis of acoustic exposure, breaks down into looking at the injury, potential death and injury, versus behavioral disruption. Quickly, we can look at what happens in the case of injury. Well, you could have hearing loss.

With fish, that is expressed as a temporary threshold shift, and so what happens is that the -- If the fish is exposed to very loud sounds, they may not be able to hear the quiet sounds anymore, and this is exactly the same thing that happens in mammals, including ourselves. Fish do not have a permanent threshold shift, because their hair cells are able to regrow, and so at some point, over a period of probably a few weeks, they should return back to the thresholds, their hearing ability, that they had before.

Then the other part is if it's an extremely loud sound, then you can get tissue damage, and this comes by way of barotrauma, and barotrauma just means pressure trauma, and so this is what might happen to a diver, getting the bends. It's similar, but this is what happens if you're exposed to very loud sounds and you mechanically damage the tissue by tearing it.

Hearing loss, there is -- We don't have great consensus on what causes hearing loss in fish or the amount of hearing loss and the type of sound that causes hearing loss, and so this is just a quick overview. We know that long, continuous exposures can cause hearing loss in fish, but these are -- These experiments come from captive fish in small tanks exposed to very loud sounds for a long period of time. These were done a while back, and they have formed some opinions on the criteria that have eventually been put forth.

Sonar, loud sonars, have been used to try and expose fish, to find out if there's hearing loss or any other type of damage. This comes from a series of experiments that Art did, or Art Popper's lab did. I was involved in several of them, and these were exposures to the Navy's LFA, the low-frequency active, array, one element of the active array, and then the mid-frequency.

The synopsis there is that there appears to be some hearing loss, very little tissue damage, and it differs for the different types of fish. The fish that are more pressure sensitive are the ones that seem to be more sensitive than the ones that are not pressure sensitive, and that's not terribly surprising. Air guns have been used. Fish have been exposed to air guns. Art talked about that in the experiment at Lake Sakakawea. McCauley had done a number of experiments in Australia before, and McCauley did find a fair amount of hearing loss, and it persisted over a long period of time, but that has not been seen since.

Pile driving is also -- Pile driving has been of a lot of interest, because that can produce short, pulsate, but very high-intensity sounds. There is evidence of hearing loss due to pile driving and then evidence of tissue damage. There is also explosions.

AP MEMBER: Regarding the McCauley paper, that was in situ?

DR. ZEDDIES: That was in situ, yes. That was off the coast of Australia, western Australia. What we do know is there's been a fair amount of studies looking at mortality of fish that are near explosions. Hearing hasn't been studied, per se, but the mortality has been looked at, and, not surprisingly, the sharper the explosion, the more damage that it can do, and there also seems to be a bit of an effect of the size of the fish.

The smaller the fish, the more susceptible it is, and, of course, the fish that have swim bladders are more susceptible to injury due to mortality. This is probably a good place to point out that, when looking at mortality studies when exposing fish, it can be very difficult, because, as Art was pointing out, when you cage the fish, you are affecting their behavior, and you might be wanting to look at their behavior, and so that can be problematic. The other part of it is that -- I totally lost my thought. Well, we've got the different types of fish. If you've got a swim bladder, you can end up with greater damage. I will move on past that.

This is a slide that Art showed, and so I won't spend any time on it, but this is from simulated pile driving, and the injuries range from being very minor to being potentially mortal down here, and so these would be minor injuries that you might see and potential high injuries, mortal injuries. We have ruptured swim bladders.

An important thing to know about this is that, in order to do those experiments, rather specialized equipment had to be made, and so those experiments that were done, we were able to control the sound field environment and give them multiple exposures to a well-known sound, so that the results were reproducible. It's very difficult to do the experiments in the field, and that's one of the points that Art and Tony were getting at, is that, in order to understand what the fish are doing, we need to look at them in the situation that you usually find them, whereas most of what we are able to control is in the lab.

One other point that hasn't come up very often is that acoustics is the -- The acoustic signature is the pressure wave that's riding on top of the atmospheric pressure that's already there, and so if you move the fish to deeper -- As the fish go deeper, the percentage of the acoustic pressure is relatively less than the pressure that the fish is experiencing statically, and so where the fish is in the water column can also determine the amount of damage that the fish might sustain when it's exposed to these louder sounds, and this is particularly the case with the barotrauma. Having the

fish acclimated to the depth that you're exposing them to is quite important, and often overlooked in some of the experiments. I believe you were going to talk about that.

DR. RICE: Part of the issue too is that it goes on -- Like just beyond hearing and the fish ears itself. You may have non-auditory impacts to the fish as well, and so we could look, in terms of chronic impacts, where the sounds don't kill the fish, but instead it's a sub-lethal exposure over long periods of time.

We could get into long-term stress, and this could either be behavioral or physiological stress. We could look at masking. When fish or other animals use sounds to communicate with each other, if there is some other noise in the background that obscures the fish sound, that's referred to as masking. If I'm talking, having a conversation, and a giant semi drives by and you can no longer hear me, that's a perfect example of masking, and so part of the concern is that for, either air guns or ships passing by, that may mask whale or fish sounds.

Then, probably most critical from the perspective of fisheries, is the idea of disrupting the reproductive behavior, resulting in lower spawning success. One of the things that I enjoy about being able to use this scientific approach of being able to conduct a survey listening for spawning fish is that typically we can sort of oversimplify it. Spawning fish are happy fish, and, in an unperturbed ecosystem, there should be a regular periodicity to spawning activity.

When you start to see major changes in levels of spawning activity or duration, it is usually indicating that something has changed in their environment. From the fisheries perspective, you may not be killing the fish, but there may be lower population levels for years to come, and so part of the issue of why this is not known is because this takes a long time for things to unfold. This has been one of the critical issues driving a lot of the marine mammal conservation issues, is what is the ultimate impact on population success and viability.

For a long-lived whale that may live literally centuries, that's going to be difficult to track, but you have some of these -- Whether it's Pacific rockfish or some of the sciaenids or groupers that are living from sixty to a hundred years, and particularly when they have a late-onset or late-in-life reproductive maturity, these are very, very long-duration processes that will take a while to not only unfold, but to be able to detect.

Then there is also the concern of fish leaving the habitat, and so work that Tony mentioned in Norway, fish will -- There is evidence of Norwegian cod departing an area where seismic surveys are going on and seeking sort of quieter locations, and that would presumably result in lower catches. Again, the long-term consequences aren't known, and that's really one of the big sort of looming questions that needs to be addressed.

DR. ZEDDIES: Okay, and so Art mentioned the book, but most of what we have talked about has been looked at and summarized. It's in this book. It is the group that -- There was a group of us that Art and Tony gathered up to suggest exposure guidelines. It goes through a number of the -- It goes through the literature and looks at the available knowledge as to what causes hearing loss, what the exposures are, and it suggests guidelines for various types of sound sources, so you can find them in tables. I think Art showed one of the tables, but it suggests what sound levels would be appropriate for pile driving or air guns or shipping and what sort of damage you might expect from those, but, anyway, it's this book. It's produced by Springer.

DR. RICE: In many cases, in spirit, this is a sort of sister document to the sound exposure guidelines for marine mammals that NOAA is currently developing, and I think a lot of these issues -- There is a tremendous -- Even though the vast majority of fish biologists and whale biologists tend not to talk to each other, there are a lot of commonalities in the problems that they're facing.

DR. ZEDDIES: When you're looking at trying to evaluate the impact that the animals might sustain in an area, then your basic approach is to either model or measure and figure out what the sound footprint looks like and then multiply that area by the animals that are in that area. Here is an example. This was the Tappan Zee Bridge. It was the Tappan Zee Bridge replacement, and so there is pile driving that was being done in order to replace the bridge, and sturgeon were known to be in the area and migrating through.

A number of areas were identified where the piles were going to be, and we modeled those. Propagation modeling looks something along these lines. This is a radial, and so this is looking at a two-dimensional radial slice away from a pile and the propagation as it goes towards the banks of the river. It's just meant to be an example.

What you end up with then is the footprint of that sound in the water. I know it's hard to see, but we get these ranges to the sound levels, and then those are cartoonishly drawn here to show these are the ranges for the criteria levels for the fish, and so the red is the potential area where the animals might be injured and the green is the area where the animals might have a behavioral change. This is the basic approach that we would take to determine effects on the animals in an area.

DR. RICE: In the context of trying to figure out what are the consequences to populations, I think one of the advantages that both the fish and the fisheries communities can benefit from is the tremendous amount of thought that has been paid to this within the marine mammal community, and there is an ONR, Office of Naval Research, working group that has developed a conceptual model affectionately known as PCOD, or the Population Consequences of Disturbance.

This framework was originally entitled the Population Consequences of Acoustic Disturbance, PCAD, but they have broadened the scope to really say no, it's not just noise and it's not just acoustic disturbance. This same sort of approach could really be used for any particular type of stressor.

Just to walk you through this really quickly, if we look left here, this is our disturbance. This could lead to either a physiological change in the animal or a behavioral change. From an acute perspective, meaning it's going to be very, very short term and rapid onset, that would then be -- Either the behavior or the physiology of the animal would impact vital rates. By vital rates, we mean feeding, we mean reproduction and survivorship, and that then impacts population dynamics.

From a chronic exposure, either the physiology or the behavior will lead to an impact on an individual's health. This could be through immunosuppression, which is linked to stress, meaning they're more prone to disease, or there may be some other health-related impacts, and those health-related impacts playing out over the course of days to weeks to months. In my case, with this cold, it feels like a month. It would then ultimately lead to vital rates and eventually population dynamics.

While this had been developed for the study of marine mammals, this is really applicable to any organism in any ecosystem. It's all trying to answer what are the population consequences of any type of environmental perturbation.

Just to wrap up here, there is plenty of other things we can talk about, but we'll finish here. We have gone over a number of aspects in the field and what may have emerged is a number of risks. The anthropogenic sounds could impact fish physiology, behavior, and ecology. These impacts range from short term to long term. They go from individuals to populations.

They could be on the small scale, meaning there may be a few dead fish after a survey or very low mortality, and that kind of loss -- If you're bringing in a trawl of thousands and thousands of fish, a few fish that may be killed beforehand by a seismic survey, that loss there may not be considered, or it may not be considered acceptable. In terms of large scale, this long period of low risk and sub-lethal, but accumulated impact from different actions, may be affecting many individuals or the population.

Again, from a risk perspective, that may or may not be considered acceptable. I think, as the scientists, we're in a role to tell the stakeholder communities what the data tell us and where do the data leave off. Then, fortunately, we get to step back and you guys can have the hard conversations about what level of risk is considered tolerable. Again, there is an opportunity here, where we're not reinventing the wheel. We can learn from studies in other taxonomic groups. There has been a tremendous amount of study on both road-noise impacts and construction impacts on birds and frogs and humans. One of the nice things about studying fish is that, because they're the base of the evolutionary history of the vertebrates, they all share this ear, and so a lot of the acoustic component of things that impact other species also applies to fish as well.

What we can do is use these other study groups to identify data gaps and be able to target them quickly and empirically. We will leave off there. We're happy to answer questions. We've got more stuff that we could show if it's of interest.

MR. GEER: Just to let you know, the book that David showed is Attachment 6 in the meeting materials, and so you all have a copy of it. That was very interesting. Any questions or comments?

MR. SARTWELL: It seems like a lot of the studies were on the physiologic impacts were on adult fish. I mean what is your best guess on even acute or chronic exposure to eggs, sperm, larvae? Is there developmental issues that need to be considered there with chronic exposure?

DR. ZEDDIES: Yes, they certainly do need to be done. They are being done. people are looking at that. This was meant as an overview. As far as explosives goes, it looks like the smaller fish are more susceptible. In terms of pile driving, and perhaps the air guns, it might be the reverse of that, but it's an important topic.

DR. RICE: There's been recent work that shows developmental impacts on oyster larvae when being exposed to pervasive noise. Again, where it was thought originally to be addressed to only things with ears are impacted by noise, it looks like it's much more widespread than just vertebrates.

DR. ZEDDIES: Not to mention ocean acidification on shellfish as well.

DR. RICE: That's the next hour.

MR. VITOLS: I guess my question goes back to the seismic testing, and I don't know if you can actually answer this, but how are those seismic tests actually conducted? You spoke of arrays, and I think somebody had mentioned a four-knot speed of vessels. My question is do they work a grid? In other words, is it more like a drive-by and they move on to the next part of the grid? There is a lot of data or a lot of focus here on the pile driving, which obviously is a consistent impact, but can you shed a little bit of light on the technique, if you can, on the actual seismic testing?

DR. ZEDDIES: Absolutely. In fact, most of the work that I do on a daily basis is looking at seismic surveys for impacts on marine mammals and not the fish. If you're asking about how do we test fish -- Are you asking about how do we test the impacts on fish or are you asking more in general about how the seismic surveys are conducted?

MR. VITOLS: Actually, that's a Part A and a Part B, but yes, I'm curious about the techniques that they actually use out there.

DR. ZEDDIES: Okay. The impacts on fish are more or less what I was showing you. They're caged fish that are exposed to an air gun. Then there is the larger studies, where you would look at catch rates when a seismic survey is near, and the results for those are somewhat mixed, and they're difficult to interpret, because it looks like the fish may be trying to avoid the seismic survey and make themselves more susceptible to being caught, and so sometimes the catch rates go up and then sometimes -- There is only a few studies, but sometimes the catch rates go down, because the fish have left the area. That part is difficult to know.

As far as how seismic surveys are conducted, there is a number of different types, and they can range from being fairly small, like what's called a vertical seismic profile, where you have a relatively small array that's in a fixed location and the shoot time is maybe eight hours to a couple of days or something like that.

On the other hand, you could have very large seismic surveys that are conducted over a couple hundred square kilometers, and those might go for several months, and they may be composed of several vessels, up to like four vessels or so, each of them towing two arrays and shooting every twelve seconds.

DR. RICE: If I could jump in here before I hand it over to BOEM, but this is a survey that we did in the Gulf of Mexico following Deepwater Horizon. This was basically a population assessment for sperm whales. What you can see is that here is sort of two-minute sound sections with individual seismic pulses being repeated about every ten or fifteen seconds. Again, if we zoom out, here is what that same survey looks like over the course of fifteen days. If we zoom out again, you can see the signature over the course of about three months.

From our survey that had a total of twenty-two recording units and a transect along the continental shelf edge of the Gulf of Mexico, we're looking at three. This little cartoon is Florida. You can see the relative locations of these different sensors. The whites of the areas represent data gaps. Basically, all of this yellow -- These are eighteen-month recordings. All of this yellow and red

that is happening, these are all industry seismic surveys that are going on, and so these sounds are propagating across hundreds of kilometers and for months on end.

I had a fun discussion with a friend in industry who said yes, but it's a seismic -- An individual seismic impulse is not that big of a deal. It's like a lightening strike. It's got a sound. I was like, true, but most lightening storms don't last for six months on end. Again, what we deal with is an issue of scale, and by sort of zooming back in time and zooming out in space, you can actually start to see what the footprint looks like in these areas. Brian, did you have anything you wanted to add to that?

MR. HOOKER: Sure. I was just going to say, just regarding how it's surveyed, yes, it is in a pattern of basically mowing the lawn, and I just wanted to -- I am certainly not the expert on oil and gas surveys, but it wasn't more than a year ago that John Johnson from our Gulf of Mexico Regional Office came and gave this AP a really good presentation on all the surveys that were even proposed for the Atlantic, and I'm sure that Roger could make those available. They're on the website, or remind us where they are on the website, so if you did want to look at that slideshow that he did when he gave it to this panel that you can look at that.

MR. GEER: Wilbur, you're relatively new to the committee, but it was several times, I think. I've seen that presentation four or five times. Each time, I got a little bit more out of it, but it's great detail on how this is done and the process and showing photographs of the actual guns and all those things. That should be available.

MR. PUGLIESE: Yes, and a lot of it is tied directly to the archived advisory panel meetings, and so either the material that was provided or the presentations provided. They are either connected directly in there or we will make sure that any of those presentations -- A lot of that went to our deliberations and discussion when we were doing the energy policy, and so we did have a lot of the information, a lot of really useful information, to understand, and it's pretty extensive, as I think we're reiterating.

MR. GEER: I will make sure you get it, because we could spend an hour-and-a-half talking about, and we've all seen it already.

DR. ALEXANDER: I just had a comment and a question. The comment about this is that we need to be realistic. This is the Gulf of Mexico, and so that might be eighteen different surveys for eighteen different companies, because there is surveying on spec going on there all the time. This is not one survey that's doing this much impact, and so you can't equate that to what if there was going to be a survey done on the east coast of the United States. It wouldn't be like that, and so just to be clear.

My question was one thing that I haven't heard through all of this, because there is all of this concern about mortality of fishes and mortality of mammals, but it would have seemed to me like it would be a simple physics exercise, because we know what the sound output and the pressure output is from an air gun or from these different kinds of sources, and why hasn't someone just calculated how far away, for a typical source, you have to be before you don't have lethal effects?

DR. ZEDDIES: We do that all the time.

DR. RICE: Yes, for marine mammals, that's definitely done.

DR. ALEXANDER: Could you tell us some of those numbers, because I have never been able to get anybody to say that out loud.

DR. ZEDDIES: I'm not sure I want to be the first.

DR. RICE: It should be in writing somewhere.

DR. ZEDDIES: I will some examples of things, roughly speaking, from what I remember, but the -- It depends on the criteria that you're looking at, of course, and so if we're looking at the -- If we're looking at marine mammals and we're looking at the current criteria, which is 180 dB RMS SPL, or 160 dB RMS SPL, which are -- Then you're looking at several kilometers to 180, up to a kilometer. If you're looking at the SEL or the peak SPL of 230 dB, then you're looking at tens of meters at the most, for the mid-frequency and the low-frequency animals. For the high-frequency animals, the thresholds are set lower, or the suggested thresholds are lower, and that is on the order of hundreds of meters.

DR. RICE: You may want to explain low-frequency and high-frequency animals.

DR. ZEDDIES: I might want to do that. That would be a good idea. what I was talking about is marine mammals, and they come in a variety of hearing flavors. The low-frequency animals are the large baleen-type whales, the blue whales and fin whales and things like that. The mid-frequency animals are most of them, the dolphins. The high-frequency animals are porpoises and things like that, and it's pretty clear, from the research literature, that they have different sensitivities. They are listening to different hearing bands and the onset of injury occurs at different levels for these different species, and so that's marine mammals.

For fish, we can do the same. We can make the same calculations. For air guns, for the most sensitive fish, it's probably in the tens of meters for exposure to air guns, or less, and that is suggested in here.

DR. ALEXANDER: I looked through that, and I couldn't see a number like that.

DR. ZEDDIES: Well, because what's given -- The thresholds for injury are given, but the source levels that you're working with -- Your sound source is going to be changing, and so you should calculate it each time. We calculate that often and so, roughly speaking, those are the ranges that we're thinking of. It's not hundreds of miles. It's meters.

MR. HOOKER: The first part is just a follow-up on what the question was regarding what the actual zone of influence is for fish. Almost all of our environmental assessments that we do in the Renewable Energy Group does try to calculate out, based upon what the sound source is, what the exposure would be to the existing criteria, which are the 206, the 150, and I forget what the cumulative SEL is.

DR. ZEDDIES: The 206.

MR. HOOKER: That's the 206, is the cumulative SEL?

DR. ZEDDIES: Yes.

MR. HOOKER: Anyway, so we do try to calculate that out, based upon the data that we have. If you look in some of our environmental assessments, but, as David said, it changes based upon what your input is. My actual question was regarding more on the empirical data. Are you guys aware of any -- We have only two studies for seismic that were -- One Art said didn't show any injury in the lake setting and then the one McCauley, which he was able to get temporary threshold shifts, but are there any other empirical studies that show, either from seismic G&G or from lesser types of survey equipment, that have shown injury or mortality?

DR. ZEDDIES: There was one other one, and Art did mention it. It's the one that Art did with David Mann north of Alaska, in the northern part of the north slope of Alaska, and that one did show some hearing loss, but they had multiple exposures, whereas the one in Lake Sakakawea was single exposures.

Then McCauley's, I think that was multiple exposures as well, and I think that might be it. I know of people that are using either air guns or water guns for deterrent, but I don't know that -- I am not aware of studies that have looked to see if it's affecting the hearing or injuring the animals, but it's probably not.

DR. RICE: I feel like most of the studies are done on survivorship, where it will be captive fish in a pen on the seafloor and then they come back two weeks later, after the survey goes by, to see how many dead fish there are.

DR. ZEDDIES: Yes, there is those types of studies.

MR. HOOKER: Just to quickly follow up, I mean Tony Hawkins showed some results of schooling fish dispersing, but he didn't show if they re-coalesced afterwards. The time series wasn't -- It seemed to be truncated after they dispersed, but it didn't show -- Are you aware of that study that he showed? Did the fish just, after a given period of time, re-shoal, or did they stay dispersed for a long period?

DR. ZEDDIES: I think we don't know. I suspect that they did, but they did somewhere else, and so wherever they were looking, they might not have seen them come back together again, but I'm not sure.

MR. KELLY: The question is have there ever been any studies to determine a fish's capability to acclimate themselves to noise? For example, in the Gulf of Mexico, with over 4,000 oil rigs and constant activity and supply boats, drilling, the operations are consistent twenty-four hours per day, yet they persist as fantastic fish aggregating devices. They may in fact be aggravating as well, but the fish seem to overcome this, for the benefits of the protections and so on and so forth of being around those oil rigs.

DR. ZEDDIES: We certainly know that they habituate to sound. The initial reaction to the sound is generally greater than reactions subsequent to that sound, and you're absolutely right that you will find fish in noisy areas, but it's always a tradeoff for the animal in trying to decide whether it's worth being there or worth leaving. In some cases -- This is one of the problems that we get

into when we're trying to study this, is that the more motivated the animal is to be there, the less likely it is that you're going to drive them off of it.

If it's a preferred breeding ground or a preferred feeding ground or something, they may stay there even though they're sustaining damage, whereas if it's something -- If it's a place that not's critical to their survival, it might be very easy to drive them off, and so this is the context in which you are studying behavior, and this is what makes those behavioral studies so difficult.

MR. KELLY: Evidently there is some level of adaptability when the benefits outweigh the problems that would be associated with it. They still manage to communicate with one another and carry out their reproductive activity, correct?

DR. ZEDDIES: Right. I mean if they're there and they are a breeding population, then yes. Whether it's -- But it's a relative question. Is it better than they would have been somewhere else? Is it sufficient for them to sustain that population? I don't know.

DR. RICE: There may be physiological costs too by hanging around. In the cases of both humans and rodents and other species too, by being in a more noisy environment, and typically that increases baseline levels of stress hormones, which has physiological consequences, too. Humans living in cities tend to have higher stress hormones than those living in more quiet areas. The same has been demonstrated in rodents and birds.

I can't remember, off the top of my head, if that's been demonstrated in fish as well. Yes, they may be hanging around platforms and going about their daily business. The real question is do they have the same life span? Do they have the same reproductive success? We don't know.

MR. BUSH: You spoke about the deterrents here just a moment ago. It's something we're looking into. We have three species of sciaenids that are main components of our bycatch in our shrimp trawl industry back in North Carolina. We have done a lot of work to try to get the fish out of the net after its in, but we've started playing around with the concept of trying to keep them from even going in.

If you've ever seen any of the bycatch reduction studies they've done, once they get in the net, they just swim along until something scares them out, and so if we can keep them out, that would be great, but we're looking at something that -- They usually respond more to the lower frequencies, no more than a couple hundred, but is there anything that has stood out, maybe in some of the work that you've done? I know it seems like you did your research more for industrial purposes, but is there anything that really stood out as something that really caused an avoidance reaction in the species without becoming something that's damaging or causing mortality?

DR. ZEDDIES: Certainly there are -- I am aware of a study that looked at deterrents and keeping fish from coming into a turbine, and that seemed to be effective, but, just like you're saying, it's low frequency. It's fairly loud, but I think you're asking something along the lines of what sort of signal structure would you use, and I don't think we know anything about that.

DR. RICE: There was a study that was done a few years ago showing that if you take Gulf toadfish and you do playbacks of dolphin whistles to them that they immediately stop calling and their

stress hormones go through the roof. Given that, certainly sciaenids comprise about 60 percent of the diet of bottlenose dolphins. You may want to try some dolphin whistles and see what happens.

MR. BUSH: We're working on that. The concern that we have with that is we don't want to end up with a net full of dolphins either. We've played around with that, and you're all familiar with the pingers, I'm sure. We have even thought about laying a base track down of pingers and then using like simulated dolphin noises around it, and so you're scaring the dolphins away, but still getting the reaction out of them. I just didn't know if anything stood out that might be useful for us to look into.

DR. RICE: There are a number of scientific studies that would be fun to think about, possibly at the bar later, but I mean I think -- Again, it's taking what do you know about the behavior of the animals and what do they do in their natural world and how can you use that to the advantage of fishing?

Certainly one of the challenges with any kind of deterrent is habituation, and so, in the case of Asian carp or lamprey invading the Great Lakes, there's been a tremendous amount of effort with deterrents there, and some degree of success, but, after time, the animals acclimate and they go after -- Another sort of deterrent is needed, and so this is where some degree of behavior -- Taking advantage of the animal behavior may be required.

DR. HALPIN: Just real quick, you mentioned stress hormones. There was an interesting study that was done post-9/11 on right whales. It was one of the only kind of natural -- If you call 9/11 a natural experiment, where ships were not out offshore and the sound levels went down. The stress hormones in the whales actually was reduced. Also, there was another one with looking at the effects on climate of aircraft being downed for a week. I mean it's rare that you could actually have a quiet ocean, or a semi-quiet ocean, for a few days, but it actually did have noticeable effects on stress hormones when you actually took the sound out of the water, and so I would imagine probably most of the animals in the Gulf of Mexico are stressed all the time.

DR. ZEDDIES: That could be. For what it's worth, the stress hormones in fish have been measured in a few situations. Ones that I'm aware of were in small tanks with a lot of sound for a long time. I wasn't bringing that up, because I'm not sure that it's representative for chronic exposure in a larger area.

MR. WILBER: This sort of builds off of Clark Alexander's question, where he's looking for the magic distance, and I'm going to ask that question in the context of a pile-driving project in a riverine environment. Riverine environments are seldom straight shots. They're full of lots of hair-pin turns and they've got muddy bottoms. When you try to look at what environmental factors determine how far this pressure wave is really going to go, I assume lots of turns in the rivers and muddy bottoms versus sandy bottoms will sort of absorb the sound, much like foxhole design was used in World War II. Is that true?

DR. ZEDDIES: Yes, and so, back to the project that we did for the Tappan Zee Bridge replacement. This is propagating out towards the -- This is from the middle of the river out to the bank, but it's taking into account what the bottom is made out of and what the bathymetry looks like. When we're trying to determine the acoustic impact, we do take into account the environment

that's there. If it's a riverine environment, if it's shallow water and it's making a hair-pin turn, we would take that into account.

What you can see, even on this one, is that pretty much the red is where injury could occur, or roughly speaking. What you can see is pretty short compared to the much larger range. The yellowish is about the behavioral. Injury is somewhere very close to the pile. Behavioral effects could occur out to something somewhere out in this range, which this is in miles. It's three-quarters of a mile, and that makes some sense, but that's specific to that environment, but it's a river. If it's another river, it's not going to be that much different.

DR. RICE: Certainly sound propagation conditions in shallow water systems become tremendously complex. Most of the foundation on the physics of sound propagation was done -- It was either funded by or conducted by the U.S. Navy, and they consider shallow water anything less than a hundred feet. There is certainly a difference between a hundred-foot-deep body of water and a five-foot-deep body of water, and there has been no tactical or strategic need for the Navy to understand sound propagation in a river, unfortunately.

MR. WILBER: Just as a quick follow-up, the studies that I've seen looking at how pressure waves from explosions propagated down through foxholes during World War II, if there were two ninety-degree turns on a distance that otherwise would have been lethal -- If there were two ninety-degree turns in that same distance, it went from lethal to just a mild injury, and so would you expect the same kind of dissipation in like a tidal creek?

DR. ZEDDIES: What I would say is, when you're thinking about sound in a river, it's really -- If you're thinking about the sound in the water in the river, the river is very small compared to everything else that's around it, and so, really, what's controlling the sound that's in the river is actually the bottom of the river. It's all the rest of it, and even including the air.

If there is hair-pin turns, if there is land blocking it, it depends on the land. If that's going to deflect the wave say downward, then it might be protective. It could transmit the wave back into the water, and so, unfortunately, it's very complicated. With explosions and air in the foxholes, you've got a very big difference between air and the rest of the surroundings, and so I think you can get better rules of thumb that way.

AP MEMBER: I'm assuming the magnitude and number of pile drivings going on is substantially higher than any of these acoustic surveys. I mean the numbers have got to be --

MR. WILBER: I mean the context is we have a lot of pile driving occurring in tidal creeks, and the creeks themselves are not necessarily large enough that you would worry about a dolphin or sea turtle or even a large fish kind of going into the creek, but there is a river that the creek is attached to, and if that's within 300 meters or 200 meters -- If there's enough turns inside the creek that you can now reliably say no effect on the protected species in the river, then you've gotten yourself out of a huge regulatory morass, but if you still have to do the sound analysis, then you're kind of stuck. There's really no clear way to do a sound analysis in a system that's kind of turning like that. What are you really gaining?

DR. ZEDDIES: Yes, because you're thinking about the sound propagating through the water, which is sensible, but it's really the sound propagating through everything that's there, and the water is a very thin ribbon compared to the substrate that's there.

DR. RICE: There may be very low-frequency sound components that go through the mud or rocks or dirt.

Mr. HART: Kind of following up on what Pace was asking, we have moratoriums in North Carolina for pile-driving activities, and I understand it's hard to look at behavioral impacts to fishes from these, and I have heard that there are studies out of the Northwest looking at salmon behavior, about being turned back from their spawning runs and not coming back that year, basically foregoing their spawning run. Do you know of any studies like that?

DR. ZEDDIES: There were tagging studies that Tom did. I'm not sure what -- I know of, but I don't know the answers.

MR. GEER: Any other questions?

MR. PARKER: I am looking at page 32 of Attachment 6, and they're talking about large commercial ships in the ocean, northern hemisphere, the northern Atlantic, I guess. They're talking about they have doubled between 1965 and 2003, to nearly 100,000, and that's expected to double or triple by 2025. That's nine years away, with an expected increase in the amount of ambient noise entering the ocean, and most of this noise is below 300 hertz, which is the damaging frequencies to fish. That low-level noise means serious implications to fish and background noise and so forth and their biology. It sounds like kind of fighting a losing battle there. I mean how are you going to quiet down ships?

DR. RICE: Absolutely, and part of the issue too -- I can't remember if this book takes it into account, but with the enlargement of the Panama Canal, not only are you going to have an increase in the number of ships, but the size of the ship is also going to get bigger, which will also have a huge sound component.

One of the things that our colleagues at NOAA are funding is a large ocean basin scale project called the Noise Reference Stations, where they have different acoustic sensors distributed in many national marine sanctuaries as well as other ecological areas of interest, basically to sort of answer this question of what do we see in overall noise levels at very long-term, broad spatial scales, both before and after the enlargement of the Panama Canal.

MR. HOOKER: Just in response to that, I mean we do have some ways to currently look at that. If you look at the Port of Miami, the amount of traffic in and out of the Port of Miami and for some areas that I work in, the Port of New York and New Jersey, I mean they're heavily industrialized port areas.

You could possibly look at what the fish productivity there is and in adjacent areas, to see how fish are coping. I think, right now, they're still functional. Now, whether or not they are optimal, as Aaron was referring to earlier, or if they're stressed or if they're not producing at maximum efficiency, I think there's a lot of questions around, but I think we can look at some existing places

and try to make inferences on how the ecosystem might change or adapt. The Atlantic coast isn't a pristine environment by any stretch.

MR. GEER: I had more of a methodology question. When you were talking about the spawning -- That's interesting to me, the spawning of the black drum and oyster toads. How difficult is it to discern between -- I mean because there is more than just one fish making sounds out there. How difficult is it to filter that information out?

DR. RICE: There are certain species that are easier than others. Like for things like red drum or some of the other sciaenids -- Weakfish are another one where there's like a series of pulses. It can be done, but it's just a little bit more time intensive. What is nice, from a scientific perspective, about the toadfish and black drum is they just have this really rich, harmonic content that makes their sounds just stand right out.

MR. GEER: As far as the passive receivers, you have a series of those out?

DR. RICE: Yes, and so it's basically a microphone connected to a computer and batteries just sitting on the bottom of the ocean. We use the term "passive" to draw contrast with active acoustic, which would be like a fish finder or a sonar system. All this does is just listen.

MR. GEER: How does the acoustic array systems impact your receivers? Like the VEMCO systems that are out there, are there any -- They're pinging all the time.

DR. ZEDDIES: Yes, we hear them.

DR. RICE: Yes, they're a much higher frequency, and so you will get them. Depending on sort of the frequency range at which you're sampling, you may or may not pick up the VEMCO receivers. One of the things that we've been doing is that, since most of the fish communication is in the low-frequency domains and the VEMCO receivers are way above, being able to combine a telemetry system with one of our microphone units, to be able to sort of get both tagged fish and the --

MR. GEER: That was my next question that I was going to ask you. Theoretically, they could go together?

DR. RICE: Absolutely.

DR. ZEDDIES: In fact, for the Tappan Zee project, we had VEMCO receivers and --

MR. GEER: Because if you think about that, having them work in unison with each other, there's such a large network of that. You can expand how much you can be collecting.

MR. CARTER: Pat, you might want to look up some work done by Dr. Grant Gilmore in Florida, because he has used this for red drum and whiting and black drum, to find out where they're spawning and what time of year they're spawning, and he's trying to relate it to the intensity of the sound to make population measurements.

MR. GEER: That's why I asked about tying it in with the VEMCO, because a lot of the states, a lot of the areas, are putting out VEMCO systems now to get information on movement of animals, but if you can get information on the spawning aggregations and the sound associated with it in conjunction with -- At the same time is great, because it's easier to send one boat out there to collect the information than two. Any other questions or comments?

DR. ALEXANDER: I just had a comment to follow up on Kevin's question. Most of that work that you have heard about has been done up in Puget Sound, associated with the Department of Transportation in Washington State, and they have been doing work since the 1990s, and continuing now mostly with DOT and Washington Sea Grant funding. There is a lot of information there.

MR. HART: Thanks. Those are the only ones that I had ever heard of, and so that's why I was wondering if that's been done for any other species.

MR. GEER: Any other questions or comments? We've got lots of time left, folks. This is the last thing on the agenda today, unless we move something up. Roger is looking at the agenda right now. We can move something up. I'm looking at the agenda, to see if we can move anything up, but the problem is that some folks aren't ready and some people aren't here.

MR. PUGLIESE: The other thing is if people look at the agenda and have the intent of watching the, and this is a going to be a webinar tomorrow, and seeing a specific discussion on -- I was going to ask Pace about getting into some of our habitat activities today, but -- I think that's one of the issues of shifting. We always have the opportunity to do those, but if somebody is specifically going to be listening for that, they will miss that.

MR. WILBER: Was there any desire for the AP to go back and look at the adopted policy statement, to see if now, with this understanding, is there anything different that -- I mean what was the objective of -- The council already approved the policy statement on non-fishing impacts. Then I didn't know if there was an objective to now go back and look at that policy statement, to flag any things that need to be rethought, or have these guys even looked at it and commented on it? I don't know. I don't want to make up work that you're not trying to --

MR. PUGLIESE: Part of the -- The bottom line is that we had advanced this. We had integrated some of that and actually had commented on seismic testing specifically to BOEM, with a blanket statement about impacts on essential fish habitat and areas and provided even spatial information. The intent today was to advance the information.

Despite the fact that the five-year planning cycle was literally just pulled out -- The Atlantic section was pulled out of that five-year planning to build the record on what the implications would be on this, and it does provide the opportunity -- I am not sure the intent was to open up the existing policy statement. If there was any other discussion or positions relative to sound or seismic testing that we want to further develop, that's the opportunity we have, to either address it under say the threats section of the developing FEP or just an addendum to the policy, but it opens it up to this group for continued discussion, and it's in response to the council specifically wanting to have more information to back up some of the position and an understanding of what the impacts of sound are on fish and the seismic testing specifically.

MR. WILBER: I am going to ask Brian's question, in just a slightly different way. My recollection of kind of how it got to this point was that there were various open comment windows and recently-closed comment windows from BOEM and from the National Marine Fisheries Service on impacts from the seismic testing on managed fish.

My understanding, Roger, is the council has not commented in writing to either of those agencies under the EFH provisions of the Magnuson Act. You guys still have that option, even though the windows are probably closed, but they're not like closed tightly. You could still send in comments.

One of the things we could do is say, okay, we've heard all this information and you have a comment opportunity and do you want to exercise that comment opportunity and what exactly would we harp on in those comments? I mean I think that's the more immediate question on the table, you know whether we need to open up the policy statement or the Fishery Ecosystem Plan and tweak paragraphs and stuff. That's a much longer-term sort of action, and so if we still have a short-term action on the table or not is I think the question to pose.

MR. GEER: Was the council going to respond to that?

MR. PUGLIESE: It was mainly a request to get additional information on what the impact was of seismic testing on fish, and so that was it. The original letter was sent, and it was specific -- It was a letter directly to BOEM identifying that any reviews of seismic testing that the considerations of avoidance of essential fish habitat and habitat areas of particular concern, as provided, which we provided them that one extensive map of all those designations in the South Atlantic region, that those be considered and avoided.

There was a more generic response already provided to that effect, but it wasn't to a specific call or a permit request for a seismic testing activity. It was basically sent to the highest level, to say that in any review that these should be considered, and so we do still have that latitude, and that's your call. This is the advisory panel's recommendation capability. That's the point of this.

If that still is a concern, in response to everything that's happened so far -- Again, part of it was also to very specifically build more of the record on what was initially discussed and really get into the weeds on really some of the specifics of what the considerations are, because the issue of sound is seismic, but we got into a lot of things beyond the seismic discussion, the soundscape and some of the implications in the future that we're even going to touch later on. I think Scott is going to touch on some research also that's being done on that. That's your prerogative as advisory panel members.

MR. GEER: I mean I guess that's the question. I hate to even say this, but do we readdress the policy statement, after spending, painfully, two meetings going through that? Or is it -- Considering it was just approved, what, in June of last year? No, it would have been in December. It would have been after the November meeting, and so it just got approved.

MR. PUGLIESE: I will tell you what everybody can do, is think about that. I will send out the letter that was distributed previously. I think everybody may have got it, but we have new members that may not have it, and the latest policy statement and you can raise it for consideration. We still have a day of the advisory panel, and we can come up with your recommendations on how we proceed.

I think a lot of the detail that's been provided is far more than anything we had before in our deliberations, a significant part of the more detailed record about what some of the implications are of seismic testing, and so it's well within the bounds for an additional recommendation from the advisory panel.

MR. WILBER: I just want to round out the regulatory context of this, since we might have been skipping some details, for some of the people in the room. Three years ago, two years ago, BOEM initiated a programmatic EFH consultation with our office about the seismic testing, and they also did it for the Northeast, or GARFO, region, and so it was a joint, two divisions, of the National Marine Fisheries Service.

Our determination at that time was that we did not want to do a programmatic consultation and we wanted to consult on individual permits or whatever BOEM calls these things for letting people go out and do the seismic testing. In the meantime, a flood of applications have come in. There's been state CZM consultations and ESA consultations have started and things like that, but BOEM has not completed the EFH assessments for any of the individual permitting actions, and it won't be until they do that and initiate EFH consultation with us that we will then reengage, from the National Marine Fisheries Service's perspective.

Now, I will reread the letter that the council sent, but I don't really think sort of the path forward for executing the regulatory responsibilities, from the council's perspective, is necessarily as clear as the one we've laid out from the Fisheries Service's perspective, and so, again, the question out to the whole panel is does the panel want to make a recommendation to the council on how to deal with this Magnuson-Stevens Act -- Not necessarily responsibilities, but what the Magnuson Act gives you an opportunity to do and how to make best use of the new information in doing that, and that's not that different from the question -- I mean I have to wrestle with the same issue. I've heard a lot of information, and hopefully it will be included in the EFH assessment that we receive. We have to figure out now what to do once we receive that assessment.

MR. HOOKER: I have a question. It's not necessarily on the -- It's kind of looping it back in, like what to do with this information. You mentioned the research activities plan and the FEP, or is that separate from the FEP, the research activities plan that you mentioned this morning?

MR. PUGLIESE: No, that's not separate.

MR. HOOKER: It's part of the FEP? It's one of the sections?

MR. PUGLIESE: Yes.

MR. HOOKER: Okay. One thing I would like to know is if you guys had to choose like one research project, or maybe two -- There's two of you, and so each of you get to pick one, but what would be like the highest priority research project in regards to sound and marine fish that you think would need to be done? I know this is an impossible question to answer, now that I'm asking it, but have you thought about that? I mean there must be one project that would be the best project that you could see in really advancing this discussion.

DR. ZEDDIES: We've got bills to pay. Of course we've thought about it.

MR. HOOKER: The one thing you stand to profit handsomely from.

MR. GEER: Probably, more specifically, in the Southeast.

DR. ZEDDIES: Where do you want to start with that? Baseline data is a big issue, and then I think the Holy Grail of this -- The Holy Grail of the questions that you're asking, where things are trying to go, is how do we go from sound to reproductive fitness? That does start with -- That requires starting with a baseline of some sort. Like this is what the animals would do absent of the sound.

Then, if the sound is there, how does that actually impact the ultimate reproductive fitness? That's going to depend on the various species. There is so many factors that go into that. Can we think of experiments to do to do that? Yes, absolutely, but I think it probably takes a -- It would take sort of a large concerted effort to do things like that.

MR. HOOKER: From that answer, I'm really gathering that it is almost entirely on the behavioral side. You think we have a good foundation on the lethal thresholds pretty well and that it should be almost entirely focused on behavioral?

DR. ZEDDIES: I would say that the -- I am hesitant to say that we've got the lethal side under control, but it's at least understandable. It's much easier to quantify lethality or injury than it is to quantify behavior or effects, and so the -- The injury, I think, is also somewhat more amenable to laboratory type of research. That's what the simulated pile driving and things are -- I think we certainly need more of that if we're going to understand more.

Going along with that, generally the areas of insonification, where lethality or injury occurs, are much smaller than behavior, and so understanding behavior is the hard part, and probably we cannot emphasize enough that it's context driven. It's to the point of the individual animal. I mean if that animal is engaged in something that it doesn't want to disrupt, then the threshold of sound to get it to change its behavior may be much higher than it would be for an animal that is engaged in something like a simple migration, where it could deviate, because it's not feeding or something like that. Then, paradoxically, your threshold for disturbing that animal would be much less.

There is a number of questions. Some of them get into like the theoretical realm. I don't think we have a great framework for understanding how we want to deal with behavioral responses when it comes to sound, or really for anything else, but behavior is a very difficult one, and so we would need a lot of data.

The framework that things can be put into is the PCOD, the population consequences of disturbance, and so that is a well worked out system to which you could evaluate potential population effects, but there is a lot of unknowns that are required for that, but the statistical background is there. I mean there's modeling approaches that could be taken, but it's the feeding those data into it.

DR. RICE: I think there's abundant lab studies on the physiology, and while there are still plenty of question marks, at a certain point, when looking at the viability of populations, like what matters is more the behavior and the ecology. If a fish's ears are impacted, if it's still spawning and spawns

to the same degree that it did with damaged ears or perfect ears, there is no impact. I mean there's no ecological impact.

I think it's really scaling lab experiments to the field and scaling our understanding of what we know from the basis of individuals and applying it to what's really happening at the population level, because, at the end of the day, what we want to know is what are fish stocks going to be doing in twenty years? It's not are blood cells being ruptured or are ears being damaged. What we care about is are there going to be fish and how do you go about having an experimental approach that's ecologically meaningful and relevant to the broader community?

Don't get me wrong. I'm not saying that the physiology work is not relevant. I mean it provides a really robust, empirical foundation to build all these things on. It is the body of literature that doesn't exist in marine mammals. In the marine mammal community, we wish we had sound pressure levels that rupture ears and create organ damage, and so one of the advantages with fish is that you can address these things, and so now I think it's being able to say, okay, how do we scale up and look at ecological consequences.

MR. GEER: Are you writing this down and coming up with a price for it?

MR. HOOKER: As I mentioned earlier, I am interested in these things and what the council identifies in its documents as priorities and where synergies can be. If the advisory panel feels like, when they review the FEP, or whoever is on that team, if they take that in there and make that part of -- If it makes the priority list, that's important for folks to know. If it's still low, considering maybe runoff or some of these other direct mortality issues that people are experiencing right now, that's good to know, too.

MR. GEER: Mortality is fairly easy. It's an if it's dead, it's dead type of thing, but it's coming up with these estimates. I mean, in the lab, you might be able to do it, but you don't know what the behavioral difference is. When we talk about hooking mortality in fish, does that just go to the bottom and die or it may swim off and just never spawn. It might not spawn that year, and that's what we're talking about here as well, that we just don't know what the behavior is going to be.

I think it's really interesting to look at that. I agree with you that I think it would be very -- It's complicated in how you do those kinds of studies, but I think they're worth exploring, in some regard, because I just -- We may see low mortality, direct mortality, but, over time, if the spawning stock is not spawning over time and it's like the population is declining because of that, it would be nice to know what's happening to them.

MR. HOOKER: It sounds like what you're saying is it's not a priority. I mean it's almost such a big-picture thing that it's not -- I'm not trying to --

MR. GEER: It's a priority, but I mean it's like there are so many things affecting the fisheries populations, and it's like I don't know what the most important is. Some people are going to claim it's overfishing and some people are going to claim it's water quality. Is it sound? Is it climate change? I mean I think these things are all important. If a definitive study can be done, some kind of a study on a key species that shows that yes, it is impacting the behavior, could that be used as a guideline for something?

MR. PUGLIESE: Yes, and I think, in our deliberations last time, getting into some of the discussions on what some of the needs are or what people thought may be known, it was pretty telling when it got down to species-specific impacts that so little was known for many of the South Atlantic-managed species in terms of -- I mean look at all the presentations and what the species impacts are. They're all outside of our region, and so I think some of those species-specific impacts on different life stages and different things I think are going to be very important to understand, to at least have a handle on really what some of those, as well as the habitat themselves, because I think that was the other thing that some of the members had highlighted before.

You've got the species using the habitat, but then you have the bottom habitats that have species that are tied so closely to it. Not just the reef fish, but some of the smaller fish and invertebrates and the life-bottom components that are not going anywhere and what some of the longer-term impacts may be on that complex of system.

I think area-specific impacts from these different types of aspects -- I think you have couched them very well, but to try to get some on those individual species. Now, the one thing that was interesting was the opportunity, as you indicated, about using baselines as almost proxies for those that kind of give you a telling, and they were very telling, about the temperature change and about those that you could extrapolate to other species. Those, I think, were really useful to understand that, and so maybe there is a way to pick some specific ones and then maybe do that and actually get to a larger group of fish within an area.

DR. RICE: One of the other things to take into consideration too is that there is so much going on on the ocean that it's likely that sound alone isn't going to be the nail in the coffin. It's the combination of sound along with a bunch of other different stressors, and one of the paradigms that's really talked about in the marine mammal community is cumulative effects and cumulative impacts, and what is likely going to be occurring impacting fish populations is this combination of different things.

It's certainly critical to discern what does sound alone do to both individual fish as well as populations, but also what -- What about sound plus warmer water temperatures, sound plus an oil spill, sound plus ocean acidification? How do all of these things interact and is this interactive effect even worse than any individual effect on its own? Not to make the question more difficult to address.

MR. CHAPPELL: This reminds me of -- I think it was a Halpin paper about the global human footprint. It was like a mapping exercise, a GIS exercise, and I don't know if it was -- There is two dudes from Duke, I believe, and I don't know if that was your stuff or not.

AP MEMBER: There was a paper from U.C. Santa Barbara.

MR. CHAPPELL: That was global and it could be age, but --

AP MEMBER: (The comment is not audible on the recording.)

MR. CHAPPELL: Does it include noise?

AP MEMBER: (The comment is not audible on the recording.)

MR. CHAPPELL: It kind of sounds like the better -- You could get this better. Through time, this should get better, as far as the ability to map out where sound is, and maybe a greater component than say something else, overfishing or something like that, and it's kind of as an end product to use, because then you're addressing the cumulative impact, which seems to be what we're thinking -- Obviously it contributes to, but that was -- I was trying to remember if it included noise.

MR. GEER: Pace, did we answer your question?

MR. PUGLIESE: I guess I have kind of walked around it somewhat. I think one of the most important aspects is the collaboration between the council and our partners at National Marine Fisheries that is implementing the EFH mandates and, in building this, Pace, as well as Brian, were key to get this information and get the individuals involved to provide the foundation for this discussion.

I think, to ensure that a full opportunity in the review process acknowledges the council's identification of essential habitat and what these potential impacts are, is that it would probably be a very good recommendation to see the advisory panel advance or have us collaborate with National Marine Fisheries Service to advance a statement to the council and then allow the council to determine where to go from there. All said and done, I think that was the intent, to a great degree, the intent of making sure that we move this forward and build the appropriate background information and have a statement come from the advisory panel.

MR. GEER: Thank you very much, gentlemen. That was great. That was really good.

MR. PUGLIESE: Just another related -- While we're still on this topic, one of the things I did want to do was to make sure that I reiterated the thanks to both Chris Knowlton and Holly Morin with the University of Rhode Island to get this operational. It literally yesterday ran and then up and going. They gave us a straight-line activity.

The flip side of it is that, since it was useful, there is a request back to us on if the panel feels that this was a valuable effort and some questions about that, and so I may circulate that tonight. I think what they're doing is that this is a new type of an opportunity to really address directly into true management needs, and if they can actually get into a process where they may be able to respond and provide these types of webinars, on request, for specific topics, they may get into that type of mode, and so getting guidance on how valuable this is. Is it addressing the types of things we were looking for? I think that's important, and so I will circulate a couple of quick questions that we got from our partners that provided this and do, again, thank Aaron and David for taking the time, and Brian and Pace for getting the ducks in a row to make sure this happened, and our webinar partners, too.

MR. GEER: On another note with those webinars, I've had the opportunity to participate in a few of those that are during lunchtime, and you would think that nobody is watching this or nobody is listening to it, but I did one a few months ago and, over the course of the next two weeks, everywhere I went, someone was saying that you did a really good job during the presentation, and I was like, you were listening to that? It's a good avenue.

You're sitting there eating your sandwich or whatever you're doing during your lunch hour and you can chime in. It's just being made aware of them. That's what happens a lot of times, and I would have never -- I did one on ocean acidification, which I would have never even thought of chiming in on until I was asked to give a presentation on it. They're really good sources of information and feedback, and so I was glad we could do that.

We're going to move the last item from tomorrow to right now, since we have a few minutes, and this shouldn't take too long, and that's the Artificial Reef Policy Statement and Development. It shouldn't take long at all, and so that will free us up a little bit more time tomorrow.

MR. PUGLIESE: Mainly, this was a status report, and it's tied to things that were already discussed earlier today that the Artificial Reef Team had been developing the Fishery Ecosystem Plan section as a follow-up to advance discussion we've had in the past. There is a real desire to highlight and expand the presentation of information on artificial reefs in our region. They are designated as special management zones, and those are designated as essential habitat areas of particular concern.

There is a lot of desire to advance that information. The policy statement effort, at the last advisory panel, identified key state players and brought in Brian Hooker and I think may have a couple other partners that are going to be involved. It's going down the same road. A Basecamp has been set up, and it's going to advance to build the foundation of a policy statement to bring back to the advisory panel in November.

The idea is to advance that avenue so that it can be deliberated and then forwarded to the council. All I wanted to do is to make sure that we understood that this was advancing. We have the people working together, and there will be a draft developed and provided to the council. One of the other connected aspects is highlighting and expanding the presentation of artificial reef information on the website, and specifically through our atlas, habitat and ecosystem atlas, and the digital dashboard, expanding some of the presentation of that information, and, again, work with our partners at the states that have some of the more detailed information.

A lot of those areas already we're trying to integrate video and imagery and maybe even more detailed distributional information that the states are already providing, but do it in the context of our whole region and how those are all benefitting the entire system.

MR. GEER: Would you house that information through the dashboard or would it go back out, because ours is -- We have all of that already on ours, and so would it be on the dashboard or would it be that you would click and it would go to our website?

MR. PUGLIESE: Some of those, I think, are connected. If the video is already existing somewhere else, it might be able to just draw on that. Those are going to be the techno operational characteristics, as many of those are drawing from other places already. Whatever is going to be the most efficient to be able to access that and operate the best is where we'll end up going with those.

We're not trying to reinvent the wheel or recreate it. It's whatever is going to be efficient, and it gets even more complicated, because some of the aspects of the system may be evolving to ArcGIS online capabilities. If that happens, then it's going to be kind of seamless connected to a lot of

places. We will defer to some of the techno wizards, and some of our partners at FWRI are on the cutting edge, and so we're moving down all those roads at one time.

MR. GEER: Does anybody have any questions for Roger about that at all? None. Then we're going to finish up early today. Do you have any other closing comments?

MR. PUGLIESE: Just that I appreciate all the effort today, and, again, all of our presenters and advancing things. We will probably look to David and Aaron, maybe, for some additional input as we further move down these roads with sound and fish and activities there, and so hopefully they will be willing to be engaged further on some of those discussions, too. With that, that's all I had to say, and thank you again.

MR. GEER: Okay. We are adjourned for today. We're going to meet starting at nine o'clock tomorrow morning, and so have a good afternoon.

The Habitat Protection and Ecosystem-Based Management Advisory Panel of the South Atlantic Fishery Management Council reconvened in the Hilton Garden Inn, North Charleston, South Carolina, May 12, 2016, and was called to order at 9:00 o'clock a.m. by Chairman Pat Geer.

MR. GEER: Welcome to day two of the habitat meeting. I'm Pat Geer, and I'm the chairman of the committee. We're going to get right into the discussions this morning. We have the South Atlantic Landscape Conservation Cooperative Regional Conservation Blueprint Development. Louise Vaughan is going to give us a presentation on that, and I will yield the floor to Louise at this time.

MS. VAUGHAN: Thank you. Good morning. My name is Louise Vaughan, and I work with the South Atlantic LCC. Thank you so much for having me here today. I was really excited to come down and present to you. I'm just going to give you an outline of where we're really going today and what I will be talking about.

First, I would just like to give a quick overview of the South Atlantic LCC, what we are, what we do, and then I want to talk a little bit about our products, how we do what we do, and then primarily about our products, which primarily are our indicators, our Save the South Atlantic, and our conservation blueprint. Then I'm going to speak a little bit about what's next, some potential improvements coming down the line for us, and then I'm going to talk a little bit about our tools, and so how you can actually access our spatial data and how you can interact with it.

What is the South Atlantic LCC? LCC is standing for Landscape Conservation Cooperative. Is everybody familiar with LCCs or know what they do? Sometimes I go in and people just don't. The South Atlantic LCC, it's a forum. It's really a place for people to come together and develop a vision of what is landscape sustainability for our cultural and natural resources.

The idea is that if we're coming together and we're coming out with a shared vision that we can cooperate in that vision, meaning what is my best role? What is my mission? What is my organization's mission, and what is my best piece to tackle for completing this vision of getting to this point and how can we collaborate on its refinement? The idea behind that is this plan will change. As we have successes and as we have failures, our plan will change, and so how can we collaborate on this refinement of the plan?

LCCs form a network across North America. There is about twenty-two LCCs, in general, stretching down to Mexico and up into Canada. We are number fourteen. Notice that we go out 200 miles to the EEZ in the marine environment, because the marine environment is awesome and we really respect it.

LCCs actually -- We all have similar goals, where we're coming up with this plan, this living spatial plan that's trying to identify the best places for conservation action, and all LCCs really have this common goal, but the way we go about it is a little bit different, and because we're looking at a really large ecoregion, we are collaborating with other people who are also engaged in really large areas, like climate science centers, NOAA RISAs, and USDA climate hubs.

We're really lucky at the South Atlantic LCC. We are stationed in Raleigh, North Carolina, on the Centennial Campus of NC State University, and we have monthly lunch meetings with the Climate Science Center. We get to collaborate and chat with them often. The USDA Climate Hub, our Science Coordinator, Rua Mordecai, can look out his window and see the USDA Climate Hub, and we're really well positioned to kind of talk to these other large regional groups.

How is the South Atlantic LCC governed? We have a very diverse steering committee, with representatives of very different groups, and each representative of our steering committee has an equal place at the table. We're not the Land Trust Alliance Cooperative. We're not the USGS Cooperative. We are the South Atlantic LCC, and the Steering Committee really guides our strategic direction.

We have seven full-time staff, and our staff really represents out cooperative spirit. We are funded by four different funding mechanisms, the Fish and Wildlife Service, Army Corps of Engineers, the National Park Service, and the Wildlife Resources Commission has given us an in-kind donation of office space, and so they keep our lights on.

What does the South Atlantic LCC do? Our mission is to facilitate conservation actions that are going to sustain natural and cultural resources, guided by a shared and adaptive blueprint, and the blueprint is a living spatial plan. You are seeing our current blueprint up on the screen, 2.0. It's a living spatial plan that's identifying the best places for shared conservation action. We have four categories: highest priority for shared conservation action, high priority, corridors, and medium priority.

How is the blueprint being used? One way that it's being used is to amplify the impact of existing efforts. By this, I mean that the blueprint is being used as a way to recognize the good work that's being done on the ground. Regardless of whether the LCC was in existence or not, people would be doing good, important conservation work on the ground, but how can we use this plan, the conservation blueprint, to recognize that and help them measure their conservation success and, more importantly, recognize the importance of their work, so we can pull in additional resources?

One way that we've really been able to do this is through the Wildland Fire Resilient Landscapes Program. This was a competitive funding source at the national level, and they were really looking for on-the-ground existing partnerships that were able to do work to increase the resiliency of our forests. In the South Atlantic, we have the longleaf pine ecosystem that is dependent on a fire regime, and so we were able to say we have people on the ground and give us this money so we can do great work, and we'll be able to measure the impact of that work.

As you can see from this map of the United States, we were the only group east of the Mississippi to get this kind of money. So far, we've gotten $2 million to date, and that goes to support prescribed burning on public landings, private lands, and federal lands. Recently, I happened to be giving a presentation to the National Fish and Wildlife Foundation. A man in the audience came up to me afterwards and he was asking me a lot of questions. As it turned out, he used to work in the White House, under the Obama administration. He was one of the architects of this funding resource, and he said this was our vision, to give it to partnerships on the ground to be able to go forth and do this kind of work. All the other money really went out west, to kind of fight catastrophic fires.

How else is the blueprint being used? It's being used to anticipate and plan for change. Again, the National Fish and Wildlife Foundation, in the wake of Hurricane Sandy, realized that there was a lot of money left as part of this disaster relief and they didn't really quite know what to do with it. There was a lot of funding opportunities.

Recognizing that disasters are going to happen in this region again, they recognized the need to go out and preemptively identify conservation priority areas. We worked with them to help them collaborate with people within the Cape Fear Watershed, so they could anchor their prioritizations around data provided by the Natural Heritage Program and NatureServe, and they also used the conservation blueprint in the Florida Critical Lands and Waters Program, Florida CLIP, as their regional dataset, so they could identify places of high conservation priority.

Another way that the blueprint is being used is to adapt to change to conservation action, and the best story to really illustrate what I mean by this is what one of our cooperative members, Mark Cantrell, worked for the Fish and Wildlife Service in Ecological Services. He was looking to do a dam removal project, and, originally, he was going to go up into the pristine waters of western North Carolina and do a dam removal project there.

Looking at the blueprint, he was really able to kind of think about it a little bit differently and ask himself the question of where can I do a project that's going to have the most conservation impact? Am I going to maintain pristine waters or am I going to go somewhere else and get more improvement, more bang for my buck? He did, using the blueprint and looking at some other plans, he did shift his project to a different area, to do a dam removal project there, and, for us, that's really important, people using the blueprint to think about where they could have the most collective impact.

Now that I've told you a little bit about who we are and what we do, I want to talk a little bit about our process of how we do it, because I think it's really important. Everything we do at the South Atlantic LCC really comes down to two primary approaches, and that is the Lean Startup Method and working with our cooperative and inclusive participation.

The Lean Startup Method is the method that is originated out of the tech companies, Google, Facebook, Apple, and it was used by Toyota in the mid-1990s to improve their automotive manufacturing. The idea behind the Lean Startup Method is that you're going to minimize time in your development process and maximize time in your revision and testing process.

What this ultimately means is that you're going to spend a small amount of time developing a product and sending it to market and you're going to spend the majority of your time revising it,

so that it matches what your customer is really looking for. It's very similar to the adaptive management cycle and, at the South Atlantic LCC, we kind of call it adaptive management fast and furious. It moves very, very quickly, but where we're really maximizing it is our maximizing our ability to learn what our cooperative members really want and to revise our blueprint based on the best available data that we have available.

One way that we've really made the Lean Startup Method our own is through our cooperative community, and so we engage our cooperative community in all parts of the Lean Startup Method. Our cooperative community really serves as the people who generate our ideas. They are our design team for how we identify conservation priorities. They are our product testers, and they are our source of experts. They are really our pool of expertise, and we're always engaging with them, because we're always in a state of revision. We are revising our indicators, we are revising our blueprint, or we're revising the way that you're accessing and interacting with our data. We're always in a constant state of revision.

Our products, we have three primary products. We have our indicators, which really form the foundation of all of our products, we have our State of the South Atlantic, and then we have our conservation blueprint. We have about approximately thirty to thirty-five indicators that represent nine different ecosystems across the South Atlantic region. Collectively, our indicators are really meant to represent ecosystem integrity and intact cultural landscapes.

Our indicators go to inform our State of the South Atlantic. Each of you should have a State of the South Atlantic laid out before you. The State of the South Atlantic is ultimately a report card for our region. It's an ecological report card. It's basically looking at indicators across the region and averaging how much area is in good, high-quality condition, according to our indicators, and receiving grades.

We break this down by subregions across the South Atlantic and we break it down by ecosystem, and so the marine ecosystem does have a grade. Collectively, we scored a C overall. This is something that we hope -- This is our first State of the South Atlantic, and we hope to have another one coming out in the next two years or so.

The State of the South Atlantic, here is going -- If you look a little bit inside, here is how it breaks down our region into the North Piedmont, North Coastal Plain, our subregions there. It's telling you which region scores what type of grade. Also, one thing that I would really like to point out -- It's a little bit hard to see, but you can see it a little bit easier once you open it up. On each page, we have something that looks like you would see on your cell phone, these bars that look like cell phone bars. That is reflecting the confidence we have in our indicators, and it's our way of communicating uncertainty.

Again, what I'm showing you here is the grade for our forested wetland ecosystems. You can see exactly how that grade changes across the region, based on that large regional map. We are telling you a little bit of a story about the forested wetland ecosystem. We are giving you a visual, so you can understand what it is, and then it's breaking down the indicators to show how they grade and how you come up with that collective grade of a C.

This is really meant for a wide audience, and if you want to know a little bit more about it, you can go online to our website and get really way down in the weeds, if you want to see how we

score it and how the indicators performed individually. This is what we call the top of the layer cake, and it's meant to be a communication tool.

Finally, we have our conservation blueprint, and this is what we're really all about. In our conservation blueprint, what I'm showing you on the screen is Conservation Blueprint 2.0. It is completely data-driven by indicators, and let's talk a little bit about how we're building the blueprint. The first thing we did is we broke down the region into large broad and general ecosystems, beach and dune, estuarine marsh, estuarine open water, forested wetland, forested marsh, maritime forest, pine and prairie, upland hardwood, landscapes, and fresh water aquatic ecosystems. Those last two ecosystems, landscapes and fresh water aquatic, we consider them cross systems. They drape over everything, and so the indicators associated with landscapes and fresh water aquatic drape over the entire landscape, where applicable.

Then we have our indicators for each of these ecosystems. The indicators are meant to represent different characteristics that, taken as a whole, will represent that ecosystem's ecological integrity. They're spatially modeled, based on existing data. That's one of the criteria that we try to hold ourselves to. We're not really interested in creating brand-new data and brand-new models. We want to use existing data available, and it's spatially modeled to 200-meter pixels.

All of our indicators go through a review process. They go through a review process where our cooperative members come together and they serve on a review team. Then we try to do ecological testing with them, to see if they're actually predicting what we think that they ought to be predicting for, and so we go through a series of ecological testing. That means they are tested to determine how well they perform.

This is kind of a conceptual model. On the left-hand of this model here, you will see that we have indicators and that the indicators really drive ecosystem integrity, and this is what the State of the South Atlantic really is. It's scoring ecosystem integrity, but, once we get to ecosystem priority, how can we spatially identify those places of ecosystem priority? The way that we did that is through a conservation planning software called Zonation.

What Zonation really does, it takes into account all of our indicators, and it basically scores the landscape based on those indicators. What it does is that, as it moves throughout the landscape, it iteratively removes cells that have the lowest value, based on indicators.

After we run through Zonation, we use linkage mapper, which is an ArcGIS software, to create our corridors, and the corridors are really looking at places that we consider high-integrity hubs, and they're looking at connecting those high-integrity hubs through a least cost path analysis. Ultimately, that is how we get our blueprint priorities of highest priority, which is the top 10 percent of the landscape. It's the 10 percent of the landscape in the best ecological condition. High priorities is next 15 percent of the landscape in high ecological condition. Then we have medium priority, which is basically what's not already captured that is above 50 percent, and then we have our corridors, which approximate about 5 percent of our geography. This is really looking at what is the best path to create through big ecological hubs.

I just wanted to give you a better sense of what that really looks like. What I'm showing you right now is our forest wetland ecosystem, and there it is up there on the map, and you will see it's kind of an embedded ecosystem. Forested wetland extent is considered an indicator. Another indicator

within the forested wetland ecosystem is priority amphibian and reptile conservation areas, PARCAs. This was an expert-driven indicator, and it's really meant to capture places, the best places, capable of supporting viable reptile and amphibian populations. Then we have our forested wetland bird index, and this a measure of habitat suitability that's based on patch size and landscape characteristics. Here, darker is better, and so the index goes from zero to three.

When we put it all together, this is an output of a Zonation run. Again, darker being better, and this is what it looks like. For this particular ecosystem, we ran the indicators through Zonation, and, for this particular ecosystem, we were able to score it from zero to 100. Then we tie that together with other ecosystems. This ecosystem in red is our upland hardwoods, and so we're using the same methods across all other ecosystems, like upland hardwoods, and then we do a final Zonation run, and that is what is ultimately giving us the conservation blueprint.

Here are some members of our conservation design team for this particular approach, using Zonation. We had great folks, like Mark Anderson from the Nature Conservancy, Will Allen from the Conservation Fund, as well as Mary Davis from the Southeast Aquatic Resources Partnership. They were the ones who really kind of the ones we used, again, as our source of experts to come up with this method and this approach.

Now, one thing is if you were -- It is possible to be in a state with multiple LCCs, and this can be very frustrating, and so take into account Virginia, which is a part of three different LCCs, and so what about places like Virginia? What are they supposed to do? We've got this great prioritization map, but it's only good for the southern part of our state.

Remember I said that we're part of a larger network, and so all LCCs across the south are coming together for the Southeast Conservation Adaption Strategy, SECAS. In October of this year, we're stitching together all of our blueprints for a larger Southeast-wide prioritization, a Southeast-wide map, and this is to help places, like Virginia, that have different LCCs, so they can have one large SECAS map. Again, each LCC has a common goal. We're trying to get at that spatial prioritization, but they're taking somewhat different approaches, and they're also taking into account their own unique challenges about what's going in their particular ecoregion.

What is next? The next thing that's coming up is that we have Blueprint 2.1 coming out. Blueprint 2.1, with luck, will be finalized and released in July of 2016. We're bringing it to our steering committee for a stamp of approval this June. That will incorporate improved marine indicators, and it will -- One thing that we really hope to do, going forward, is to be able to make connections between coastal actions and marine impacts.

I just want to show you, because I think this would be particularly interesting, especially if you were interested in the marine environment, where we've been and how the evolution has really happened. What I am showing you right now is Blueprint 1.0, which was an expert-driven plan, and how this was done is we brought together teams of experts, people from across the South Atlantic region. We had workshops, and we asked them, on the inland side, to physically point out watersheds that they considered important and then we looked at existing conservation plans and overlapped them and we prioritized the South Atlantic inland region based on sub-watersheds, HUC 12 watersheds, and so that's basically what you're looking at right now.

Then you can see the marine environment, what we're looking at, it's a prioritization based on lease blocks, and you can see things like there's kind of the Charleston Bump and the Gulf coastal frontal edge and the shelf break there, but it's really coarse, and I would imagine not particularly helpful to the marine side of the environment, and there is a lot of uncertainty.

Our Blueprint 1.0 priorities were highest priority, high priority, areas of further investigation, meaning we just didn't know, it was a 50/50 chance that there was good things there or not, and then we have low priority. Based on our feedback from this plan -- This was done very quickly. It was our first iteration, and, based on our feedback, people wanted a data-driven plan. You can see one major problem of this blueprint is that it's prioritizing areas primarily along the coast. I think, out of this, about 99 percent of our coastal areas were prioritized as the highest priority, which we knew just wasn't right.

Also, we could see that there were really large gaps, like South Carolina and the Piedmont of South Carolina. There's just -- It's either a low priority or further investigation. People just really didn't know, and so we knew that wasn't right.

Then came Blueprint 2.0. That was built on the methodology that I just described, and, again, this is looking at our highest priority, which is 10 percent of the landscape in the best condition, high, medium, and corridors. As we have been going -- We released this about a year ago. Since we released it, we've been looking at some of our indicators a little bit more carefully and seeing how we could improve them. One thing that we noticed is that some of our marine indicators were not performing as well as we hoped that they would be.

What I am showing you right here is Blueprint 2.1, and this incorporates the improved marine indicators that we have and much better freshwater aquatic indicators that were able to capture a lot of different priority areas, especially in the upper Piedmont region, that before we were missing.

The improvements to marine indicators specifically -- For Blueprint 2.0, we used the potential hard bottom condition, primary productivity, and marine turtles and mammals. Primary productivity was not working well, because it was equally showing places that were bad. There was just too much productivity, there was too much effluent, it was too productive, as well as places that were good.

The indicators we used for 2.1 are potential hard bottom condition and marine mammal distributions considering seasonality and habitats, and this is really coming out of the Duke Geospatial Marine Lab, and that was actually really exciting. It's great data. They were looking at environmental variables to predict density and then looking at seasonality based on sampling points, and so we were able to incorporate that uncertainty and seasonality into our marine models, and that's one reason why the marine portion of our 2.1 blueprint looks so much different.

In future improvements to marine indicators, and this is something that I think is more exciting, one thing that we're really looking at and one thing that our indicators really give us the ability to do is to be able to think about how the indicators can reflect change by conservation action, and so we've been successful, again working with a great group from Duke, with Dean Urban's lab, to look at if you do specific actions -- Again, we've only been able to do some of these models for the inland side, things like for prescribed burning and acquiring new conservation lands, but, if you do that action, how is it reflected in the indicator?

We're doing this through spatial models. So far, that work has been really great, very, very interesting, but now we're really looking at what about coastal actions and how that reflects the marine environment. This year, we funded a project, which is collaborative with Coastal Marine Modelers and the South Atlantic Fishery Management Council, and the idea is to develop an integrated ecosystem model for our region to help inform more ecosystem management-based approaches to managing marine sources.

Also, it will kind of help to capture the idea of how we can communicate this, and it's based on food web base modeling, linking fishing pressure to reserve design, and the best way you can really learn more about it is to ask our local steering committee member, who is available here, Roger Pugliese. Do you want to speak about it now a little bit?

MR. PUGLIESE: Just quickly. I wanted to make sure that -- I think that, for members that were involved -- We've got new members now that may not have heard it, but this is something that I think I briefed the advisory panel in the past about, an opportunity that we had. Through the Atlantic States Conservation Cooperative, we are actually moving forward with the opportunity to expand modeling capability and really build, as Louise has said, a more complex understanding of the food web connections, but this is -- This team that's been brought together to do this is really going to advance far beyond that, into the future.

Right now, we're looking at the first iterations of a new generation of Ecopath, Ecosim, and Ecospace modeling, to better represent the entire food web systems, but, in the newest generations, some real opportunity to integrate environmental model inputs as well as spatial inputs from our developing more refined information on habitat distribution and species distribution, different things that I think the group that is involved is really going to provide a foundation now.

That said, I think one of the most important points is that some of the participation is coming directly from our links with management activities, and so we have both our present and past chairs of our Scientific and Statistical Committee involved directly in the evolution of this process, with Marcel Reichert and Luiz Barbieri. Marcel is with South Carolina DNR and Luiz is with Florida Marine Resource Institute or not anymore. It's FWRI now.

The point is that, right from the beginning, it's trying to have a grounded one that is going to provide products and capabilities that are going to inform what council management needs are in the future, but also provide this linkage and the ability to really understand connectivity with the other modeling efforts, connectivity into the estuarine systems, the river systems, and our essential fish habitat designations, and really crosswalk between the blueprint and the council's activities under essential habitat and the atlas.

It's some real exciting things coming down the line, just some of the cutting-edge thinking about where to go with this, and so it is in process, and hopefully we're going to be getting some of the first movement on structuring design and expansion, and it's building on activities in the past. We had generated a number of -- We had the opportunity, years ago, to work with the Sea Around Us Project and be one of the test beds for creating the first ecosystem model that gave us kind of a conceptual idea of the South Atlantic ecosystem.

We have engaged, re-engaged, some of the partners, and they're expanding that whole network and how we go, and so I think we're going to -- The interesting side is that the LCC has really

provided the opportunity to take it to the next level, where we couldn't get resources from the other partners.

Also, the other really interesting thing, and I think Louise really highlighted it, is the fact that, with the connections, and this is why there is such a close coordination and tie and directly working with them, but it provides a direct linkage with the USGS Climate Science Centers, and some of the discussions we talked about, what some of the changes may be for habitat into the future, here is an opportunity, through that process, to get directly to what some of those types of things may mean and translate those to habitat, to fish, and to the future.

I think this collaboration opportunity and the modeling effort is going to provide a lot to enhance what was intended by the next generation for ecosystem discussions, the FEP, the evolution of our atlas, the evolution of information and policy discussions for conservation, and even expand the whole essential fish habitat far beyond what has been done in the past.

The whole ability to integrate the base into those for expanding into creation of corridors is a very different type of a concept that nobody else is using in the country, I think, and so I think your South Atlantic LCC -- I will say that, because that's really what that intent is, is that it is really trying to expand that whole concept of regional conservation on a broad scale, looking at the highest level and being able to build on and expand the capabilities in our region, and so that's at least a teaser. More to come on where we go, and we do have some things that will take that to some of the next levels when Pat gets into some of the evolution of the different modeling capabilities that are being done in other areas that we hope to apply here.

MS. VAUGHAN: Then other improvements that are reflected in Blueprint 2.1 are that we have much better improved freshwater aquatic indicators that I think will serve us very well, especially when we're trying to make connections to the marine environment, to have the freshwater indicators be so much better, and some improvements to the upland hardwood indicators.

Again, Blueprint 2.1 is scheduled for a July release date, and that is pending approval from our steering committee members. Before I take some questions, really quickly, I just want to say there is many, many different ways that you can get involved with the South Atlantic LCC. Go to our webpage and join our web community. You will be able to get our newsletters as they come out, through email announcements. It's really how we say, hey, we need a revision team to look at other indicators.

You can connect with staff members. My role actually with the South Atlantic LCC is user support. If you want to use the blueprint, I come to you, at your leisure, whenever is convenient to you, and try to help you use it in any kind of capacity. You can join a team, a review team, a user team. There is many different teams you can join, and you can explore the conservation blueprint. If you find a problem, a fault, or something you think is wrong, we want to know about it, because these are things that we track very carefully, so we can use them as validation points for future iterations of the blueprint and to help us. Before I talk about how you can really access the data and how you can get to it and how you can explore it, are there any questions so far?

MR. GEER: Are there questions for Louise?

MR. CHAPPELL: Is somebody from DMF here, NC DMF?

MR. PUGLIESE: No.

MR. CHAPPELL: I feel like I'm speaking for them, just because I used to work on this project, but it was called the Strategic Habitat Area Assessment, that they're still doing. It's taken a whole bunch of data on natural resources, mainly on marine-type habitats, seagrass and oyster beds and also low-elevation uplands. We also wanted to look at that, because I was having to lead this stuff when I was there. I'm not there anymore, but we had a data source that was low-elevation uplands, which was specifically addressing sea level rise. There is some data available that could be used. They're not quite done, the last I heard, but, like I said, I haven't been involved in it for like five years.

MS. VAUGHAN: That's actually really good to know. I do know Anne Deaton, if she's still working for DMF, who is really amazing. Also, one limitation that we have about being regional is that we're trying to use regional indicators, indicators that apply to the ecosystem as it falls across. However, we are very much interested in high-quality, local datasets, because we can use them as validation points to test our indicators, to see how well they're performing. That's some of the things that we've done, for example, with our freshwater aquatics. Our old freshwater aquatic indicator, we tested against sampling points collected in North Carolina, because they were very good, very robust, and that's when we really found out they were not predicting what we thought that they should be predicting for. Hence, we scrapped most of them and developed new ones for 2.1, and so that's really good to know. I would love to follow up with you afterwards, to hear about how we could get ahold of some of that data.

MR. PUGLIESE: Let me jump in there. Very specific to that, in discussions -- Anne apologized that she wasn't able to attend, and we were trying to make sure that we didn't lose that connection, but, as a follow-up, very specific to that point, and you're right that right now they're actually in a review process for the strategic habitat areas.

One of the areas that is going to be looked at is the Cape Fear River system, looking at all that information, and I think there's a desire to look very closely at what is coming out of the blueprint, and there is that opportunity to crosswalk and be able to use, potentially, some of the prioritization that's coming directly out of here, so a direct potential application, kind of stepping forward and using the blueprint to enhance or refine that capability, and that's important, because that has connection back with our essential fish habitat, because when we did the last iteration of discussion on that, that was identified as areas of particular concern, as the state refines and identifies and describes those systems. There is definitely an interest and a desire to not only provide information, but potentially actually use the system as a tool to enhance that effort.

MR. WILBER: Roger, can you explain how what you just described for the Cape Fear relates to the Cape Fear River Partnership or is it the same thing?

MR. PUGLIESE: What it is, is that's going to be building on the Cape River partnership and how that fed into the Shaw activity, and so taking -- I think a lot of that may have been integrated directly into some of the prioritization, at least the partnerships, and so there is a crosswalk between all of those, not reinventing the wheel and taking the opportunity to use this tool to maybe provide a capability to refine the prioritization.

DR. ALEXANDER: I was wondering whether you could describe what the indicator potential hard bottom condition -- What that is. Is it the potential of whether it's there or not and then the condition of something that might be there? That just confuses me.

MS. VAUGHAN: I'm actually really glad that you brought this up, and not to jump ahead really quickly, but one of my roles with the South Atlantic LCC, along with user support, is really working about how people interact with the data. We have thirty-three or thirty-five indicators, all with fancy-sounding names. What does that ultimately really mean? For a potential hard bottom condition -- What I'm showing you right now is the South Atlantic LCC. It's our simple viewer, and this is a way that you can access the blueprint, did a little bit deeper, and understand it.

The simple viewer is really meant for everybody. We kind of lovingly call it Google Maps for conservation. It's just to kind of figure out what's going on around you, and so you can click in the marine environment, anywhere in the marine environment, again, on a lease block, and that's going to provide you a summary of that lease block.

If I go under indicators, potential hard bottom condition, and this is where -- This is based -- Again, we're always reaching out to our cooperators, and so a lot of my job is going out and interviewing people to see how they're interacting with the data and studying the way that the human computer interaction of the way that people are doing it, and this is something, again, we're really borrowing from a lot of tech companies, because the way that we access data is completely digital, and we should really be thinking about the ways that we interact with the data that is most useful to inform our conservation decisions.

One of the bits of feedback that we received through these interviews is I don't know what you're talking about when you talk about the indicators of biodiversity, resilience, hot spots, and what is that? Forested wetland, priority amphibian and reptile conservation areas, I don't know what that is.

What we've done is we have built in simple descriptions. Potential hard bottom condition is measuring the protected status or potential stress of solid substrate, because hard bottom is providing an anchor for important seafloor habitat, and so that's our description of what that is. If you want to go a little bit further, you can go to our conservation planning atlas and you can read -- This is where you can download that GIS layer for yourself and read a metadata description for it and figure out where exactly that we got it from. The reason I punted to that is because I couldn't immediately answer your question, and so these are the tools that I used to help me do this.

MR. WILBER: I will jump in with maybe a little bit of an embellishment to the answer. I'm on the team that's reviewing the marine indictors, and I will tell you that I probably have made two-thirds of the meetings. I have missed maybe a third in the last year. The question I think you're getting at is exactly one that we discussed a year ago, that hard bottom was really portrayed as a presence/absence kind of a thing, and it was hard to imagine any management decisions that would change the presence or absence of hard bottom on the scale that was being discussed in the indicator, and so, if that was the case, then it is really an indicator that's useful for guiding conservation decisions or a barometer for how well the offshore area is doing.

At the same time, we were wrestling with some sea turtle issues and some primary productivity issues, and eventually the content in the meetings kind of got swept into the whole discussion of the Duke marine mammal data, and all the energy kind of went into that. My vague recollection is that the hard bottom indicator is still on the top of the to-refine or to-fix kind of list.

MR. PUGLIESE: Let me make a comment to that, too. It's that I think that's one of the reasons that we're doing some of the modeling effort, is to get into all of the different types of data that can refine the marine indicators even beyond, I think, the work that's been done with marine mammals.

As Pace has indicated, and I think Pat will get into some of that detail, it is really ripe for integration within here. We have the opportunity to refine this further for species, for habitats, and beyond, and the idea is that this is some of the modeling, and the information gathering for that modeling, I think, will be supported and expanded, and I think that's also going to expand probably the group participation in the indicator design into the future.

While we're at 2.1, that will be another generation to really refine it, and I think that's the intent. Not think, but I know. Louise had indicated that was the intent of this effort with the modeling, is to refine how we get really tied directly to the other marine indicators in a better way on managed species, et cetera.

MS. VAUGHAN: Yes, and also, and you would probably know better than I, being part of the review teams, but we were using the South Atlantic Marine Bight Assessment, which was looking at -- We can't possibly know where all hard bottom is, based on our sampling efforts, and so we're looking at predictive of where they should be. If hard bottom is existing there, it's likely that it's anchoring some good things that we would want to get to, because, on the marine side, it's kind of a question of we need to go out and sample before it's potentially destroyed by threats.

MR. WILBER: What I would kind of summarize is it comes back to the whole Lean Startup Method, which I think has worked really well for this effort, and when you kind of put your first iteration out there, you see a forest of problems and you see a path to solving most of those problems, and how to deal with hard bottom, or whether to even deal with hard bottom, has always been on the problem list, but the path for how to resolve that problem hasn't been very clear, or at least been as clear as the path to resolve the other problems for the marine indicators. As they cycle through their revision process, they're clearing up the things that had an obvious solution, and now we're kind of being left with the things that need a little more energy.

MR. BUSH: Thank you, Louise, for the presentation. I was curious. There's a lot of areas where there is high-resolution data already gathered, and I know that sometimes it's a language problem. Folks have put this stuff together for one purpose and it's great, but there's really no way to roll it in, but, like, for example, Virginia, and now North Carolina, has gathered a lot of data in the estuarine environments for the aquaculture of shellfish and things of that nature, and this is -- I mean it's got a lot more than just presence and absence, and I didn't know if you've looked into possibly trying to find a way to incorporate at least as much of it as you need from sources like that.

MS. VAUGHAN: I think for -- There have been a lot of indicators on the table, and one thing that's especially difficult in the marine environment is we were really looking for those indicators

that spread across the entire region, and it was my understanding that, for some shellfish, that it didn't apply as regionally, but, again, we would be interested in that finer-scale data, so we could test to see how well, especially in the marine environment, that our current indicators were predicting for things like that are important locally.

As that expands, I mean I think we would be very interested incorporating that in the future, and that is something that I would be happy to talk to you about later, about how we could potentially access the data and if that data is going to spread down to South Carolina, Virginia, and Florida, the northern Florida areas.

MR. PUGLIESE: Related to that, I think one of the other -- Again, these are cross-walking between different things. As we refine the spatial information for essential fish habitat designations, the intent there is to get those at the finest level, at the state level, also, and so I think that cross between how that is getting integrated into the spatial distribution information we're using and then how it can be integrated into the blueprint is an immediate pathway to make those happen further, because that's been some things that we've gotten -- The hard bottom was a compilation of information.

We've already been looking at that distribution relative to the detailed information relative to other predictive models, to take it even a step further, and so I think there's a number of other things ongoing that are going to both inform what's needed for our essential habitat and then also how best to use the finer-resolution information that the states are doing and then integrate that into maybe things that could be done on a regional scale also within the blueprint, and so there is some, like Pace had said, paths forward on a number of these that we can take advantage of.

MS. VAUGHAN: Yes, and I also should mention that we're on an annual update cycle for our indicators, and so, every year, we're going to -- Since the release of 2.0, when all the indicators were done within a year to inform that plan, we're now taking a suite of indicators per year and really going over and refining them, to improve them.

This year, again with the availability of the Duke project, looking at station density and seasonality distributions, we really wanted to use that. I think, in total, we changed a couple of the extents. We did change a good many indicators this year, but we do have kind of a running list of ones that we know are not performing as well as we would like them to, and that is a challenge of the Lean Startup. There is a lot of pros to the Lean Startup, but also a challenge is you know you've got some indicators that are not performing as well as some other ones are.

MS. WENDT: The emphasis of this program seems to be preserving habitats with the highest ecological integrity. What if your interest is in finding areas with the greatest potential for successful restoration and habitat improvement? Is that something that's within the scope of this program or is that really beyond?

MS. VAUGHAN: No, that's within our scope, and that's really where our medium priority comes up, and that is areas that are -- Again, we're scoring the landscape from zero to 100, and so that's looking at things that are greater than 50 percent, but they're not captured in that existing top 25, and the idea being around that is that these are areas that you could do work and that would really improve the quality of the indicators.

I also recognize that there is also a flip side to that, areas that are very poor that you have an opportunity to work at, and restoration is something that we've talked a lot about with our cooperative community and internally, and even the way that the medium priorities kind of originated is, when Blueprint 2.0 was released, we went out and did a series of eight workshops across the south, where we invited people to come and review our draft Blueprint 2.0 data, and restoration opportunities was one of the things that we heard, again and again, mentioned from our cooperative, and that's actually why we included that top 50 percent in that medium category, but, as we go further along, I think it's something that we're more and more interested in, especially when you're looking at corridors for connectivity.

Those aren't necessarily going through the highest quality habitats all the time. They are going through the best habitat on a least cost path analysis and the shortest distance, and so I think there's a lot of room for restoration, particularly within those corridors as well, that we would be interested in exploring and looking at in the future.

MR. HOOKER: Thanks for the presentation, and I guess I'm following up on what Pace was saying. I thought it was a valid point that hard bottom isn't -- It's a sensitive bottom habitat and it's something we want to conserve, but, at the same time, it's not necessarily a good indicator of health, because it is a relatively static -- It is ephemeral, in a lot of cases, but it does seem to be the absence of fish. If there is not independent trawl surveys or independent surveys of one kind or another in the South Atlantic -- Have your group looked at like other indicators of fish health? That seems to be the biggest absence, and one that I think is a more clear indicator of health, rather than whether or not the bottom is hard.

MR. GEER: Brian is looking right at me at that. Going through -- They call theirs the Status of the South. We did a report card, and it's the same organization that helped do it, and they do a great job, up at the University of Maryland, in getting you started on that. Going through this process, trying to pick those indicators and coming up with them is probably the most difficult thing, because some people want to throw everything in but the kitchen sink, and other people want to -- The idea of a lot of these things is what do you have regionally, first of all, and what can you reproduce every year? That's the important thing.

Now, I would say fisheries would probably be a good thing to add to your list. I agree with that, because that's something that we can get the information every year. You don't have to put twenty-five species in there. I mean with our state report card, we picked three species, a keystone species, a forage species, and a major predator. I agree that fisheries -- A lot of times, a lot of these report cards and things, they leave fisheries out, for some reason, and I don't know why.

MR. PUGLIESE: I will get to that, because I think one of the things is that this is an evolving process, and that whole idea of the model effort was to get to this point of compiling, on the regional scale, as much as we can on fisheries, on habitats, and all those. That was going to absolutely be informing this process and then what would provide the best indicators in that really review of all of that type of information I think is going to be something that would be an outcome that's intended, and that's why some of that was specifically funded, was to provide that.

I think some of those are kind of a no-brainer, but that's why, was to actually -- Instead of just throwing something in there, it was to maybe do it in a more strategic way of pulling the information in and have an informed decision about what the next generation would be.

MR. CARTER: I'm just going to pile on with the indicator suggestions, since that gate has been opened. What about the seagrasses?

MS. VAUGHAN: Seagrasses, for 2.0, and that's a very good question, but it was determined that they're not regional. That was the answer that I received about it, but we certainly recognize it being very important, especially in North Carolina, where we have so much open water estuary existing. The majority of that ecosystem exists there, and so that's something I think that we would really like to validate, especially as DMF, it's my understanding, does have better data for that in North Carolina.

Yes, that was something that was potentially considered, and the way -- I should back up and say that, when we started with our indicators, we had a long list of indicators, and one of our goals was a short list of indicators. The goal was about three indicators per ecosystem. Now we have expanded that. Some ecosystems have more indicators and some ecosystems have less indicators as we go through the review processes, but the idea being that, if our indicators are going to serve as our measures and if we're going to be able to track them, we need to keep it to a shorter and more concise list, but I agree with you that I think seagrass would be a really great indicator. The data has been a little bit squirrely and it's not as regional, but that's my short answer.

MR. PUGLIESE: I think some of it was looked at closely, because we did have the finest resolution of some of the mapping provided by the States of North Carolina and Florida and integrated into our EFH, and a lot of that was trying to be looked at. I think, as we move down the road, there may be innovative ways of looking at this information to make them more applicable on a regional level, because the one thing that we always get into when we start talking about the value of different multiple habitats in the Southeast is you look at a functional nursery grounds for gag grouper, and the settlement zones in the State of North Carolina and Florida are going to be seagrass beds, where, in the States of Georgia and South Carolina, it's going to be primarily oyster bar systems, and so maybe there is a way to integrate multiple habitats as a function for a settlement or a life stage. That would be an interesting way of looking at how to do this, but I mean it's just the beginnings.

MS. VAUGHAN: That's, to be able to create an index, might be something that we go forward. I do want to show you guys a little bit about how we access the data a little bit further, and I'm happy to answer any and all questions after this. What I'm going to do is show you how you can access our data, because, Pace, I believe you were one of our -- Were you one of our interviewees with Hilary Morris?

MR. WILBER: I've been interviewed a bunch of times.

MS. VAUGHAN: We really appreciate all the people who allow us to come and bug them and ask really great questions. From some of our feedback, we have really made a lot of stride improvements, and it's been a huge learning process for me, because I think one of the first interviews we went on that I met with Wilson Laney. He was one of my interviewees, and I said, okay, Wilson, go to our conservation planning atlas and access our spatial data. He was just like, I don't know how to do that and what's the link? I was like, it's not on our homepage, and that is problematic. We really need to improve the way that people access this data.

Now, if you are at the South Atlantic LCC homepage, you can click -- Here is a nice section that talks about the conservation blueprint, our ecosystem indicators, and the State of the South Atlantic. You can go to each one of these pages and it will tell you a little bit more.

If you go to the conservation blueprint, you can see that there is primarily two ways that you can access the data. The first one I'm going to start out with is the South Atlantic conservation planning atlas. Now, most Landscape Conservation Cooperatives have a conservation planning atlas. It is our geospatial data library, essentially.

It's an easy way to search for the data that goes into our blueprint, as well as other regional datasets that we think might be of interest to people. You can see neighboring LCC conservation planning atlases down here, which is very nice, especially for the Southeast region. When that data becomes available and when that plan becomes available in October, it will be hosted on -- You can get to it from here.

Honestly, what I really like most about the conservation planning atlas is, a lot of times, I have to go and chase down data, and it's a very unenjoyable task for me, because sometimes there are datasets that I know are really easy, I know that they're out there, but they're just really hard to find, and this really kind of takes away a lot of that.

If you're interested in the SLEUTH projected urban growth model, and this is the model that is showing the megalopolis of urbanization coming by 2100, you can go here and you can find it. Better yet, you can download it, and it comes with a full suite of metadata. You can download a layer file for your ArcGIS desktop and you can download the external source and come up with a zip file and you can get it explicitly, and you can also read these really quick and easy recommendations.

Another thing, another goal, of conservation planning atlases is that not everybody has access to ArcGIS or being proficient in ArcGIS is just not a part of your skillset, and maybe you're just not really interested in making it a part of your skillset, which is understandable, and so this is what I call kind of an everyman's GIS. You can go and create your own maps here. You can open this in a map and you can look at urbanization models across the south and see where they're coming.

You can log in, if you're willing, and you can save your own map. You can share that map with other people, if they're a part of this network, and my favorite is -- It's taking a little bit for this map to load, but you can export it. You can add different data layers, like you would in ArcGIS, and create really, really simple maps, and then you can export it to a PDF, a PNG, or a PowerPoint slide. This comes with a legend, credits, the North arrow, the whole shebang.

We have had a lot of success for this, especially when we go out and we work with the biologists on the ground, who either they have one GIS expert available for them and they need a map really quickly, to show the importance of an area, they're going to a public meeting, or they're going to go meet with their regional director and they just need to have a quick and easy map and maybe their GIS analyst is out on sick leave or on vacation, but they can go and they can make their own maps really, really quickly.

Again, you can add datasets. You can search the entire conservation planning atlas. You can search our data, under the South Atlantic LCC, and you can see all of our blueprints that come up

and you can add these datasets, if you want. You can modify your search and say, well, I'm interested in spatial data across all LCC conservation planning atlases and you can search, or you can search all of Data Basin.

Data Basin is supported by the Conservation Biology Institute. They have been really, really, really great and wonderful at providing support for us and for users of the conservation planning atlas. I was out on an interview, and just as an experiment, I hit their "help" button and sent a quick email to Data Basin. Within two minutes, they had sent me a response, saying, you know, let's talk more about your question, to which I said, it was just an example. I just wanted to show how quickly you guys responded and so never mind, but it's been a really, really great and wonderful dataset.

You can go and find Mark Anderson from the Nature Conservancy's biodiversity resilient hotspots, the Nature Conservancy's 2013 and 2014 secured lands database, which is looking at lands protected for conservation across the South, the Southeast, and the Northeast. It's a really, really great resource, and the ability to quickly make maps on the go and to explore data is really great. This is where we direct our review teams when we are going over and reviewing our new indicators, so they can look at them and we can do it altogether. It's been really great.

Then we also have, on our homepage, a link to, again, our simple viewer, and our simple viewer, as I mentioned before, it's really a way to quickly, easily, and simply interact with the conservation blueprint, learn a little bit more about the indicators and the landscape context. Again, on the inland side, it's summarizing by sub-watershed, HUC 12 watershed, and, on the marine side, the summary unit is at the lease block scale.

Now, if I click on the inland side, you can quickly see a pie chart and see here that this watershed is 96 percent considered highest priority, 3 percent considered priority. You can read about what these priorities mean, exactly how that falls out, and one of my favorite parts is that, as I mentioned, we have conducted about twelve workshops, where we have collected maybe about around 300 people coming in, and this is the notes that we've collected from them, and so this is what we consider our expert opinion about each particular watershed.

You can see indicators, and you can see a pie chart here showing the percentage of what ecosystems fall within that particular watershed. Again, you can see the indicators, see a brief description of what they are, and, if you click on this link, it's going to take you to the conservation planning atlas. You're going to show up on that page, specific to that indicator, and you can read and investigate a little bit more.

It's also showing you how well this particular indicator is performing, and so, for this particular watershed, 100 percent of this area, forested wetland area, is considered a priority amphibian and reptile conservation area, and so it's doing very well. Especially, you will see there is this dotted line here, and that's representing an average of this indicator across all watersheds across the South Atlantic region, and this is something that came out of our interviews, is people wanting to know -- I've got this indicator, you're giving me a score for this indicator, but how well am I really doing?

Ideally, over time, we would like to think about progress of that indicator and how we can measure success or how that projection of that indicator is going to occur, and, again, this is showing you all the indicators that are applicable within this particular ecosystem.

We're also showing you a land cover chart here, and this is the inland side, and you can see what's going to happen. We burned in urbanization in this, and so, if you click on any of these categories, you can see, over time, that this is predicted to increase by 1 percent of development, and so here is these land cover classes here.

One of my favorite tabs is partners. Let me see who might be interested in working in this area with me. What we did is, when we're looking at our regional and state conservation plans, we overlay that to see what types of organizations might be interested. Again, we look at land trusts, people engaged in the land trust community that are working there.

Then it comes down to ownership. Who is owning this? Is it federally owned? Is it a private land owner? Is it not conserved? This is coming from TNC's secured lands database, as shown down here, and you can learn more about it, and it's just looking at how much land is in conservation and what kind of conservation status is that.

One thing that we know is really lacking in it is the simple viewer in the marine environment, and this has been particularly problematic for us, because the marine environment, it's half of our region, and when we've gone out to work with people who are experts in the marine environment, it became quickly apparent to us that, if you're working inland, there's lots of really good information here that is completely non-applicable if you're working on the marine side.

Ownership, it's not very helpful. Partners, we do have these areas where you can see that there is partnerships available, especially habitat areas of particular concern, and that's going to take you, when you click on that, to the South Atlantic Fishery Management Council webpage. Land cover, not applicable. Again, you can learn more about indicators here, and you can learn about the priority, but this is something that we know that we really need to work on, and one thing I would like to ask, kind of in closing to this presentation, is is anybody willing to help us improve the marine interaction for our simple viewer?

It's something that I would really like to tackle over the next year, if you're willing to have me show up one day at your office, maybe bring you a cup of coffee while I pick your brain. Pace can tell you it's really not that bad. Pace was one of our best interviewees. I heard a lot about Pace in staff meetings. Thanks to Pace, you don't have to log into the conservation planning atlas to download the conservation blueprint, because, as Pace rightly said, and I have heard repeated again and again and again, I don't want another password or user name, and so thank you, Pace. That has really resonated with a lot of people, and so thank you, but one thing that we would really like -- We have met with a couple of people, but we would really like to improve the marine interaction.

We recognize that a lot of the functionality for the simple viewer is just not applicable. We know that we could do a better job, and so, as part of the Lean Startup Method -- I would really love to speak with you, if you're willing, over the next year and you feel strongly that there's a lot of good data out there and a lot of ways to really think about the marine portion of the blueprint in terms of interaction and helping communicate it, and that's all I've got, and I'm open for questions.

MR. CHAPPELL: I was just going to say sign me up. It sounds good.

MS. VAUGHAN: Great. I will get your contact information. Thank you.

MR. GEER: We kind of ran across the same thing with the South Atlantic Alliance when we were looking at gathering data for our projects for healthy ecosystems. First, I think we started out in the ocean, and it was fairly straightforward, and there wasn't a lot, but we were able to get some. Then when we came inside, the magnitude of the information just exploded. There was just so much more information, and so I could see where the problems are with that, and the South Atlantic Alliance -- There is information available there, if the website is still up.

MR. PUGLIESE: One note about that is a lot of the information on habitat and species and different things is directly from our atlas, and so I think the crosswalk between the refined atlas and the conservation blueprint and better representing essential fish habitat and distribution of species and fisheries I think is going to be something that we need to do to make it a little more seamless in terms of the way they present that, both in the way it's presented in the conservation blueprint, but also in the way the atlas has it and then how they can inform each other.

MR. GEER: I thank Bob Vandola did some efforts looking at fishing effort. That may not be on the South Atlantic.

MR. PUGLIESE: Yes, and I think that's part of the -- I think it was funded through some of the energy activities, and I think that may be available, but maybe we want to refine that even further, because I think that was one avenue we have already initiated a process to apply catch information relative to biological distributions and some other avenues, and so I think there's multiple ways, and so that's one thing that can be looked at, but I think there's also an opportunity to go beyond that.

DR. WHITTLE: I was just going to tell you that SECOORA is going to archive all the GSA data, and so I think most of it is overlapped, except for Bob's, which is also on the South Carolina server, if you guys are looking for it.

MR. GEER: Any other questions on this? I have one question. The other regions -- With the Southeast, you're going to try to put all the cooperatives together, mesh them together.

MS. VAUGHAN: We're stitching the plan together.

MR. GEER: Are the other regional cooperatives -- Are they on the same level as the South Atlantic as far as progressiveness?

MS. VAUGHAN: The South Atlantic LCC has been furthest along. Again, that's probably due to our Lean Startup Method of putting something out there, Blueprint 1.0, really quickly, to gather as much feedback as we can, but Peninsular Florida, they already had a lot of really great data to start out with, with Florida CLIP. The Appalachians have been coming along really, really well and the Gulf Coastal Plain and the Ozarks. They will be releasing their first versions of their individual blueprints, and that's what we're using to stitch together for the Southeast Climate Change Adaptation Strategy, or SECCAS.

One thing about that that I should mention is that when we do our prioritization and when we do our corridors, we look outside, and so we match up with Florida CLIP to see how well that overlap happens and to see if there is that overlap there, because you don't want two or three or four different kinds of plans that are completely catawampus at the corners and disjunct, and so we do validation with other priorities near our boundaries, but outside our boundaries, to make sure that our plan is -- We're not building corridors to nowhere and things like that.

MR. GEER: All right. Seeing no other hands, thank you very much, Louise. It was very informative, and I want to talk to you during the break a little bit about some things in here, because we had the same issues. Thank you very much. It was really informative. Moving on, we now have Pat Halpin coming up. He's going to talk about some regional models and tools.

DR. HALPIN: As the slides start to come up here, is everybody awake and ready to go? I've got a lot of material to cover. Roger asked me to talk about models and tool development. That's kind of broad, and so tried to cut the slides down to under a hundred, but what I want to cover is actually I picked four topics. One, and this actually fits really well after just talking about the South Atlantic Landscape Cooperative, is to talk about ocean planning and give kind of a framework of marine data and how it fits into ocean planning issues.

I added in some noise and sound issues, because we were talking about that a lot yesterday, and I think it's really good to kind of go back to talk about that. I'm going to be focusing a lot on protected species, but everything we're going to talk about, we need to actually build up the fish and fisheries components, and I think the protected species part is farther ahead on some issues and maybe not quite as far ahead on some others, but we don't really have an even playing field for all the different kinds of data types that we need to be dealing with.

I want to throw in -- Since Roger said to talk about tools, I want to show at least one new tool, and so I will just show a tradeoff analysis tool that we're in prototype right now, and then the last one was what can we do in the South Atlantic region, and basically I have like one slide at the end to say let's talk about that, what's the next steps.

My lab group's main focus as we really look at trying to provide information and tools to help balance where and when we can develop ocean resources while maintaining marine species and habitats, and so we do a lot of work on trying to provide geospatial data and models on marine areas and marine habitats.

An example framework, just to put some context here, I decided to just use a framework dealing with energy issues in the Southeast. That's topics that were coming up yesterday, and so I thought I would kind of go back and touch on some of those. If we're thinking about trying to integrate species distributions, underwater sound, and regional coastal marine spatial planning altogether, you can kind of put that into a framework, where you might start out with areas that are lease blocks, either going up for seismic surveys or renewable wind energy. It gives us a new use, a new application, to be considering and considering how does that affect other kinds of resources and other kinds of species.

One of the big pieces that we're working on is providing contiguous species density data. We have been working on marine mammal data specifically in my lab, but then also partnering with two NOAA labs on the development of seabird and fish data as well.

Augmenting and supplementing these species models are also maps of biologically-important areas. You often don't get the life history importance just from the numbers and abundance of species, and so you might have a map that says here is where you find a lot of the species, but it might not tell you that that's an important breeding area or that's a calving ground or that's a spawning area or whatever. It's just going to tell you that you have a lot of that species at some time of the year, and so you need to augment some of this stuff, often by expert opinion, but also other kinds of data that might tell you what's the actual use. For the marine mammals, we also helped work with NOAA on a publication of important marine mammal areas for the whole U.S. last year. It came out as a special volume.

For noise, I thought I would just go back to the noise issues. We talked yesterday -- I think the several presentations yesterday brought up the fact that there is chronic noise that is occurring constantly, mainly tied to shipping traffic and things like that, but there is also event noise, and so a pile driver or something that's a pulse kind of noise are other kinds of factors to think about.

Then, finally, when you try to bring this altogether, you are trying to bring this together into some planning context, and so multisector coastal and marine spatial planning, and so the whole idea is how do we group all of these things together and get the best available science, so we can actually start making better decisions?

I am going to focus, to start out with, on just marine mammals. We have been involved with NOAA on a program called Set Map and Set Sound, and so the Set Map part is the citation mapping part and then the Sound Map part is mapping out sound in the ocean. My lab is very involved on the Set Map side, on actually creating a lot of the density and abundance models. We have also been working with the Sound Map side on just basically taking some of their raw data and turning it into compatible maps.

One reason I wanted to throw this up here is that there's a framework that's been developed to categorize the kinds of available data and to create a hierarchy, and we have five different tiers of data types. At the bottom of the hierarchy is just expert knowledge, and so if you don't have any actual spatial data, you might be able to interview people and experts and be able to draw on maps to say here's where we think species are, here's where we've seen them, but you don't actually have a data-driven process, and so that's the bottom of that pyramid.

The next one up is that you have records. Maybe you have points on a map and maybe they're more opportunistic and you have some incomplete data, but you do have some records. The next tier above that is that you have some statistical models that give you probability of occurrence, and so it's telling you that here is a probability that you would encounter that species in this area for some time period.

Above that are what we call stratified density models, and then the top of that, kind of the gold standard, is something we call habitat-based density models, which allow us to give predictions that are actual estimates of numbers, and this is really important with the protected species side, because the legal mandates and framework for the Endangered Species Act and the Marine Mammal Protection Act require us to actually have counts, so they can estimate takes, and so it's not as much so we can say that this is a high-probability right whale area, but we actually have to say, how many right whales would you expect to be here, in a number, and so that's a much higher goal, target, to try to hit.

After a lot of work, we finally published a new round of marine mammal models, just two months ago, for the Atlantic coast and Gulf of Mexico, and this took a considerable amount of work, aggregating decades of data together, and so we're actually really happy about that. Unfortunately, we're already starting to do the next revision, and so it's like you get to be happy for like an hour and then you start working on the next version. It's like they say of painting a battleship. You start on one side and you get all around the other side and then you start over again, and so we're already working on a new version, guys, and so no rest for the weary.

I would like to go through, just very generally, the kind of modeling process -- I am using marine mammals here, but this process could be the same for most any marine species. The first step in the process is you gather together observation data, and this is probably the most tedious part of the whole game. On the actual modeling part, at the end, is usually significantly less time. I always tell students that 95 percent of the time is actually getting all the data together and then the analysis often is like one computer command.

That observation data, aggregation, and normalization of all the data is a huge amount of work. Then what we do is we fuse that data with other kinds of environmental data, physical environment, oceanographic datasets, to give us environmental characteristics, and this is a very big thing for the stuff we're doing, because we're actually putting together a couple of decades worth of data collection, and so we have to go back and recreate the oceanographic conditions on every single day for the last couple of decades, sample it where we saw the whales and dolphins, and sample where we didn't see whales and dolphins and then move on to the next time step. It's literally creating terabytes of datasets that we then sample. You winnow that data down into a reasonable -- It's essentially winnowing it down to like a spreadsheet, but you start out with terabytes of satellite imagery and things like that in oceanographic models.

The third step is the magical statistical modeling process, where we use a lot of different kinds of methods to do these estimates, and then, finally, creating model products, and there's a lot of different products. The most initial product to come out is an abundance or density map, to say here's where you would expect to see this many humpback whales in the summer, but then, from there, there could be lots and lots of other kinds of combined synthetic products that you might create from that.

At the beginning of this kind of work are lots of surveys, and, to get this kind of abundance level estimates, we have to have not just observations of animals, but you have to have all the geometry and all the site conditions, and so, a lot of times, one of the most disappointing things is I get people coming up to me all the time saying we've got this marine mammal sighting data from our whale-watching cruise. You're like, that's really great, thanks, and then you have to tell them that it's completely useless, and it really just frustrates the hell out of us and frustrates the hell out of them, because if they don't record the angles and distances and all the geometry and everything, we can't create densities from it.

It is useful data to validate models or to see presence of animals, and the same thing happens with fisheries data. I mean if you don't have a rigorous statistical sample, it can be partially useful for some things, but it's not going to let you build the kinds of models we need. We get data from both ships and aircraft, and so one of the big things we've done in this new round of models is we have combined the two together, and this took a huge amount of effort to normalize data, because it's a big difference between what you would expect to see, statistically, flying in an aircraft over

an area than what you would see moving in a slow-moving ship, and so we have to do all sorts of work to be able to normalize that, so we're getting the equivalent counts of animals from different kinds of survey platforms. We actually do it all the way down to every single aircraft and every single crew and every single set of observers. We use different statistical models, and so it's extremely detailed.

This is showing, as you can see, the lines. The red lines are aircraft surveys and the blue lines are ship surveys, and this is gathering together mainly NOAA, but also some academic lab surveys over the last couple of decades, and you can see it's really uneven. You will see New England is completely painted red there, because they have the North Atlantic right whale aircraft surveys every year, and so it's looking like complete coverage there.

You will also notice, in the Southeast, there is a couple of small postage-stamp areas. Right off of Jacksonville there, because that was an area that the Navy has been surveying specifically, and then in Onslow Bay, there was another site, and so there's places that have very differential surveys.

The next step, just to keep moving along here, is this fusing with oceanographic and physical data. This is the part where we need to be able to go through those time series, and so that little stack of GIS data layers is showing, for every single observation, that we have to go and kind of recreate all the oceanographic conditions, sample it all, extract that out, and then move on to the next date.

There is a lot of different predictor variables we use, and so here are some of the physiographic predictors. If we were thinking about fish, we would be using different stuff. For large, migratory marine mammals, things like submarine canyons, slope edges, distances to different bathymetric features are things that these animals are responding to. If I was doing demersal fish, I would be using different kinds of environmental covariates.

In addition to those more physical variables, the physical variables are the easy ones, because they're static. You can go in and get an elevation bathymetric model and basically looking at topographic conditions. The ones that are more challenging are the dynamic features that are changing all the time, and so we use predictors, like sea surface temperature, but then we use a lot of predictors, things like distances to fronts, eddies, cyclonic and anti-cyclonic eddies, the persistence of the eddies, total kinetic energy, wind speeds, all sorts of things that we calculate for every single time stamp, and these are dynamic. They're changing all the time, and so if you were sighting whales in August, it's going to be very different than when you're sighting them in March.

Just to show you some of these, this is some of the calculations for looking for sea surface temperature fronts, and so it's one thing to have a map that says here's your temperature, but finding the frontal boundaries or areas that often are aggregating the edges of those fronts are often where you have two water masses hitting, and you end up with prey aggregations.

Similarly, with eddies and other kinds of features, we calculate where the eddies are, and we're looking at cyclonic and anti-cyclonic, cold core and warm core rings, upwelling areas, and usually the edges of those rings are where we're ending up seeing aggregations of prey that are attracting top predators, and so it's a lot of work to build all this stuff up. Then we have other productivity-related predictors as well. If we've got a minute -- I don't know how much -- We're kind of

running behind on time, but I could show you some animations if you want to see some pretty pictures.

MR. GEER: Go ahead.

DR. HALPIN: The pretty pictures? Okay. Everybody loves pretty pictures, and so let me see if I can find where we stashed the pretty pictures. What we're looking at here is this is actually walking through, pretty slowly, the time series of the data that we've had to build up. We're going through different variables, and so, right now, we're starting with kinetic energy. We will show you kinetic energy and then show you going through the years, looking at sea surface temperature, looking at chlorophyll, looking at other oceanographic variables.

We basically build a whole dataset that's a couple of decades of what is going on in the ocean offshore and then we sample that. We're just now shifting over to temperature, and then we will also show you shifting, in a second, on to productivity. One thing, while we're just talking about this, is I'm going to be focusing on some of the stuff that what we're considering the more near-shore models within the U.S. EEZ. We're also building models for the Atlantic Fleet Testing and Training or Training and Testing. It's AFTT. We could say either and nobody would know, but we're doing that whole area right now for marine mammals for the Navy, and so, actually, that's pretty much this whole study area. Okay. Back to our regularly-scheduled program.

I am going to pick one animal out, and the kind of poster child for marine conservation issues on the Atlantic coast is the North Atlantic right whale. It's a highly-endangered species. One of the things that does make it an interesting case study is that it has a very, very distinctive range, but we're looking at an animal that has a population of somewhere between 350 and 400 individuals in the region.

It has a very distinctive foraging area in the summer months and a calving ground area in our region in the winter months, where the mothers and calves are found, and then a migratory corridor in between, and so it gives you a good example of how you have to deal with a dynamic migratory species, and so a single map doesn't help us. We need to be able to capture not just the patterns, but the patterns as they change over time.

This is looking at model output for the North Atlantic right whale in the summer season, and what you can see is in the summer season, most, but not all of the animals, most of them are in the Cape Cod of New England area, and one thing that we were very pleased about with the modeling here -- My main modeler on this project, Jason, came to me and he showed me this map, and we counted up how many cells there.

We're looking at a surface here that's predicting right whale density and abundance, and so some of those cells have numbers that are like 0.5 right whales, and so it's not like you're going to cut up a right whale in half, but the idea is it's going to give you a surface of what would be the abundance and density, and we actually counted up how many cells, and we got 379 right whales, which is right about spot-on the exact number. I was like, holy crap, and Jason was like, is that good? I was like, yes, that's good. Usually, if you're in the order of magnitude, people are like, awesome, you're in the right order of magnitude, and so we actually were getting numbers that were very reasonable, which we were very happy about.

This is the summer season, when they're aggregated off of Cape Cod, but what we need to be able to do is create models that can actually show the change in that pattern around the year. The summer, they're aggregated in the foraging area. In the winter, part of the population, not the entire population, but part of the population, is going to be down in the Georgia/Florida region, in the calving grounds, and we were able to actually get that kind of change, and so we were pretty pleased about that.

Another example, just to show you briefly, is one where have a fair amount of data. Humpback whales are fairly ubiquitous to the U.S. east coast, and this is showing the winter/summer patterns, and so you can see also a very strong signal for the summer, where they're in the foraging areas off of Cape Cod and New England. In the winter, we still look at stragglers that hang out. A lot of the whales, the humpback whales, end up going down to the Silver Banks in the Caribbean.

What you can see here is actually the same map. The left-hand side is the model running throughout the year, and on the right-hand side is the same model running, and what we're showing is the survey effort drawn on top and the actual observations of the animals. We had enough data for this one where we're actually running this model on a daily time step, and so this is showing you, as you see the patterns changing, this is looking at the annual year for a humpback whale. We would love to be able to do this for every species in the ocean, to be able to have a map that shows you how the animals are shifting around from month to month, but we can only do this with ones where we have very, very detailed data.

For this example, we have enough data that we're creating maps at a monthly time step to -- We're proving that kind of data, and we were able to actually run the models down to a daily time step, but, for most species, we just don't have that kind of density of data across time.

MR. GEER: Why don't we take a ten-minute break while we work on our technical difficulties.

MR. GEER: Let's everybody sit on down.

DR. HALPIN: Sorry about that, but the animation seemed to overwhelmed that computer and hung it up, and so hopefully no more -- I won't show any more animations. I did want to show a couple of issues on the sound side, since we talked about that yesterday, and I just wanted to show a couple of examples.

Another piece of the NOAA Set Map/Set Sound Program is looking at broad sound mapping, and these topics came up yesterday, and so there is different kind of categories of noise budgets you would have in the water column. There is ambient noise, which we really would consider to be the natural sounds, snapping shrimp and fish, and that's the sounds you would expect to have without any human intervention.

There is more chronic noises, shipping and fishing vessels, recreational vessels. Those are inputs that are pretty much happening 24/7/365 days of the year, and then there's the event noise, things like pile driving, seismic surveys, things like that. These are broad categories, and there are some lines between that. We were talking about the Gulf of Mexico. If you think about all the events going on in the Gulf of Mexico, does that cross the line into just chronic noise? Because there is so much going on, so many single events happening constantly across that whole basin, that it's almost like just a chronic situation.

This map is probably a little hard to focus your eyes on, but it's a broad ocean basin scale map, mainly driven by shipping vessel traffic, showing noise density at a very, very crude ocean basin scale, and I was just going to zoom in and show one example for the Atlantic coast. This is looking at some chronic sound maps, and I've got it at three different depths here, and this is not work that we have done. We just made the maps and took the data from other folks.

This is looking at sound at thirty meters, fifteen meters, and five meters. As it looks like it's getting closer to shore, it's because we're decreasing the depth as we just went through there. One of the main patterns that you see is that, in these models of noise, what you're seeing is more noise closer to shore, because you probably have more vessel traffic that's in close to shore, and so that's one just very general trend.

One thing I just wanted to show also was to contrast that with an example of an event, and so this is a simulation for a single event. Instead of chronic noise, this is a pile-driving simulation for the what was proposed Cape Wind Energy Project, and so here is looking at pile driving, and the idea here is looking at the noise emanating around a pile-driving event in a smaller area. It's just giving you an idea that there's that chronic noise, and one thing that I think that people sometimes do is they will focus on these maps and they don't tend to put them together, that you have those events going on top of the chronic noise fields that are already going on daily.

Just to throw in a completely cartoonish example, we will go back to our friendly North Atlantic right whale. You've got the seasonally-migratory species. If we look at that species by just taking observations, you will see there is lots and lots of observations of right whales in the Northeast, in their summer foraging area. We don't have a lot of direct data on migratory patterns, and part of that is that it's hard to get permits to go and stab right whales and put hardware on them, which is what you have to do to do telemetry tracking.

There were some tracks that were done several years back, and so this is looking at two right whale tracks, and they pretty much hug the coast going up the coast from the winter calving ground back up to the foraging area, and so those two tracks there is two different right whales going up the coast.

This is my little cartoon here. Imagine this is a momma right whale leaving our region and there she goes up to New England to go feed for the summer, and the point I wanted to make is if you actually sampled that track and the sound fields, what you see is that it's not an even distribution of sound, and so animal, any migratory animal that's migrating across an area, is going to go through a fairly differential sound field, and there's going to have peaks and valleys there in terms of the sound intensity that you're hitting.

That's just something that I think is going to be interesting to think about in the future, how we think about that for different animals. What part of their migratory pathway is going to be more or less noisy? The noise issue, with marine mammals, is not the expectation that you're going to be damaging marine mammals as much as masking their communication. That's the biggest issue we're thinking about, is that they're unable to communicate because you're interfering with a lot of sound. It's like going to a cocktail party or something and everybody is talking really loud and you can't hear the person across the room. It masks the communication for the species.

That was a general overview of some of the ocean planning issues of trying to bring together things like marine habitats, ocean uses, and noise and just kind of conceptually doing that. I want to shift gears and talk about ongoing marine life data and modeling processes that are happening at this moment, and so kind of thinking about this regional coastal marine spatial planning.

Back in 2010, there was an Executive Order from the White House basically saying thou shall do spatial planning, and they said that you would do it at a regional scale. What has happened is that different regions have been starting to form in the U.S. to put together ocean plans. Right now, there is two ongoing plans that are formally being done in the Northeast and the Mid-Atlantic. The Northeast Regional Planning Body was formed and is being supported by NROC and the Mid-Atlantic Regional Planning Body was formed and is being supported by MARCO.

My lab is leading the marine life analysis, and we have crated an acronym called Marine Life Data Analysis Team, the MDAT team, and it's a collaboration with my lab at Duke and two NOAA labs, and so the NCCOS Biogeography Lab as well as the Northeast Fisheries Science Center. We are covering actually both of those regional planning processes in parallel, and that's been going on for the last year-and-a-half or so.

Unfortunately, for the South Atlantic Region, they did not form a regional planning body, and so there is no formal ocean planning process moving ahead in our region. The regional planning processes in the Northeast and Mid-Atlantic, they actually -- I got the draft Mid-Atlantic Ocean Plan Report in my email last night, not to be distributed, but they have to be finished with their plans by December 31, and so they're actually -- The draft plans are done for the Northeast and the Mid-Atlantic. They're going to be going into review, but they basically have to have everything completed this calendar year, and so the South Atlantic didn't get onboard.

The way the data has been getting developed for the Northeast and Mid-Atlantic is we have put together this collaboration of two NOAA labs and one academic lab. The NCCOS lab was doing seabirds, the Northeast Fisheries Science Center was providing the fish data, and my lab was handling the cetaceans and sea turtle parts of the projects.

One note here is this was the charge we had, and it was a fairly narrow description of marine life, and I think that's come back to haunt people later, because the charge was to organize all the data on basically large vertebrates, and so you've got seabirds, sea turtles, marine mammals, and fish, and there wasn't a column there for invertebrates or for habitats or other things. It's a fairly narrow description, and so that's -- That's just the way they did it, but I think if the South Atlantic region is thinking about doing something similar in the future, we might think about other ways to have a broader perspective.

We have assembled, in the last year, more than 3,500 GIS data layers and models we've created, and so we've been busy. They go online, live, on Monday, and so this stuff is out there, and it's all going to be publicly available.

The Northeast and the Mid-Atlantic have been using this concept heuristic kind of model of a data pyramid. I am so sick of seeing this slide that I could puke, but it's like one of those things that -- It was a great idea. The idea was that you would show different levels of data. At the bottom of the pyramid is individual species. When we say we were creating 3,500 or more data layers, these

are individual species for different periods of time, plus ancillary data on the qualifying the models, and so error and confidence and things like that.

To me, that's still the most important raw materials, is the outputs at the bottom of the pyramid there, but then there's lots of things, kind of going up the pyramid, which are grouping species together, and so functional groups of species. Instead of looking at one species, maybe you want to look at a group of twenty or thirty different species aggregated together for some functional reason. Then there were things like diversity and species richness and other kinds of statistics that were kind of agglomerating or adding things together. Then, finally, at the top of the pyramid, is this goal of being able to identify ecologically-rich areas, by combining lots of information together.

The big issue, for planning purposes, is that, as you kind of create these more synthetic products, you can start to use them more for applications like pre-application siting and things like that, because it could give you maps that might indicate areas where it might be more or less suitable to do different kinds of activities.

The raw data at the bottom is probably more specifically what people are going to use for regulatory use, where you're required to go and look at takes of individual species and things, and so it's the more synthesized you can get, the more it's probably better for planning purposes.

We have tons and tons of stuff, and so I'm just going to show a couple of examples of some of the data. I'm not going to go through 3,700 GIS data layers, even though I would love to. Going back to the humpback whale example, this is showing an example of a summer density map, a July density map, but, on the right-hand side is a map of standard error, and so one of the things we've been trying to do is, for every single product we create, we are also creating several different maps that show how you might help interpret the data, and so standard error, coefficient of variation, things like that that will help you look at the confidence we have in the data.

This is looking at that case. The bottom two panels, and these are also for humpback whales, is showing -- The bottom two panels are a pair that you would look at. The lower end, on the left side, is the 5^{th} percentile. That would be the lowest estimate of our prediction, and the other one is the 95^{th} percentile, and that's a higher-end estimate, and so it gives people an idea of the range. If you ran the model hundreds of times, what would be your lowest predictions and your highest predictions?

The upper two panels are standard error, and then the one that has the brighter red color there is the coefficient of variation, and we feel this is very important for when you're creating these kinds of maps, because the coefficient of variation tells you where the models are really variable. You will notice that offshore is bright red, and that's because we have very little data way offshore and we get the most unpredictable predictions for humpback whales offshore, and so I think it's hopefully intuitive for decision makers to be able to look at a map and say, okay, the map is looking pretty good for some of these near-shore things, but, offshore, we shouldn't trust it as much.

This is showing one example, and there is actually 130 different seabird species that were modeled. This is looking at surf scoters. The NCCOS lab has produced models for seabirds. They're using what is called relative density, and so instead of being a number that's an absolute number, it's a relative count of that animal, and it's a slightly different target to produce.

Then the last one here is showing an example of the fish data. The Northeast Fisheries Science Center did not create environmental models of the type that I was showing you for marine mammals. What they did was interpolated the trawl survey data. This from their fall trawl surveys, and they interpolated that using inverse distance weighting interpolation methods to create contiguous maps, and so this is a pretty different kind of product, and so it's important to know that the marine mammal data is one kind of target. It's actually absolute value numbers, which is really a higher bar. The seabird data is for relative density, and then the fish data that's being presented is just interpolated trawl surveys, and it's in biomass and not numbers, because it would be very -- You could end up with lots and lots and lots of small fish in a trawl, and so they're counting up kilos of biomass and not individuals, and so they're pretty different.

There is also lots of different data sources, and we had to supplement the fish data with some other datasets, and so that was the Northeast Fisheries Science Center trawl survey that I just showed. This is the NEAMAP dataset, which is much more near shore, and the reason we're showing both of these and providing the data for both of these is that you end up having the federal trawl surveys are offshore, outside the three-mile limit, and then you have more near-shore data, and so this is to try to fill that gap.

Unfortunately, the datasets aren't directly compatible. It's hard to just combine them together, because the methods are different, and this is one of the issues that causes some problems. You have different data you need to look for near shore and different data you look at for offshore.

As far as the raw data goes, I try to tell people that it's been scaring the planners and people in the Northeast and Mid-Atlantic when we tell them we have just generated 3,500 GIS data layers. They go, oh my god, our heads are going to explode. What I try to tell them is you don't need to look at all 3,500 data layers. Just think about it like having a library, and you just need to know in the library where to go when you need to find it, and so I think a lot of people are concerned that it's overwhelming them with data, but, really, it's just the data is there. If you need to see these different species or analyze these things, you can go and check things out of the library and take a look at it.

All the data that I just showed is being made available at the NROC portal for the Northeast and the MARCO portal for the Mid-Atlantic. Selected data layers are also being displayed through the Marine Cadaster for the whole region, and one thing we're doing to try to keep control on revisions is we're providing all the data through a web service, so that if we make any updates, it gets updated to all the different data portals simultaneously, and we think that's really important, because what could happen is you could have one person doing a regional plan and we create an update of a model and they're using something six months out of date and then they're wondering why the maps aren't matching up anymore.

A couple of examples of grouping species. For the marine mammals, we have aggregated the species together into taxonomic groups, managed species, and then sound sensitivity. We thought it might be interesting to planners to be able to look at separating out baleen whales from small dolphins, large dolphins, sperm whales, and beaked whales and then to be able to pull out different types.

Here is an example. This is just pulling out the small dolphins. You will see some near-shore populations and then populations offshore, near the shelf break. These are baleen whales, the large

whales, the humpback whales, minke whales, fin whales, right whales. This is looking at the deep-diving sperm and beaked whales, and the big issue here is that, instead of looking at an individual species, you are now clumping together fairly functional groups that have different behavioral patterns, and you can see their geographic patterns are very different.

One thing that we've put together that I'm actually hoping to get a publication out on here real soon to document this, is we went through and split out the cetaceans into their hearing classes, based on literature reviews, and so we have cetaceans that are using low-frequency sounds to communicate, cetaceans that are using mid-frequency sounds, and cetaceans that are using high-frequency sounds.

We feel that this is going to be useful for people doing ocean planning work to be able to say, okay, what are the kinds of groups that might be interacting in this kind of -- Their hearing range is in this sound category and, if I'm doing pile driving or I'm doing seismic surveys or I'm doing sonar tests, which functional groups of species might you be impacting?

The avian group also broke out lots of different kinds of categories. These are also based on going back and looking at the scientific literature and separating out different species and their potential impacts and two of the categories there, just to bring up, are sensitivity to collision and sensitivity to displacement, and those, we felt, are going to be important for renewable energy and wind farm development, and so some species might be more sensitive to actually interacting with turbines and some might be more sensitive to being displaced by turbines. This is showing a map here of the species at risk for displacement, just to show you an example.

A few of the others, and I will just blast through these pretty quick, is trying to aggregate things together, and so a simple one is just aggregating all the abundance, and so this is the total abundance of marine mammals, and you can see kind of this bifurcated distribution, where we have a lot of numbers of marine mammals near shore, dominated by a lot of small dolphins, and we have a lot offshore, where you have both dolphins, but also larger whales that are hugging the shelf break, and so kind of two different distributions there.

The next two are just ways to look at richness and diversity, and so this is looking at species richness, just a count of how many different species that you're finding, and then this one here is just looking at diversity using a standard ecological Shannon index for diversity.

The last one I'm going to show here, and I'm cruising this just to give you some highlights, because we literally do have 3,500 datasets I could walk through, but one of the questions that comes up over and over again is people say, well, where are the hot spots? When you look at a map, and this is going back to the humpback whale example, the first thing that people ask is, well, where is the hot spot there? Is the orange area the hot spot?

One of the issues that we struggle with is that colors on maps may just be related to whatever the GIS person wanted to use and so the thresholds that you're using to show breaks could be different. We have tried to come up with different ways to hopefully come up with an intuitive way of identifying these core area, and so, just to show you just one example, what we've done is taken the datasets for all the different species and gone through and said, could you find the area that contains some proportion of the population that we're predicting, and so the map on the right right

now shows pretty much the entire -- It's 99.9 percent of the humpback population would be in that red polygon.

If you lower it to a 98 percent threshold, you will see it gets smaller. If you lower it to 90 percent, it's even smaller. Here's 75 percent, 50 percent, and so this was a way to try to come up with a way to show people, especially the people on these regional planning bodies, if you wanted to find a core area, you have to pick an arbitrary threshold, and what's the threshold that you want to use?

We did a lot of work on how to optimize this, and I took all of those slides out of this talk, but, if anyone is interested, I could show you really cool ways to pick a magic number, or an optimal number, but what they ended up picking was 50 percent just was a number that they thought was workable and easy for planners and people to understand. This is an area where 50 percent of the population of humpback whales are in that red area, under this prediction.

It's one way, and it's an arbitrary threshold, and that's what we have to keep kind of reminding people, that if you're doing this kind of stuff, you're picking a number. Is it ecologically meaningful or not? It's really just trying to identify where would you -- It's a human-imposed threshold that we're putting on here.

One of the things that happens then is people then want to say, well, can we stack up those core areas? This is all the marine mammals, and all the different marine mammal species, core areas, stacked up to find where you have lots of overlap, and so you can see that you have a lot of marine mammals -- The richness of marine mammal core areas is along the shelf break, and that's mainly because that's where you get the most overlapping species, and so all these things need to be qualified when you're thinking about them.

I could go on, and I would be happy to talk to people at breaks or whatever on some of the other nuances. There's lots and lots of other stuff we're doing, but I want to show you the examples there. All the data that we're producing -- We have the marine mammal data done for the whole Atlantic coast and the Gulf of Mexico. The seabird data is for most of the Atlantic coast. The fish data for these two projects was going from Hatteras north, because we were relying on the Northeast Fisheries Science Center, and so one of the main things I want to think about is, if we're moving south, what can we do with this group to try to organize the data better?

AP MEMBER: Thanks, Pat. I just wanted to stop there, just to also remind folks that -- This is all the marine data, but there is still the -- The marine spatial plans also have other like socioeconomic data. One tool that has been beneficial has been VMS data, which doesn't necessarily have the same penetration in the South Atlantic as it does in the Mid and North Atlantic, but there a whole bunch of other datasets out there that are a part of it and kind of help paint the picture of what's going on.

DR. HALPIN: Thanks for bringing that up. I mean I just didn't have time to go into that, but there is a huge amount of other kinds of use data, recreational fishing, commercial fishing, VMS data, just tons and tons and tons of other stuff, and so I think it would be really good for people in this group -- We could send the links out to actually go to the NROC and MARCO portals and see all the stuff that's getting aggregated together, because that's a lot of good material that goes way beyond the marine life data.

One thing I wanted to show is Roger asked if I could show a tool, and so I thought I would show some tools that are under development right now, just real briefly, and the issue here is thinking about potential tradeoffs.

This example here for the Southeast, what we've got is one map on the left showing the footprints of potential seismic survey areas, and one thing that I just wanted to show is if you overlay the marine mammal data and you look at it, you go, ouch, because we've got the -- This is a map of mammal diversity, and we're actually looking at, in the U.S., probably one of the most highly diverse areas for marine mammals, and so that becomes an issue.

If you're thinking about seismic surveys or wind energy and other things, there's a lot of correspondence, and this happens all over the place, and so it's not just the Southeast. You go up to the Alaskan area in the Arctic and you have the same kind of issues, where you have highly migratory species overlapping in areas for energy development, and it's just a fact of life that they're seeking out the same environments. It becomes more important to be more precise in how we can tease out -- Are there opportunities in space and time that can minimize conflict? That's one of the issues to think about.

With wind energy, you've got kind of two different issues going on here. You have potential marine mammal corridors, migratory corridors, going right through a lot of the wind energy development areas. You also have seabird flyways, and so the issue becomes really important of how would you actually think about reasonable ways to compare the tradeoffs with these.

This is just showing the same thing here. This is looking at the right whale corridor and high wind potential from the NREL maps. We have also looked at displacement risk for species. One of the things we're looking at is for the seabirds. Can we look at species that are at risk of interaction or displacement?

One of the kinds of tools that we're prototyping right now is balancing competing uses, and if you could create a map of the value of wind energy -- That map there, I know it's kind of small and a little hard to see, but it's a map of the wind potential that's been translated into net present value, in dollars, and it's not just a map of the wind potential -- It's wind potential at ninety-meter hub height for turbines, but, also, what we've got is the Atlantic wind connection. The little blue lines drawn on the coast there from New Jersey and that area, that's the trunk lines that you have to plug things into, and so wind energy is great, but you've got to be able to plug it in somewhere, and so wind energy off of Newfoundland or something would be wonderful, but there is nowhere to connect it. This map actually spatially looks at valuing wind energy, but also wind energy that is closer to connections. That is one side of this.

Another side of this, if we're thinking about seabirds and cetaceans, would be valuing protection of those species, and if you were a wind developer and you only thought about wind energy, you might decide a decision point up here was perfectly fine. It got you the highest wind value, but you didn't actually consider seabirds and marine mammals or something.

If you were a conservationist, you might be out here and saying, no, no, no, the best solution has got to be the solution over here, which is our high conservation solution, and it doesn't actually get us much wind energy, but lots of -- It doesn't impact any species. This is kind of a cartoon kind of idea, conceptually, of how this would work.

What we think about though is that there are some potential tradeoffs that you would have, economic tradeoffs and value tradeoffs, that you would have. What you would hope, and I hate to use the overused win/win solution term, but the win/win solution would be an optimal solution, where you're getting good wind energy and you have low risk to endangered species. That's the sweet spot that people would like to be able to get to.

The reason to build tools like this is to try to look through how we can actually put numbers on these things and maps and actually sit down with people and try to achieve these kinds of solutions, if they're possible, and so I'm going to show you an app that we've built to do this. I actually am not advocating that you do this on an app, but I think the idea is more organizing the data and the thought process to get to this kind of solution.

This kind of complicated image on the left side is an economic analysis of valuing bird sensitivity areas versus wind energy potential. An economist would look at this and their optimal solutions are going to be on the periphery, what they call the frontier. The optimal solutions would be in that upper right corner, and so you see the blue dots there. Those are the sites that are simultaneously high value for wind energy and are also not going to impact seabirds, and so those would be the places you would want to pick.

The new app we've developed is we have this all linked directly live in a GIS system, so that you can actually go to the map and find the site and you can find it in the economic analysis and vice versa. You can go to the economic analysis and click on one of those dots and it will say where it is in the ocean. These are things we're trying to develop to get people to the table to talk about these ideas in a more rational way.

Another issue that can complicate things is timing. We mentioned seabirds. Seabirds, we think, and this is somewhat of a simplistic idea, but once you build turbines and set them out there in the water, you're going to have interactions with seabirds pretty much year-round. There may be a different seasonality, but you put a turbine out there for thirty years and it's going to be potentially interacting with birds for thirty years.

The interaction with cetaceans is probably going to be most pronounced when you're actually doing the construction and maintenance phases, when you're out there making a lot of pulse noise, and so the issue here is kind of two different worlds. We're thinking about, well, you would be wanting to tell decision makers where the best place to put turbines in relationship to seabirds -- It's more of a spatial problem, but telling them when they want to build the construction is more of a temporal timing problem for cetaceans. When are you going to do the construction?

The application we've got allows you to not only pick a site, so you can pick a location that gives you high value for wind energy and low impact on seabirds, and then you can find it on the map, and so this is showing an example here. It's hard to see, but picking a site here that had high value for wind and low impact on seabirds, and this is the actual location offshore over here.

It's saying, okay, this is the site that looks like, in our crude model, does both. It simultaneously gives you a lot of wind energy and is possibly not going to be a big impact on seabirds. Then what you can do is then look on that site and what it does is it gives you back the time of the year, with cetacean data, that's the best time for doing construction.

We're trying to do both simultaneously, and so it's saying, okay, if you wanted to build a wind farm there, do it between March and July, when we have the least amount of migratory species going through that part of the ocean. Does that make sense? I mean this stuff is all prototyped. We actually have the prototype working. It's actually live online. We haven't actually advertised it, but I am thinking about it really as more of a heuristic device, a teaching device, more than that I want to say that this is how we should do planning, like everybody get a -- We can put this on your iPhone, if you wanted. The idea is to try to get people thinking about these issues of spatial patterns and temporal patterns and how can you actually coordinate these things better.

The very end, I want to talk about the South Atlantic region. We've been focused a lot the last two years on getting a lot of data developed for the Northeast and the Mid-Atlantic. That is still ongoing, but they are wrapping those things up. We haven't been focusing our attention as much on the South Atlantic, and we would love to. It's kind of absurd that a lab from North Carolina is doing all the work in New England and the Mid-Atlantic and we actually aren't doing our work here, and so we would love to come back home.

What I would like to do is think about what's the new stuff we could do here, and, actually, we're in a good spot, because we can learn a hell of a lot from what has happened already in the other regions.

One thing we have been trying to do, thinking ahead, is we've been trying to take all the work we've been doing so far on the marine life data and making it consistent and seamless and multi-scale. As much as possible, we have been taking data from the Northeast, the Mid-Atlantic, and making as much of the data as we can -- If it extends into the Southeast, we're making it all consistent, and so it's going to be fairly, hopefully, seamless for us to be able to extend.

The one area we actually would need to develop new partnerships and really retool a lot is going to be with the fish and fisheries data, because the Northeast region was covered by the Northeast Fisheries Science Center. Their datasets around the North Carolina/Hatteras region border, and so we really need to think about, well, what's the partnerships and the data availability that would really help to build that kind of team down in this part of the world.

I just thought I would end on that and talk about the fact that we've got a lot of data models and things for marine mammals and seabirds. We already heard about the South Atlantic Cooperative. We've actually already given them all the marine mammal data. I feel kind of bad, because it seems to be dominating some of the process, and I feel we need to add fish in there, and so we're real interested to see if we can start to put in other taxa, other species, other things that are going to be more important into the Southeast plans. That's it. I will just stop there, and I'm happy to take questions.

MR. GEER: Any questions for Pat? I don't see any hands going up right now. Pat, I will say that the complement to NEAMAP is SEAMAP in the South. They have a groundfish survey they've been doing for quite a --

DR. HALPIN: We're aware of that.

MR. GEER: That one is available, and that and NEAMAP will complement each other real well for fisheries data near shore.

MR. PUGLIESE: To go beyond that, I think one of the facts that we've been integrating the information directly across the SEAMAP system, which not only includes the inshore and near shore areas, but also the rest of the fishery-dependent surveys, including the National Marine Fisheries Service component, but it's actually being housed separately in a totally different system.

It has a complementary spatial footprint on South Atlantic fisheries connected with ours, and so how we would expand, enhance, and refine that I think is going to be -- Because we already have a link to be able to start that process, and we have been building some layers. How we go beyond that, in collaboration with the efforts or mirroring some of the efforts that were done, that may be the vehicle, versus the NROC and other ones. This is the avenue, that, in combination and connection and feedback into the LCC too, and so I think those are all happening.

That's, to some degree, why you're also involved on the modeling team, and so we're going to pull you in more directly on the ecosystem modeling, because that's the intent, to be able to build this type of information that can feed these systems and expand the footprint and better representation of fish, fish habitat, fish distribution and fishery operations in our region.

MR. HOOKER: Thanks, Pat, and I think that model, that tool, that you developed -- I think it could be valuable to developers for wind energy or for other activities on the Atlantic OCS. Is there currently a -- Where we are right now with wind energy in the Mid-Atlantic and the Northeast, primarily, is that leases have been issued, and so the places have kind of already been identified, but they're in the early plans of trying to identify their schedules for construction and that type of thing.

Although I think you made a very good point that it's not the answer, necessarily, but it's a good starting place for understanding what your activities may impact during the time periods that you may do those activities, but is there a way right now for -- Do you have any outreach planned to the industry to make them aware that these tools are out there or is there -- I guess how could we make this available, if folks would like to look at it?

DR. HALPIN: The first thing, like I said, is this is a prototype. Actually, the thesis student who is working on it graduates on Saturday. On Monday, I am meeting with him to talk about writing up the first paper on it, and so we are -- We do want to get this out there. I think there's tons of stuff that can be expanded on it.

We actually did this with no funding. That tool is just something we did as a little game, and so I think there's ways to operationalize it. There's all sorts of other information. I mean we only have two axes there, and one was like valuing birds and valuing wind, and so where's the fisheries or where's the -- There is many, many other things that could be added into the model to make it more realistic.

There's a lot that could be done with that. We would love to actually roll this out and start engaging the -- The whole idea is how can we engage industry stakeholders and people and sit them down at a table and, instead of having them just yell across at each other, to be able to say, well, are there those sweet spots? Can we find places where you can actually do things and the earlier in the process, the better?

I mean what we're hoping to do is build things that could help people in pre-application phases or, even if they already have one, go back and evaluate like the time periods and things to try to avoid conflicts and litigation and things like that. I mean the whole issue is can you do that stuff in a way that will make people happy and have a little more confidence in how to move forward, and so we would love to roll this stuff out.

We kind of went out on a limb and just developed some of these things as a prototype, because we felt like that was the best way to show people. Here's a little working model. It's kind of that Lean development idea of like build something, even if it's wrong. Build it and throw it out there and get people to start to look at it and then they can fill it in and flesh it out, because we need to have some economists look at -- We're using very generalized assumptions on the wind energy and the economics and pieces, and there's all sorts of things that need to be tightened up, but I think it's a good -- It's a good platform to get people headed in the right direction.

MR. HOOKER: I mean just to follow up quickly, as I said, because -- Even now, in North Carolina and South Carolina, the areas have been generally identified, and so you may not need to spend as much time on the wind resource aspects, but I think just being able to click on the map and say this is my lease hold, and I want to do something that minimizes impacts to whatever resource, when is the best time to do that, and I think having that available --

DR. HALPIN: We're prepared to do that. I mean if we had any resources to do that, we could actually start on that tomorrow, to actually create an interactive map that would go through all the lease blocks and say when is the best buildable time period and things like that, and so we have the data, and we're kind of ready to move ahead.

MR. PUGLIESE: I guess, to that, but it was going to ask you about a different variation for the South Atlantic. One of the things you highlighted -- Let me reverse it, and I will go back to the habitat question I had. In the Northeast area, it didn't include habitat distributions. In terms of the value for our region and the advance that we've been trying to integrate a lot of that information more effectively in what we're presenting, I would assume that that would probably provide another level of sophistication or characterization that would be valuable to that in our region.

DR. HALPIN: Absolutely, and so the -- I mentioned that the marine life data, the charge for it, was to look at these vertebrates, seabirds, sea turtles, marine mammals, and fish. After the fact, through some of the meetings, stakeholders showed up in the room and said, why don't you have benthic habitats in here?

They have kind of stapled that on at the end, which I think -- In hindsight, it's one of the things they should have thought about ahead of time. I will reserve comments on that, but they did -- They are actually trying to add that in, but it's something that I think lessons learned is that they -- I think the South could do a lot better by doing this right on day one, and so that is something that I would highly recommend.

MR. PUGLIESE: Yes, and the second part had to do with specifically a tool. I like the idea of it on the education side. However, I would be apprehensive to get too much thrown on there, because, when you start talking about that will inform you about timing, I think, in our area, one of the most important things in any of those type of decision discussions are going to need to be like spawning periods for managed species and different things like that. That's going to be critical

to make sure that those get into that discussion loop and that it not be totally focused on marine mammals or --

DR. HALPIN: Even with the marine mammals, one of the things we found is that, in some places, we can't find a time of the year when you have like a perfect time of the year when there is no marine mammals, and so it actually is going to come down to, okay, which ones are you going to be impacting more than others, and, if you started adding in fish spawning time periods and things like that, it's going to complicate it even more. The whole thing we're trying to do is actually put all that stuff on the table, so people are actually making informed decisions and not just blindly drawing things on maps.

MR. GEER: Anything else? Thank you very much, Pat. All right. It's 11:30. We're thirty minutes behind schedule. Scott has the option of either going before lunch and holding everyone from their lunch with his presentation or having everyone be in a food coma afterwards. What is the pleasure of the AP? Do you want to break for lunch now or let Scott go through his presentation and then break afterwards? He's going to be an hour with his presentation, so we're going to go to lunch.

MR. GEER: Welcome back. I hope everybody had a good lunch. I know maybe not everybody is here, but I know Bill wasn't going to be here this afternoon, and it looks like almost everyone else is here, and so we might as well get started.

We're going to start off with the Advances in Navy Research. Scott Chappell is going to do that. Then we're going to go into -- Pace is going to give a brief description or report from the NMFS Habitat Conservation Division, and then we'll finish up with the Climate Change, and so we should still be getting out of here hopefully by four o'clock, at the very latest, and so that's the plan right now. I am going to turn it over to Scott at this time. Scott, you have the floor.

MR. CHAPPELL: The previous talk was about a lot of large-scale stuff, but, today, I will be talking about some fairly small projects that I have been working on and also that I know about that have been completed in the Southeast, and I do appreciate the opportunity to come and fill in for Carter and convey the status of projects that are both in the works and recently completed.

I added a little paragraph or a little sentence up there to be more descriptive and inclusive of the type of work that we've been doing, which is habitat impacts mitigation, and so I will start with the application of a fairly new technology for research and modeling, but, by new, I mean it's been around since the early 2000s, but the uses have been evolving, and I will get into that.

Then I will talk a little bit about the planned demolition and artificial reef development of some old Navy towers off of North Carolina and Georgia, which could be relevant to developing the artificial reef policy for the South Atlantic Fishery Management Council.

The first of three projects I will talk about, under the topic of mapping and habitat characterization and fish utilization, is the Navy's oyster mitigation and post-construction monitoring of the Long Shoal Oyster Sanctuary. This is actually the wording of the consultation and what we were -- Through the consultation process, the recommendations that were provided by NMFS and the agreement to create five acres of oyster habitat, five acres of oyster sanctuary habitat, for the 1.62

acres of impacted bottom at the Long Shoal Naval Ordinance Area, which is on the map there. It's a little red circle. The little yellow box is the ten acres of the Long Shoal Oyster Sanctuary.

The mitigation was -- Since it was mitigating for estuarine soft bottom habitat with the creation of oyster habitat, it was an out-of-kind and somewhat arbitrary in terms of the acres ratio, like 1.62 to five acres. Since I asked this question yesterday about the guidance provided by the FEP that I might expect there to be if it had been available at the time, to have some guidance about what the prescribed mitigation might be, and, for this, the mitigation was essentially covering up estuarine soft bottom with shell habitat, which we consider to be a net positive for the Pamlico Sound ecosystem, because there is lots of estuarine soft bottom out there, but the shell bottom, the oyster habitat, there is many reasons to try to enhance that over the soft bottom, and so there is a tradeoff, tradeoff issues, with different types of habitat in the system.

This shows some pictures of some reef ball habitat that we used. We put out approximately 900 reef balls that were dropped in August of 2013, after years of working toward a cooperative agreement to establish the sanctuary habitat. The work added about 115,000 square feet, which is equivalent to about 2.64 acres, of oyster habitat within a five-acre portion of the designated area. Just for reference, I think the biggest sanctuary in Pamlico Sound is thirty acres. The smallest is five acres, and so it's kind of slightly bigger than the smallest one.

The choice of the -- Previous to this, they used limestone marl, and the North Carolina Division of Marine Fisheries, who we worked with to do this, wanted to use something that was better able to withstand the boring sponges intended to convert the high-salinity oyster sanctuaries into rubble through time, and, eventually back to soft bottom, and so they were looking at using this more resilient material, even though now they're looking into even cheaper materials, like salvage concrete rubble.

Here is a side scan image of the sanctuary. You can see up in the upper-left up and upper-right corners that we've got three-pile dolphin markers, which are expected to last about thirty years, which is a lot longer than the typical buoy markers that they have sometimes used in the past, and that's the clustering of the reef balls, which are about four-and-a-half-feet tall by five-feet wide. Also, the area is fourteen to fifteen-feet deep.

Mitigation with stable oyster reefs is valuable for many reasons. Oyster sanctuary development is a top priority of state-mandated habitat protection plans, and this gets back to that how do you justify say covering over more EFH soft bottom with oyster EFH, and the sanctuary is available to recreational fishing only. There is no oyster harvest for I believe three years, at least three years, on it.

The reef ball habitat is greater in surface area and quality than unstable artificial substrates in the military prohibited area. There is like seven, I believe, or more ship hooks that are out there, which this project was mitigating for, but those things tend to turn over at every big storm. They move around, and they're just slightly below the surface, and it sounds like a really dangerous area to be riding around in, but the sanctuary is a good ways away from that. We're hoping that with the verified oyster coverage density and size and fish utilization, that we'll have successful mitigation for the bombing range impacts on estuarine bottom.

Per recommendations from the TNC's oyster restoration guidance, we followed up the construction with a three-year monitoring project to evaluate the success and mitigation. By the Navy contracting out to do this, the DMF was able to just basically rely on, somewhat rely on, what we're doing there, so they could focus on some of the other sanctuaries, which they have thirteen now.

We wanted to characterize the habitat and water quality for oysters, including, but not limited to, the oyster coverage, density, size categories, and characterize the use of the habitat in terms of fish species presence, relative abundance, and size distribution in the sanctuary and off the sanctuary. There has been some other studies that have tried to look at that in Pamlico Sound, using traps and divers, and they had a problem with the divers and visibility, and the traps had a very biased collection of fish.

Another thing here, as far as goals, is we would like to estimate the value of the oyster restoration in terms of ecosystem services, dollar value per acre, times annual percent coverage, and we've got some literature to base that, John Grabowski's 2013 paper, among others.

The contractor submitted proposals that were limited to survey methods that did not disturb the oysters or have any measurable impact on marine life, because we couldn't be responsible for -- We couldn't be putting gillnets out there, for so many reasons. We might catch a sturgeon or something like that, or a dolphin, and so they had to be not disturbing to the habitat, including disturbing the oysters.

We looked at various methods, including the -- Another thing to know about the study area -- Maybe if you know about Pamlico Sound, are familiar with it, it's very turbid. Oftentimes, after having had experience out there and trying to pick a day that will work for visual methods, it's often zero or near-zero visibility there, and so we had to look into different methods that maybe didn't rely on vision.

We also needed the ability to rapidly deploy, to take advantage of the limited weather and water conditions. That led to us looking at baited underwater video stations and acoustic imaging sonar, or if you're familiar with the DIDSON, and I guess its descendent, the ARIS, and I will talk about that more soon here. We decided to go with those, so we wouldn't encounter as many of the biases and difficulties and limitations of the other methods.

This is a picture of the BUV, or baited underwater video stations, that we have and we have tested, and they work pretty good for dropping around the reef balls and not getting hung up or not getting your camera banged up, and there is a little bait cage in there, and there is a way to measure what you see in the camera.

MR. JONES: How deep do you normally drop these? What depth is the normal area?

MR. CHAPPELL: The depth of water there is fourteen to fifteen feet deep, and those little things are about three feet tall. The oyster reef balls are about five feet tall, four to five feet tall, and so that's the method for looking at fish distribution or fish assemblages inside the sanctuary and off the sanctuary. It's one component of it, but I will get into that.

We're also using pole-mount and digital observers, I will call them. One is just a GoPro camera on a really long pole with a cord going up, so you can look at it on your iPad or something like that, and we're probably going to go with lasers, to get distances and sizes of what we see. On the right side there is the pole-mounted ARIS, Adaptive Resolution Imaging Sonar, with a generator and a pole mount that I've got a diagram of, to use that in tandem with the GoPro camera.

The oysters were observed using the pole-mounted GoPro while observing the same area with the ARIS for signature analysis, and so what I wanted to do is -- This is all working with the contractor who is doing the majority of the work, but we wanted to see what they looked like on a high-resolution sonar and then we could actually see the GoPro camera on the sonar imagery, so we could look at what the sonar said it looked like and then what the actual photograph looked like, so that it may be possible -- We have some data for this that we got this year, earlier this year, that we may be able to just use the ARIS and go around and estimate what the coverage is for a larger area.

The plans for fish sampling on and off the sanctuary involves dropping the BUVs for thirty to sixty minutes and watching the vicinity of the deployment with the ARIS, I would say maybe perpendicular to the approach of the bait. We hope to get acoustic signatures for the fish that we see on the GoPro, so that we can use the ARIS in part two of fish sampling, which would be slow trawling, doing transects within the sanctuary habitat and off sanctuary.

You can filter out the boat speed with the ARIS software, and, if your weather is calm enough, in the frame rates -- You can speed up the frame rate and some other tweaks that can give you some smooth imagery, partly because we're worried that the water clarity is going to limit the utility of the BUVs. We have to have pretty good water clarity there, but the ARIS doesn't need water clarity. It can see through chocolate milk, which happens a lot out there.

2014 was a planning and testing year. We tested the BUVs in late October in Pamlico Sound. The water clarity was good, and it kind of set us up, because we thought, after that one good day, that it was going to be so easy to get back out there and get good weather, but it didn't happen for the whole next year of 2015, just about.

We soaked them for thirty minutes. We had crust crab and squid and shrimp and clams. We kind of wanted to attract all the different kinds of fish that might be there, and we placed -- They were placed beside the reef, and there was no fish observed, and we had heard from the fishermen, from some fishermen afterwards, that they felt that the fish had recently left the Sound, for the most part, and so we kind of got out a little bit too late.

In the future, we plan on soaking it for an hour, which is typical for BUVs, thirty minutes to an hour, which most other BUV type sampling occurs offshore, in much clearer water, where you can actually see what's going on. We also want to make sure that there's actually fish that are still active in the Sound. That's important, and also to employ the ARIS to look at what's going on around the BUVs. It may be that some species don't want to approach the bait, or maybe sheepshead might not approach, and that's historically been with other studies that have looked at the sanctuaries, that sheepshead avoid gillnets. They are pretty good at avoiding things, unless you can see them visually.

2015, survey attempts were unsuccessful, due to that weather window that I've been talking about, and we didn't have the ARIS yet, which was going to be acquired for multiple projects. This just shows a picture there of the chocolate milk that's typical of Pamlico Sound, with near zero visibility.

2016, we had a little bit more luck, which it's very hard to see that. I think we would have to have a dark room here to be able to see that, but we finally got some pictures of the oysters that have been growing on the substrate there for about two seasons. That is two seasons of growth. I don't have a size bar on there to show how big they are, but we've got a lot of pictures. I have only seen a few of them.

Also, on the right, is a screen capture of the ARIS sonar, and it has got a circle around the GoPro mount. You can see the GoPro mount is kind of hopping along the surface, and it's much better to look at in video quality, but I didn't -- I've got some ARIS stuff later that shows some video, but, anyway, we hope to get more of this and actually determine whether we can distinguish between oysters -- Because I could see things that I thought were oysters and other types of things, but, without the actual video to look at it, you can't really tell.

For 2016 and beyond, monitoring years two and three, pending suitable weather, water conditions, contractor availability, et cetera, we hope to acquire the target number of BUV and ARIS samples in and off the sanctuary and acquire more photos of the reef ball surface with associated ARIS video and report on the results. That's just I drew some squiggly lines up there just to envision going across there with the slow trawling. That's it for that oyster sanctuary project, and I don't know if you want to stop here for any questions that there might be about that, or I could just move on.

MR. GEER: It's probably a good idea to take questions now, since we're kind of moving to another topic. Any questions for Scott?

AP MEMBER: What was the total cost of that type of monitoring? I mean it seemed --

MR. CHAPPELL: Well, it wound up being really cheap. We had to go out for bids, and some of the costs were like up to $600,000. We looked at that and said, no. The cost of the sanctuary was like $450,000, and so what it wound up being is substantially less than that, like $70,000. That was it.

AP MEMBER: $70,000 per year or $70,000 for --

MR. CHAPPELL: The whole thing, and we have the fortune of being able to use the ARIS, which was purchased for multiple projects and into the future. We decided to do an economic analysis, and it was a lot cheaper to actually buy it than to rent it, and there's a long story that goes with that, but it's being used by the hydrographic survey group at Midland to look at piers and bulkheads and look at cracks in the seawall and stuff like that, and so we're getting lots of use out of it. We just hope we don't break it. We carry it around like a little baby.

MR. GEER: I had one question. The term "sanctuary", as far as it applies to you're saying oyster sanctuary, but does that mean that there's no harvesting of oysters or does it mean no fishing at all or what does that mean?

MR. CHAPPELL: It's good to clarify that that means that you can fish on the sanctuary, but you can't harvest the oysters for three years. I believe it's three years. After that, I think they open it. They might open it up by proclamation or I'm not sure about that, but the idea is to protect the oysters until they get big enough to harvest, which I think on the cultch planning sites that they wait for three years, and so you might know better.

AP MEMBER: Scott, that was a nice presentation. When you say harvest after three years, is that hand harvest or divers, in this case, or would it be --

MR. CHAPPELL: I think that's -- This is kind of going off memory, because I guess we haven't really worried too much about the protections, but I thought that it was all harvest, any kind of harvest, but I understand that like hand harvest can be substantially less damaging than mechanical methods, but that's kind of a regulatory issue that -- If somebody from DMF was there, they could probably answer that better, but we decided that we didn't want to disturb them at all, because there was some thoughts about actually using a big crane barge and getting out there and actually pulling them out of the bottom and setting them on the deck and just looking at it. We decided against that one for something a little less intrusive, to see if it would work in these highly-turbid environments.

MR. HART: I'm kind of going off of memory too, like Scott, but, from what I remember, there was no harvest allowed in those sanctuaries, and that was part of the reason that they were starting to get that boring sponge coming in, was because there was no harvest to kind of limit the boring sponge from taking over and crushing the reefs, but I mean, like I said, I'm going off of memory too, and so --

AP MEMBER: I have some side scan sonar from other oyster sanctuaries that show mechanical marks running through them illegally, and so it's not perfect.

MR. CHAPPELL: Yes, there is no enforcement boat. Every time I've been out there, I haven't seen an enforcement boat, and so yes, no doubt there is probably some poaching that goes on, but at least with these -- The substrate is very stable. These reef balls, unlike say the marl, limestone marl, that they used -- It might be a little easier to pick up a limestone marl, but to pick up one of these -- I think they weighed 6,000 pounds each, and they're going to be stuck in the mud. They will be stuck in the mud as well and I wouldn't want to --

MR. HOOKER: You probably covered this already, but how many did you end up deploying, a total of all types, or is there just a bunch of different projects that were deploying -- You said at some point they were maybe just doing recovered concrete slabs or whatever and is there a total -- I mean the side scan looked like there was tons of stuff out there.

MR. CHAPPELL: Every one of those little circular structures shown on the side scan is one of those reef balls. They were all the same size, but, of all thirteen sanctuaries in North Carolina, they have used various materials, sometimes smaller reef balls. It depends on the location they put them of what's the best thing to use. They started out with the limestone marl and have concluded that, especially in high salinity areas, they get torn up by the boring sponges and wind up going back to the soft bottom that used to be there before.

MR. BUSH: Thank you for the presentation as well. I understand that Sea Grant is actually putting some efforts towards looking at not just the oysters themselves, but the other productivity in the area, whether or not it's going to provide more essential habitat and things of that nature. Have you all conducted, or do you plan to conduct, any studies to sort of quantify the productivity in that area, outside of oysters?

MR. CHAPPELL: Well, with the fish surveys, I hope to actually get some densities and sizes, because, with the ARIS, you can tell how big the fish is. You can get some idea of how wide it is. You can get some biomass and density estimates, at least for the fish productivity, and then, for what's growing on the oysters themselves, we will have some idea of that, but the scope is fairly limited, and we just want to get something that indicates that the mitigation was successful and we didn't just put out rocks and they got covered in tunicates and the fish aren't using them, which we expect something is going to be using them, but --

MR. BUSH: It might not be a bad thing to get with those folks. I don't know if you're familiar with Dave Eggleston.

MR. CHAPPELL: Yes, I've talked to him. I know him well.

MR. BUSH: They're going to be throwing some gillnets out in a few places to check out exactly that, and I don't know if maybe you all cover enough ground that maybe one or two of those places might not be a bad place to check for that as well.

MR. CHAPPELL: Yes, and I had really wanted to go reach out to NC State when we were in the process of contracting, but we were kind of limited to the contractors that we could use. They would have had to just happen to reach out to him.

We are limited by many things, but -- Because I know that he has done some projects looking at in-sanctuary and off-sanctuary habitat and using gillnets. He used gillnets and traps, I believe, in a recent study that he and Brandon Puckett -- I think Puckett put it out with Eggleston, and they had some difficulties with the visibility and just a limited suite of species that they could catch with that, but yes, I would like to work with them. I have talked to him about it, but that's been like over a year ago. It would be good to coordinate some efforts and get the most out of this that we can. If this winds up being a really good method for low-visibility waters, it could be something to apply to all the sanctuaries.

MR. GEER: All right. Let's move on to your next project at this time.

MR. CHAPPELL: This one is actually Carter's project, which I don't know a whole lot about. I am just going to -- If you guys want to hear more details about it, I can get the actual reports, but it's kind of more a standard kind of -- It's not really new techniques or methods. It's a benthic habitat characterization of Naval Air Station Key West, where they did a biological inventory over a benthic habitat classification, and the purpose of the survey was to help avoid impacts to sensitive habitats in military waters there, since they have to replace docks and bulkheads and things like that.

Here is a map of the study area. It's really -- You're talking about a smaller than postage stamp type of area, and so it's really small stuff, but this is kind of typical of military type of bottom

surveys, unless you're talking about -- That's the range offshore of Jacksonville that goes across the continental shelf and onto the Blake Plateau, but this is close to shore here.

Just an example of one of the survey areas and the kind of stuff they were doing, survey methods were just diver transects using a video documentation and a georeferenced feature notation. They were able to -- As they were paddling around and if they saw something, they could mark it and it was in the -- The system that they had allowed them to know exactly where they were and they could plot it. That's about the only thing close to new that I think they were doing, but they also did quadrat sampling, where you can see on there the diver transects. The quadrat sampling is related to all the points, those little purple points, which denote different types of things, if they noticed a sponge or a coral or something like that.

Then standard fish strip transects, and you can see where those were, and they had -- For the quadrat sampling, they had some seagrass stuff, and so they were able to take the seagrass quadrats and make a map out of it on the right, and so there are some little tiny areas of seagrass mapping inside a military installation. I wasn't going to say a whole lot about that, and so if there are -- I might not be able to answer many questions, but I can definitely get the report, if anybody is interested.

The next one is a benthic habitat characterization of the Patricia Target, which is a jet aircraft range off of Key West. That's another one of Carter's projects. That shows the location, west of Key West on the Marquesas Key. What it is, it's a ship. This is the outline of a vessel that is the target. There were various survey methods, similar to the previous, and just the georeference video transects, which are the blue lines.

For benthic classification, the quadrat sampling for stony corals and sessile biota coverage. That's the little yellow squares, and then standard strip transects for fish. There is a lot of stuff in that report, but I just will go through a little bit here that shows the composition of the sessile community there, and they quantified the fish as well. That's it for those two, and that wraps up the ones about habitat characterization that I was going to talk about. If anybody has any questions about those, I did read the reports, at least, but I could get a report. It's definitely releasable.

MR. PUGLIESE: Just a real quick comment. I appreciate the reports on those. I think, when you were talking specifically about refining the information on species utilization within those areas, within the oyster sanctuary, as part of refining the EFH designation, we had identified oyster sanctuaries as EFH HAPCs for snapper grouper as part of the -- It's under the nursery habitat areas, and so any refining of that understanding is -- Also shrimp. Anything that provides even more -- Plus, it also provides some more information on utilization of artificial reef components and the expansion of that too, and so all that information is going to be critical back support for any of those designations.

MR. CHAPPELL: We hope that we'll be able to identify like those species. Hopefully we'll going to see them on the BUVs first, and the camera, before I can say, looking at the ARIS, whether that signature is this species. That's a little -- It's been done with other studies, where they can identify it down to species, but it takes that -- You've got to get the imagery at the same time as the visual, so you can match them up. One emphasis of the scope of work was to look for managed species, especially ones that are related and associated with a shell bottom as EFH, and so we hope to get that out.

MR. PUGLIESE: Just connected really tightly to that is I think it would be really interesting to see what degree you have early life stages of gag, et cetera, some of those documenting that inshore use pattern, and I think that's real critical, that we add more of that. I would assume that ultimately, if that works well, that hopefully is going to be one of the products.

MR. CHAPPELL: It's so hard to sample in such a low-visibility environment. If you're like near one of the inlets and looking for gag in seagrass beds, it's a whole lot easier than looking for them here, but that's something that maybe a fish trap could find, if they like to get into a fish trap. Different methods work for different species.

MR. GEER: Any other questions for Scott on these things? Moving on, your last topic is the demolition of the artificial reefs?

MR. CHAPPELL: Before that, the next topic under the research and monitoring projects is this one about behavioral impacts, looking at behavioral impacts, and using an underwater acoustic camera surveillance system to look at the behavior of marine life, specifically fish, to pile driving, which is very relevant to the discussion yesterday, but we also want to look at other noise stressors associated with Navy-proposed actions, including such things as the pile driving, but also maybe MINEX, where they blow up mines and -- I think there was a third one, but I can't remember right now.

The study attempts to evaluate the behavioral response of fish to pile driving noise in their unconfined natural environment, and, as we heard yesterday about how fish in cages don't act like they would -- Their behaviors in a cage may be very different than what they would be if they were in an unconfined environment, and so we knew that this kind of research needed to be done, maybe not in this way. It's kind of a work in progress, but the regional focus to the Mid-Atlantic is based on nothing more than proximity and the area of responsibility for the NAFAC hydrographic survey boat, which is what we're using. We got to use their boat in exchange for them using the camera.

We are also limited by the often turbid environment of the estuaries and near-shore waters, where the majority of pile driving is occurring. Observing the behavior of fish in turbid environments suggested using an ARIS, or you probably know it as the DIDSON, if you've heard of it, along with passive acoustic monitoring at the same time.

I guess a little bit about the ARIS. You have heard of multibeam, and this actually has ninety-six beams, ninety-six beams, and it provides near video-quality imagery, down to about 0.1 inches resolution. It's real close to the camera. It's the resolved, but, the farther out you get, the less resolved it gets.

This is just demonstrating some of the survey environments that we'll be working in and that I have done some testing in, like the Naval Station Norfolk and some of the basins there. I got to drop the camera down next to an aircraft carrier pier, and I also looked at the elevated causeway training, where they make a pier out into the water and they pound those big steel pilings into the soft sediment there.

The objectives of the project were to develop the acoustic camera mount, which is shown on the right. The hydrographic survey group put that together for us from recycled materials. They didn't spend barely anything on it.

We also have to coordinate with noise-generating events to acquire acoustic surveillance data, which is very difficult in itself, and also, finally, to evaluate the acoustic video imagery for evidence of response types or response patterns relative to environmental parameters, including the soundscape. It sounds like a piece of cake, right? I don't know what I got myself into.

Anyway, the bottom mount, as I said, was designed by the hydrographic survey branch and used to drop the ARIS, along with the passive acoustic monitor, within the modeled zone of behavioral impact or injury for a pile-driving activity. Experimental treatment is included in a day of pile driving preceded by at least twenty-four hours or more of no pile driving. The control would be, ideally, another day during the same conditions, in terms of time of day, tide stage, temperature, water clarity, et cetera, minus the pile driving. That sounds like a piece of cake, too.

We also had to find a location to watch that has a high enough density of fish to be reasonably assured of seeing something while they're pounding. If you set it out in open water, where fish are just passing around kind of randomly, the chances of you seeing something while the pile driving is going on may be pretty low, but if you put it near a structure that aggregates fish, you could -- Like we heard yesterday, are the fish less likely to leave or show a response because they want to hang out in the structure, that there's a reason for them to hang out there?

We're kind of stuck between a rock and a hard place about where to look, and I would be accepting all ideas for that. This is the early stages of the project, and my thoughts were maybe to look at a migration corridor, if we can find one within the impact zone, to where the fish have multiple options along this path, so they don't necessarily have to take that path and you could say they were randomly there, but they were fairly concentrated, and we could look at their response.

This shows a modeled zone of impact for the elevated causeway training. The little red dot is the origin of the pier on the beach, and the little green circle is where we did our first sample, and so we were within the injury zone of that pile driving in about sixteen feet of water, I believe.

I wish we could turn the lights down for a little bit, but this is a little bit of ARIS imagery. This shows the sand ripples there. We actually looked at a crab pot. That green dot that was on the previous map was a crab pot or was in view of a crab pot, and so we saw lots of crabs coming and going and fighting each other and walking past it sometimes, like it wasn't even there, et cetera. Let's see if we can see this now.

You will see a big school of fish there, close to the camera. You can see their acoustic shadow behind it, and that's one of the larger schools of fish we saw, but, most of the time, there was a crab or two going up and down over the sand ridges or we would see some rays passing by, but it was kind of a random location. It wasn't particularly attractive to fish. You could even see the crabs inside the pot.

Most importantly, after -- I guess, to back up, we have only done one paired sample of a treatment and a control, but now we're going to evaluate how are we going to analyze this in more detail. We've thought about it, but, to get into the nuances of it, we've got some statisticians that we need to consult and some other things.

With the three to four-hour observation periods, we know we're going to have to segment up and look at, in terms of fish and shellfish, individual or group size, orientation, shape, and behavioral categories relative to recorded soundscapes, which are synchronized.

The categories, we haven't figured out yet, but we're considering using things like slow residence, slow entry and exit, fast resident, and then maybe have some subcategories, if you could tell that it's like a startle response or if you can tell the fish is foraging, if you can tell the fish is spawning, which would be something to see that, but -- You can see some of these things and also have the various size categories, which is based on other studies, other recent studies. They have used these size categories and the different sizes and orientations.

Basic shape categories, you can clearly tell a perciform fish, but to tell the difference, just without any kind of validation, between a striped bass and a sheepshead might be a little more difficult if you don't have a good acoustic shadow to see. Eels are easy to see and flatfish. You can see a flounder. Sturgeon are easy to see and rays and sharks. Crabs are readily visible. A really big shrimp, you could probably see a shrimp on it or a squid.

We've got at least a couple of years to finish this project, and it may be extended. In fact, it probably will, based on the complexities that continue to arise with this sort of project, which, after the talks we had yesterday, you can imagine. That's about it for that one. The next one is the artificial reef development of the Navy towers.

MR. GEER: I will take a couple of quick questions about that project, if anybody has any. That's really interesting. I will ask a question. The ARIS, you said, was cheaper to buy than to rent? What's the cost of it?

MR. CHAPPELL: The rental price is $750 a day, and you have to rent it for a period of time, and the availability of it -- The lady, the vendor, the like one vendor in North America, said that -- They are very high in demand during the summer season, which is when we want to use them, and so we were thinking about that and over a ten-year period how much we might be spending and just getting minimal use out of it per year, like ten days of use out of it, and that it would be -- It would pay for itself by -- I think we would save over $100,000 or something like that over ten years. I had to do an extensive economic analysis to justify buying that, and also just the use on so many different projects makes it beneficial.

MR. GEER: How much did it cost?

MR. CHAPPELL: I think it was $70,000 for the ARIS and $20,000 for the rotator arm. We had a rotator arm with it, so we can drop it down and rotate it around. It's not that much. The technology continues to evolve, and they do have competitors. They have Blue View and there is also a Teledyne system, I believe, that's similar, and so they're in the arms race right now to see who can get better.

Right now, Sound Metrics has the highest resolution, high-definition sonar like this, which is not the model we got, but it looks very similar. It's one that is three megahertz, and it sees out to a five-meter identification range. Then the detection range is out to fifteen meters, but it can see very detailed imagery. The one we got is a 1.8 megahertz, which is equivalent to the DIDSON, the predecessor DIDSON.

MR. GEER: All right. Moving on.

MR. CHAPPELL: All right. This next one is about a couple of projects, one up off of North Carolina and one off of Georgia. Basically, it's what to do with the Navy towers, better known to the Navy as the TACTS Towers. They were used for scoring dogfights. With the advent of GPS, they became obsolete. Now, considering all the maintenance costs associated with keeping the navigation lights up and the boat ramps up, or the boat docking facilities up, and all painted and up to code all of that, they've decided that it's time to take them down.

I have been working on the North Carolina towers, and that just shows you a picture of one of the North Carolina towers on the right. The ones off of Georgia actually have like -- Some of them have a helicopter pad, and so they're a little bit bigger, and there's eight of them off of Georgia and four of them off of North Carolina. In the picture on the left, that's actually when they were installed, back in the 1970s, and so you see the big old crane and they were put down in pieces, and so they've been around since the 1970s.

This just shows the study areas, respectively, for the ones off of North Carolina. They're in about ninety feet to 120 feet. They are seaward of federal waters, which made the environmental compliance documentation environmental assessments, and the same thing goes for the towers off of Georgia there on the right. That shows you where they are, offshore from Kings Bay.

MR. GEER: How far offshore are they, exactly?

MR. CHAPPELL: The ones off of North Carolina are anywhere from seventeen to thirty-two nautical miles, and the ones off of Georgia, it looks like they're about thirty to forty nautical miles offshore, something like that. It's a little bit flatter and wider down there, but I'm not going to talk too much about the Georgia operation. They actually got their funds. They reached a finding of no significant harm recently, and they're in the process of getting it funded.

I will say a little bit about it, but they already have the artificial reef permits. The State of Georgia is taking on the material, and they are having to cut the towers at the mud line and move them to the permit area, which is actually just surrounding the towers. I don't know exactly when that's going to be done, but those towers have a lot of stuff growing on them. They've got a lot of people interested in what happens to them. There's a lot of growth and places to fish, and it looks like they're going to keep the structures in the water.

For the North Carolina towers, we had to evaluate numerous alternatives, and we wound up settling on the ones that minimize the logistics and costs, safety issues, and environmental impact. On the left, just I'm showing a schematic of the vessel traffic in the area. It shows how the AIS data, automated information systems, how things go around the towers. Of course, they would go around the towers, and it seems like a prime place to acoustically monitor ship traffic noise, maybe.

Anyway, on the right, is a diagram schematic showing a Panamax vessel, which goes down about forty feet draft at full load, and one alternative would be to create the artificial reef by cutting them off at the seventy-feet of clearance, navigational clearance, required by the Coast Guard and dropping down the sectioned pieces around it and making a permanent area there.

The other option, Alternative 2, which is our preferred alternative, is to cut off the towers at seventy feet and scrap the stuff that's above, and there is many reasons that we chose that preferred alternative. It had to do with essential fish habitat. The towers are currently not considered artificial reef EFH, and there could be hard bottom around them. We have a hard bottom map in the OEA, and that's from the SEAMAP data.

Also, we have some stuff from the TNC ecoregion assessment, which is somewhat built on that, and the U.S. Seabed Data, but there is the South Tower. There is a purple line there indicating possible hard bottom, and so, if we were to drop them around there and make an artificial reef, we would have to do a survey.

There is also some interest from the recreational diving and fishing community and some concern that making them into artificial reefs changes the fish community at the location from -- You've got a structure that spans the water column to one that just spans thirty feet off the bottom, and so they think the opportunities for shallow-water diving would be removed. They would lose their visual markers on the surface, and so there is definitely some concern from the fishing community, but we have to do something with these towers. We can't leave them out there.

We're just in the process of evaluating the impacts and, considering how little hard bottom there is out here, based on the limited mapping -- The mapping is not very good, and so there could be some small areas out there. These places were like an oasis in the desert of sand-bottom habitat, and likely had mostly facultative structure-oriented species up in the upper areas, and so they could take them or leave them. Maybe not -- You know, attracting fish for fishermen, but not necessarily production, and that's not an EFH issue, but it's something to consider in our discussion in the document.

What's left on the bottom is these thirty-feet tall studs, and, by the way, this hasn't been done. we don't even have the funds yet. We're waiting on some things, but I have already talked to the Corps and the Coast Guard about everything. No permits are needed for just leaving the studs on the bottom. It's just an obstruction that's noted in the automated wreck and avoidance obstruction system and a notice to mariners.

We started out wanting to make a nice artificial reef there, and then things changed. We couldn't get a permit holder. We talked to NC DMF about taking them on, and they said they may take them on if we did everything, pretty much, but we couldn't take just a may. We needed to have something definitive that somebody is going to take the liability. It's a small amount of liability with leaving a structure on the bottom, which it's kind of interesting that off of Georgia that they told them to cut it at the mud line, because it was a navigation hazard, but yet they just moved them just a little ways away, to also be a navigation hazard, and so I don't know, but, in a different sector, they had a different requirement.

Anyway, all of our expected completion date for this OEA is late 2016 or 2017, and then there is the process of funding it, and so it will be a while. The fishermen will get some more time on it to fish and they can also go to the U-85 German wreck right there on the left, which is just south of one of the towers. That's just a map showing all the shipwrecks in the area, many of which might not be there anymore or covered over with sediment. That's about all I have for that, for the tower demolition, but I could answer many questions about it.

MR. HARTER: Scott, is that all the way up to -- I can't read it from here. Is that going all the way up to R8?

MR. GEER: In Georgia?

MR. HARTER: R8, it's kind of in a borderline area between North Carolina and South Carolina. You've got R7, R6, and R8. Does that include all of those towers all the way up to R8?

MR. CHAPPELL: Yes, and R8 is actually the farthest to the east and the north.

MR. HARTER: It's funny. Like South Carolina fishermen, they also think they're South Carolina Navy towers, and so when you say Georgia, but a lot of times they are off of --

MR. CHAPPELL: That's just a location there, and so --

MR. HARTER: Okay. R6, R7, and R8 are the ones in our area.

MR. CHAPPELL: Yes, the South Carolina/Georgia towers.

AP MEMBER: Federal waters is federal towers, right?

DR. ALEXANDER: Could you give us some sense for the timing for the work on the Georgia towers?

MR. CHAPPELL: They just got their funds recently, and so their environmental compliance documentation and their consultations are done. They just have to get the funding document, and I believe they said they had the funding document, and so I think within the next fiscal year that they're going to be going out and looking for contractors and they're going to do it fairly soon, I would say within the next year, but I gave you some contact information. If anybody else wants some contact information for who to talk to about it, it's our counterpart down in the Southeast Naval Facilities, Engineering Command Southeast, out of Jacksonville. A guy there is the project manager for it, and he could answer any questions more specifically about it.

MR. GEER: In Georgia, we knew this was coming and we started a process a number of years ago, where we were in constant contact with the Navy, where we're working with them. We went ahead, when we had to renew our permits, and we included these eight towers that would eventually be under our purview as well, and so we've been kind of -- They've been there, and we've been kind of embracing it, and we're just waiting for it to occur. Hopefully it will occur before the permit has to be renewed again, but they're in our permit now and under the thing that when they get put on the bottom in the proper approved method, then we will take ownership of them at that time.

MR. HARTER: Could you expand a little bit, one of the two of you, on what they're going to do with them? It didn't sound very logical, from the way that he described it, that they're just going to move them a little bit and leave them as navigation hazards.

MR. CHAPPELL: I guess, once they talk to the Coast Guard down there and they satisfy the Coast Guard, that's kind of where that -- I suggested that they do the same thing, cut them off at the

clearance, just like that. It's basically like the diagram that I had right there. It's similar to that, except I think they're going to carry them a little farther away. My impression was they weren't going to drop them right around the site of the towers. It didn't make a lot of sense to me, but as long as they get on the bottom and they continue to be habitat, that's the bottom line, I guess.

DR. SEDBERRY: Just one little remark. They are great lionfish habitat off the coast of Georgia.

MR. GEER: We appreciate that comment, George. We have gone out and we -- If you go to our website, you can go to our artificial reefs and you can click on any one of these and it will come up, and they will show you a video of the areas. January Murray, who runs that, she made a point of showing like nothing but sand in the distance, and then you come up and you can see the fouling organisms and you can see the massive schools of bait and you can see the large pelagic species around it as well.

There is a lot of life in those areas, and so the question of whether or not we're -- Like you said earlier when you were talking about oysters, but it's like to put oyster habitat down, you're affecting soft-bottom habitat. Yes, sand is a habitat, but I think these are enhanced habitat, in my opinion.

MR. CHAPPELL: It's about diversity, right? You've got have diversity.

MR. GEER: When you were saying moving them, I think they're just falling down. They're taking them down to the bottom, but I don't think they're dragging them off any great distance at all.

MR. CHAPPELL: It wouldn't seem logical that they would. It would be a lot cheaper just to drop them right where they are, unless there is surveyed hard bottom, because they're supposed to do a survey as well, I think, or something.

MR. GEER: As long as they meet the Coast Guard's and the Corp's clearance and the bottom, we'll be happy to take them.

MR. HOOKER: I am interested in any environmental -- Did you do an environmental assessment for the decommissioning?

MR. CHAPPELL: Yes, I'm working on the environmental assessment for the North Carolina towers, and our Southeast office is working on the Georgia towers, but they're pretty much winding up. They're done.

MR. HOOKER: As a part of that decommissioning, did you document the growth and kind of document some of the impacts of those being there? I'm very interested in examples of structure offshore.

MR. CHAPPELL: It's talked about in the OEA, what's going to be lost if you remove the scrap material, because there's stuff growing on the stuff that's going to be scrapped, and it's going to be gone, but there will be stuff that remains on the studs on the bottom, and so definitely some environmental impact, but nothing we consider to be significant.

MR. WILBER: I just wanted to point out the subtlety here, that this is so much easier to do in the South Atlantic than it is in the Gulf of Mexico. In the South Atlantic, artificial reefs are essential fish habitat under the Snapper Grouper Fishery Management Plan, but we have, by agreement between us and the council, defined artificial reefs to be structures that are in areas designated to be artificial reefs and managed by some entity responsible for managing that. It's not just a structure that haphazardly happens to be out there.

For that reason, the towers don't really become artificial reef until Pat actually takes possession of them and puts them in his designated artificial reef site, and so that greatly simplifies the EFH consultation and the environmental reviews, whereas, if we're in the Gulf of Mexico, they would be considered an artificial reef under the fishery management plans there, regardless of who takes ownership of them or where they are located. It would just make it much more difficult to do.

MR. CHAPPELL: Thanks for that clarification. That was good.

MR. GEER: Any other discussion on this? I mean this is a work in progress, and it's a number of years, but it seems like it's coming to reality pretty soon, and so that should be a good thing.

MR. CHAPPELL: Yes, and, unlike the Georgia towers, the North Carolina towers got the attention of a certain senator named Walter B. Jones, who was real curious, because his constituency sent him a letter with about a hundred signatures on it from fishermen concerned about what was going to happen with the towers.

MR. GEER: Okay. Great. Scott, thank you very much. We greatly appreciate it.

MR. CHAPPELL: Thank you all for having me.

MR. GEER: All right. Next on the agenda is an update from Pace from the Habitat Conservation Division.

MR. WILBER: Depending on what part of the agenda you look at, you're either going to get an update on what's just generally going on, a discussion of the Port of Miami, or a discussion of the mining of offshore shoals for sand. One thing kind of led to another, and the only presentation that I really have that I can give is the one on the Port of Miami. If you want to talk about the other issues, I have a couple of slides here and there, but I think most folks are kind of anxious to move this meeting along, and so we will focus on the main show here.

Many of you are aware that the dredging of the Port of Miami has been alleged to cause considerable damage to coral reef habitat. There has been lots of stories in the news media about this, going back the last couple of years. There are open law enforcement investigations on this, and there are lawsuits involved in this, and so what I'm going to talk about today is sort of a status report on a survey that the National Marine Fisheries Service did back in December. I am not going to be presumptuous to talk about the entire project, all the little nuances of the various investigations going on, because much of it involves other agencies as leads, other than NOAA Fisheries, and I will be very careful about treading into territory that is not mine to talk about.

I also want to acknowledge that giving this presentation is a bit of a stretch assignment for me today. The folks who really know about these surveys and the results are Joselyn Karazsia and

Kurtis Gregg in our West Palm Beach Field Office. Because of all the controversy, we're trying to build depth on the bench here as to who can talk about this in a somewhat authoritative tone, and so this was my chance to do a stretch assignment and so if I can handle talking about the Port of Miami work.

This slide just gives you a quick overview of the port itself, and we're going to talk mostly about what's out here in the entrance channel, which, in some places, is called the entrance channel of the Port of Miami. In other places, it's called the Cut-1 Channel or the Cut-2 Channel and so on.

Now, this is a zoom into the entrance channel. The federal channel is here, and there are various near shore and offshore hard bottom and reef structures here. The furthermost from the shore is the Outer Reef, and we use the channel to break it up into the Outer Reef North and the Outer Reef South. There is another moving shoreward. There is another structure there. That goes under various names of Middle Reef, Inner Reef, or Reef 2. We're going to call it Middle Reef for this particular presentation, and, again, the channel divides it into Middle Reef North and Middle Reef South. Then, at this area here, where the channel kind of looks like a human elbow, is where there is a near-shore ridge complex and, again, the channel divides it into northern and southern components.

Now, if you go online and get some of the wonderful data that's available from Nova Southeastern University or some of the other sources, all of these polygons out here that I just sort of have uniformly a drab kind of gray are all colored up to show you all kinds of richness of detail of what exactly is in these near shore hard bottoms and reef areas.

Soon after this dredging began in November of 2013, all sorts of reports started coming into us and coming into other agencies, from divers, recreational boaters, scientists from the University of Miami who happened to have field sites nearby, talking about various things that they've seen that were upsetting to them, largely in the form of large turbidity plumes, excessive rates of sedimentation, or actual smothering of coral reef organisms.

We also had sort of the great fortune, or maybe misfortune, depending on your perspective, of Google Earth updating its imagery of the Port of Miami at about the same time, and this is an image from 18 January 2014, and, for a long time, it was the most current image on Google Earth, and it made its way into the *New York Times* and a few other news media events. You can see here, at that time, the dredging was occurring in the elbow of the channel, and you can see the white sort of plume that's extending from the dredge and the spider barge, and we'll zoom in in a moment, to see a more closer look of what the dredge and the spider barge actually look like.

Later that year, on December 15 of 2014, Google Earth also updated its imagery again. This is the image we saw before, and this is the new one. At this point, the dredge and the spider barge had moved out to now basically be parallel to or in line with Middle Reef, and this image also has made its way into the news media several times.

Now, we're going to zoom in and kind of take a little closer view of this whole dredging operation and get a sort of better understanding of exactly what was going on, to kind of set the context for what we'll see in a few minutes from the surveys.

AP MEMBER: Help me understand the water depths we're talking about here.

MR. WILBER: About thirty-five to forty-five feet. It depends upon exactly where you're at. The channel was being dredged, I think, to fifty-five feet when you added all the various overdepths and additional allowable clearances and so on. This is the dredge here, and the dredge is hooked up by a pipeline that goes to a spider barge, and this spider barge is capable of servicing multiple dredge scows at the same time. Right now, there is only one dredge scow present at the spider barge, but, basically, you want to keep the dredge dredging constantly, and so you want to pump the material to the spider barge and have the spider barge pump it into the scow, and the scow then takes it out to the ocean disposal site, which is out in federal waters.

By having the right number of scows available and shuffling in through the system at the correct rate, you can pretty much have the dredge operating constantly and minimize costs and get the project done as quickly as possible.

One thing to note, and you will see this again in the next slide, is that this entire operation has the potential to produce turbidity or high sedimentation rates, and you can see here the sedimentation that's really associated from the dredge itself working in the channel and then, over here, you can see the turbidity that's tied to the actual spider barge operation, and a part of why you have a lot of turbidity here at the spider barge is that any kind of hydraulic dredge is going to be moving massive amounts of water and only a couple of percentage, by weight, of solid material, and so, in order to have an economic load that you take out to the ocean disposal site, there's a concentration of solids that occurs by basically having overflow at the spider barge, so that the material that remains in the hopper has a high percentage of solids in it, so you can take it out, and so you're constantly generating turbidity there from the overflow of the dredge filling operations.

This is the same picture, just now kind of zoomed out a little bit, and you can kind of see my point, is that the turbidity from the dredge itself is relatively localized around the dredge, but the turbidity from the spider barge and the overfill operation can be quite extensive, and if you want to know, you can actually measure the length of this plume from the top here to the spider barge, and it's a little over 800 meters, and there is other measures of the size of this plume as well.

DR. ALEXANDER: Pace, how do you know -- Obviously the tide is going out, the plume is behind the dredge, towards the spider barge, and how do you know that a lot of that turbidity isn't just being created at depth and is coming up to the surface and moving out with the tide and it's from the dredging operation itself?

MR. WILBER: My answer to that is the tide is not necessarily affecting these plumes. This area is pretty close to the Gulf Stream, and so the currents associated with the Gulf Stream have a pretty strong influence on how water moves around in this general area. I am not saying there is not a tidal signature, but it's not like a stereotypical kind of tidal signature, and, also, if you have ever been out and watched one of these spider things kind of fill -- I haven't been to this particular site, and so I did not see this particular spider barge, but I used to work for the Army Corps of Engineers, and, in that capacity, I saw lots of spider barges, and it looks like a milkshake that's coming out of the overflow, and so it would not surprise me if that was the case here.

MR. ELLIS: So are they doing the dredging while there's not a transport barge there? Do they have some way to store it?

MR. WILBER: No, they have a barge there constantly. I will digress a little bit right now from the actual survey we did back in December and refer to the paper by Barnes that was in the package of material that Roger posted on the website. This paper is published. It's in the *Journal of Remote Sensing of the Environment*, and it was published last year by the University of South Florida.

As this project was kind of unfolding and lots of information about it was starting to appear in the media, the University of South Florida, in collaboration with its partners, said, hey, maybe we can use satellite imagery to examine the size and the extent of this plume, and so they were able to first show that they could actually find the dredge plume in the satellite imagery. Then, what they were able to do, because it was based on satellite imagery, they were able now to basically create a ten-year baseline on a project that they had just started.

They went back in time and got ten years' worth of satellite imagery and were able to use their oceanographic partners to create a model to determine what the typical sedimentation plume associated with the Miami Outer Entrance Channel would be under various oceanographic conditions, and so they were then able to say, okay, given the oceanographic conditions at the time that this dredging was occurring, what is the size of the plume that you would expect? Then they were able to generate that plume in a computer and then subtract that plume from what they actually observed from the satellite images taken at the time of the actual dredging.

That's basically what you see here. The dredging led to a plume that was seven times bigger than what you would normally see associated with this inlet, and it was observed six times more often. Now, remember yesterday, when we were talking a little bit about piling strikes, and they were kind of related to lightening strikes, and the only difference being that a piling project is a lightening strike that lasts for six months.

If you go in and read this gentleman's paper, you will actually find that this dredge plume is pretty similar to what you see with a hurricane. The difference is, rather than lasting for a week, like a hurricane, it lasts for almost fifteen months, and so the corals at the outer entrance channel were basically subjected to hurricane-like conditions, in terms of turbidity, for a period lasting almost a year-and-a-half. Again, as this information is coming in, a lot of it's coming in with pictures, and here are some of the obvious pictures, showing sedimentation.

DR. HALPIN: A quick clarification. I haven't read that paper yet, but they were looking at the area and duration, but did they have any metrics on the intensity or magnitude of density that they were getting? I am just curious.

MR. WILBER: Yes, they do, and I don't remember exactly what the units were, but yes, they were able to do it.

DR. HALPIN: I will check out that paper. Thanks.

DR. WHITTLE: Pace, when we were permitting this, we obviously didn't have this information, but is this unusual, to have this much of a sediment plume with this sort of operation, or should we have known and pressed harder?

MR. WILBER: I am not going to venture into that territory. I will say that EPA did send the Corps of Engineers and the port and the dredge company, which collectively I will just refer to as

the Corps here, a couple of letters, one of which identifying over a hundred violations of how the -- Turbidity-related violations of how the spider barge was operating and how the scows were transporting material out to the ocean disposal site, and so if you want to take that as an inference that this was an unusual event, you probably could.

Here is a couple of pictures showing some of the sedimentation, and basically these are scleractinian corals that have had a large amount of sediment kind of fall on top of them, and we will talk in a few minutes about scleractinian corals deal with sedimentation under these conditions and how it leaves sort of a fingerprint that we can use later, during a survey, to identify perhaps some dredging-related impacts.

AP MEMBER: (The comment is not audible on the recording.)

MR. WILBER: It's hard to see, and so here is a Montastrea coral, and it's got some tags on it, because it's been part of a previous baseline monitoring. This particular picture was taken during what most folks refer to as the delineation survey, which was something that they were required to do under the Florida DEP permit, and then this picture over here on the right is a close-up of that. Actually, I think it's this coral, but now he has spun around to the other side.

This is a picture of an octocoral that has impacts. One of the things that you know, both in this particular octocoral colony, as well as the ones in the back, they look a little odd, for those of you who actually dive and look at octocorals, and they look odd, because you don't see the holdfast and you don't see the stalk coming up from the holdfast and then the branches going from that, and that's because the sediment has covered the holdfast and has basically accumulated around the octocoral, up to the point of where it's even covered some of the initial branches of the octocoral and is only leaving essentially what is the top of this particular colony present.

Based on all of that information, last fall, the folks at NOAA Fisheries, and, again, largely led by Joselyn Karazsia, decided it was time to go out and do our own survey to begin to examine these impacts and begin to quantify them and to essentially determine what the extent of the impacts are, so that we can evaluate whether the mitigation that was already being required under the Florida DEP permit was sufficient or whether additional mitigation was going to be necessary for this project.

There are lots of areas to look, and the six areas to look are all kind of identified here, but in a one-week field operation, you can only do so much work, and so the group decided to focus first on Middle Reef North, and Middle Reef North was focused on partly because of the pictures that showed the extensive sedimentation that was occurring there, but also because it appeared, based upon the anecdotal information, as well as the baseline data and the delineation survey, to be the area of these six that probably had the largest spatial extent of the impacts, and so basically we went after the biggest area first.

This is just a quick setup of how the surveys were actually done, focusing first on the panel on everyone's left. Down here is the study area at Middle Reef North. Up here are two reference areas, sometimes called control areas. Most of the project reports just call it U.S. ACE, U.S. Army Corps of Engineers control sites, and so there are two of those, and there were nine impact sites that the Fisheries Service examined back in December.

Over here on the right, we have a sort of quick idea of how the survey was kind of laid out. We basically identified bands at varying distances parallel to the channel, 100 meters, 200 meters, 300 meters, 500 meters, 700 meters, and then more than 700 meters away from the channel.

You can't really quite see it well in this particular picture, but there is a line that kind of goes through the middle here, and that sort of separates what is relatively low-relief habitat on Middle Reef North from what is relatively high-relief habitat. Now, in this greater scheme of coral reef management, even the high-relief habitat here would probably fall on the low-relief part of the spectrum, but, within this local area here, that kind of difference was pretty obvious.

One other thing that's worth noting is that, here in this high-relief area, there was a natural kind of sand channel, and there's been a lot of discussion about how many natural sand channels there are within here.

Now, when we laid out our sampling plan, we decided we could really only look at one area within the high-relief and the low-relief part at each of the varying distances and so, in order to try and provide some opportunity for randomization of where exactly those observations would be collected, we took each of these areas and divided it up into four boxes and then picked which of those four boxes, at random, the survey work would actually be done and then located the survey point at the given distance from the channel.

This is a little better version of the same slide, and so this shows you -- The red dots are where we ran surveys in the low-relief part of this reef feature, and the gray dots are where we did surveys in the higher-relief part of this reef feature, and the absence of a red dot here, over that 700-meter mark, is just simply the logistics of trying to get work done around weather windows and vacation times and everything else.

This is a little bit of a digression before we get into the actual results, but one of the things that is always important to note is that our surveys, with the exception of one other survey, is the only one who really kind of looked at the entire Middle Reef feature, particularly the higher-relief part of the Middle Reef feature. All the previous surveys and the required during the project monitoring and the project baseline monitoring that was required under the DEP permit was all pretty much assuming the impacts were going to be within that 150-meter mixing zone that's part of the Florida water quality standard.

For that reason, almost all of the past surveys were in all kind of in this area, kind of adjacent to the channel, and so we kind of took this broader look, and we also looked on both sides, both in the higher-relief area and the lower-relief area. The one exception are these points that you probably really can't see here, but, basically, there's a bunch of small little dots here that were done by the Corps of Engineers and its contractor as part of the delineation survey that was required by the DEP permit. The purpose of that delineation survey was basically to assess what the true spatial impact of the project was, and that would then fold into the post-project monitoring later on.

This is, real quick, how we did our surveys. Basically, we went to the point and we dropped a buoy. A diver went to the west for fifty meters and a diver went to the east for fifty meters. Every meter along that transect, they would collect information about what was present on the bottom and the condition of what was present on the bottom. We call those surveys the two line intercept

transects, each fifty meters long and yielding a hundred-meter-long kind of thing. The purest ecologists in the room will note that this is not truly a line intercept survey design, but this is what we're going to call it for this project.

In addition to those line intercept transects, we did six belt transects that were shorter, ten meters in duration, and there were six of those, usually two south of the line intercept transect and one north of the line intercept transect, and much more detailed information that we could use to identify species and size class structure of the coral and sponges present were collected there. I'm not going to discuss any of that data today. To be honest, it really hasn't been thoroughly worked up, but that data is ultimately going to plug into the habitat equivalency analysis that's going to be used to determine what the mitigation requirement of the project is, and so what I'm going to talk about today really are just from the line intercept transects.

MR. HOOKER: When you say mitigation, you mean the compensatory mitigation? Is there going to be a compensatory mitigation component as a result of what has occurred?

MR. WILBER: Yes, and so the project already had a compensatory mitigation requirement in the permit, and that amount was determined based upon what the forecasted level of impact would be, and so now, if that forecasted level of impact exceeds what the compensatory mitigation requirement was, then that mitigation requirement, presumably, is going to be raised.

Here are some pictures from if you want to kind of look at the little-known names up here, and so Reef 2 North, 200 meters, low relief area. This is a typical Montastrea coral that was seen, and if you look at it, you can see all of the sediment that's accumulated at the base. Now, we saw some pictures of the same kind of coral a few slides back, and that particular coral was covered with sediment. The way the coral deals with that sediment coverage is it basically uses its mucous and the little things that it can do to move things around and it basically just sort of pushes it all off to the side, and gravity kind of takes over and it starts to accumulate kind of down at the base.

These top corals, or the top polyps, they shed the sediment down towards the base, and if the sediment can't be shed by the polyps that are at the base or by the currents winnowing the sediment off of those polyps, then the sediment kind of accumulates and then those polyps down at the base kind of die, and you end up with what kind of looks like a halo around the living coral tissue. It's kind of like the halo of death. It's not really all that good of a name, but that's sort of what it looks like.

Now, one of the questions that comes up is, well, when you look and you see this kind of damage, how do you know it's recent and conceivably done within the time at which the dredging occurred, as opposed to something that happened years and years and years ago, and so what the divers do in those cases, and this is the same image here, but, right now, the divers have kind of used their hands and kind of fanned away the sediment off the base of the coral.

You may not be able to see it in this kind of setting, but if you look at it on the computer screen, it's pretty obvious, but you can see all the little cups are all very clear here, and all the little fin calcareous structures that are part of a coral cup that help the polyps stay into the cup itself, the calyx, that would normally erode away very, very quickly. They are all still present here, and so this is an indication that this was a very recent sort of event, conceivably within the time period in which the dredge was there.

This is another picture kind of illustrating the same point. On the left is a soft coral adjacent to a scleractinian coral, and on the right is the same image after the diver basically fanned the sediments away. Again, you see sort of that halo of dead polyps around the scleractinian coral, and then eventually you can also see the holdfast for the octocoral in the kind of position that you would normally expect it to be.

Then this is another more complex picture of what you would see. This one, if you note by the station number, this is 500 meters away from the channel, but this area here is evidence of sediment accumulating and burying the holdfast of an octocoral. Here, we see, at the very edge, we see another halo around a blushing star coral, all through here. We have sediment kind of completely covering up the algal turf community, and we also have some sponges that show some impacts as well.

Sponges are pretty ephemeral organisms. They almost kind of dissolve instantly, and so it's hard to kind of really rely upon the sponges themselves an indicator of stress or of an impact in this kind of a project unless you're looking at a really large barrel sponge, like a Xestospongia muta or something like that.

Here is some of the data from the line intercept transects, and I will kind of start up here and then kind of work my way across and then down, but this first graph up here in the upper left, this is looking at the hundred points done at each station and totaling up the percentage of those points, where we had what the divers believed to be project-related sediment accumulating over natural hard bottom habitat.

The blue bars are from the western area, which was the low-relief habitat in Middle Reef, and the red bars are the higher-relief habitat within Middle Reef, and we go from close to the channel to farther away from the channel out here, and then, over here, at the very end, are the two reference areas, or the U.S. ACE control sites, that were about five miles away.

The obvious thing, from this particular picture, is that very low amounts of -- Very, very low percent cover of sediment over hard bottom at the control areas, whereas you had much higher rates of sediment over hard bottom at all of the distances examined, even the one 700 meters, which was the farthest one that was examined in this survey, away from the channel. Again, that roughly correlates with that Google Earth image we saw before that you could see a noticeable plume 800 meters in length.

This particular graph here, the upper-right corner, all the colors and everything is pretty much the same, but now, rather than looking at the frequency at which there was project-related sediment over hard bottom habitat, this is when the divers actually stick their rulers in the sediment and try to measure the thickness of that sediment layer.

That is a practice that really Florida DEP is relying upon more and more as a way to determine impacts of sedimentation on hard-bottom habitat and one that we in NOAA are learning how to use and use well. One of the first rules of thumb is you learn to take a metal ruler and not a plastic ruler out into the field, because you do get different rates of refusal based upon the kind of material that the ruler is actually made of.

Again, you can look at this and see pretty much the same picture. At the U.S. ACE control sites, it was typically less than half of a centimeter of sediment accumulating over the hard bottom, whereas at all of the other stations in the purported impact area, you had a much higher amount of sediment layer thickness, or the depth of the sediment layer, and you don't necessarily see a linear kind of response with a gradual dissipation of that. There seems to be real kind of pockets to where the impact was most severe compared to others, and anybody who has actually done a lot of water quality sampling in the ocean, one of the first things you realize is that the ocean is pretty patchy too. It's not just sort of a big homogeneous sort of mix, and so the sedimentation would be pretty much the same way.

The lower left corner, we have a graph that shows the percentage of the scleractinian corals observed along each line intercept transect that were observed to exhibit some sort of partial mortality or other indicators of stress, that halo being the most obvious indicator of stress, and while it's complete mortality for the actual polyps involved for the entire colony, it's a partial mortality.

Again, it's not quite as striking as you see in the graph above it that talks about sediment accumulation over hard bottom, but you do see the same sort of general pattern, in that the U.S. ACE control sites are fairly low in the number of corals that had some sort of stress-related response there and you, and you had higher rates at all of the reported impact areas, and so the question is what kinds of things could be happening at these control sites that led to some signs of partial mortality?

We also had some coral disease outbreaks at the same time as the dredging, and that's sort of what has become the big issue, is much of the mortality we see in the project area is related to these broader regional disease outbreaks versus project-related mortality or is it a subtle thing that the project made the corals more susceptible to those broader kinds of things, and that's where most of the mental energy is kind of going now, to sort of addressing those types of questions.

Then the last graph here is octocoral colonies exhibiting signs of partial mortality. Again, it's not quite as clear here as in the scleractinian corals, but you do see the same general pattern, in that you have a lower rate among the control sites than what you saw in at least some of the purported impact areas.

AP MEMBER: Looking at the sediment plume and how it's settling out reminds me too of some laboratory work, where you're looking at the actual material that was dredged, and you might have -- Have you done anything to look at what the dredge material is and have settlement rates, based upon the size of the grain size and such -- So you could have just two grain sizes and one is just settling out right here and the other is settling out a lot further down. Have you done any actual look at the dredge material and the grain size, to see what, if anything, that might be contributing to?

MR. WILBER: There is a lot of discussion about when the divers are out there and making their field observations and they see what they believe to be project-related sedimentation at a particular site and how do they infer that, and part of it is knowing that the dredge material itself has a different composition than what the native sediments were, but then also having to factor in the sorting that would occur because of the different amounts of energy available at different times in

the dredging cycle. That might lead to coarse material settling out at a place at one particular time, but fine material at a later time.

Then you have the whole mixing issue with the native sediments kind of coming in, and so there are various ways to do that, some of which the divers can do with making really precise observations with these things the geologists call comparators with them out in the field, and so they have pictures or actual sediments of known size on something, and they can sit there and match it directly to what they see in the field.

There is also x-ray crystallography that's available for these kinds of analyses, as well as just doing some sediment grain size analysis, and all of that is being discussed, and there is more surveys that will be occurring in the coming year, and exactly which of those methods is going to be used, or a combination of those methods, is all currently under discussion.

We had nine sites in the impact area, and so now the first question is how do we eventually move to some sort of an acreage number here, and we kind of did this in a two-step process. The first step was to look at those nine areas and try to infer which of these areas seem to have similar fingerprints, in terms of sediment depth, percent of the transect that was project-related sediment over hard bottom, frequency of partial mortality of the scleractinian corals, and so on. Let's just sort of eyeball all of these data and see if we can sort of put these sites into some groupings.

That was done here, breaking it out into six groups, and it's largely kind of driven by these two columns off to the right here that talk about the sediment over the hard bottom, but it basically kind of turns this into six particular areas. That's spatially how those six areas look, and so we have Areas 1 and 2, which basically, by eyeballing, appeared to have the highest or more severe impacts collectively, while obviously those are the ones closest to the channel, and so that makes some sense.

We have a large area here, in the higher-relief area, that was next and then so on out on the low-relief areas. Now, we still are talking about impacts in this area that's 800 meters or more away from the channel, and we didn't survey this particular area. If I went back and put my little dots on here, you would see there wasn't a survey done by us in this particular area, but we did have some surveys done by other folks, including the Corps contractors. For this initial analysis, we used those data to characterize the impacts out in Area 6 here.

Now we know what areas basically can be lumped together for the purpose of doing an acreage calculation. Now we have to deal with the fact that, within those areas, the extent or severity of the impacts is going to vary. We don't want to just throw one simple number up there and paint the whole area with that, and so, based upon our analysis of the data, as well as a recent Corps of Engineers publication dealing with a similar project in the Pacific Islands, Nelson et al. 2016, we came up with this scheme here for the severity of the impacts to coral reef habitat, going from very severe down to low severity and then no real impact.

If you go through this scheme here, you will see that it's basically keyed on the type of sediment that's accumulating on hard bottom and the depth of that sediment layer, and four centimeters is sort of the magic number. If it's four centimeters or more sediment has accumulated over the hard bottom, we call that a fairly severe impact, and an area that won't really have an opportunity to recover until all of that sediment is gone. Now, whether that happens in a single storm that

whooshes through there in one summer or whether that takes years for that to move away is something that we have to kind of wait and see what happens. Then the Corps -- Everybody in government has these stoplight indicators now, and so the Corps basically took the same scale and they broke it into a red, yellow, green kind of scenario.

Now, in this particular table, we have crossed the six assessment areas that we talked about a couple of slides ago. Those are the different rows, and then the columns here are the severity of the impacts, based upon the percent cover along those line intercept transects. Then, down here at the bottom, is just doing the math.

If Area 1 has X acres to it, which we got from the GIS analysis two slides ago, and 20 percent of it was very severely impacted along that line intercept transect, then 20 percent of the total acres fall into that particular box, and then you just sort of do that across the whole little matrix here and you end up with 127 acres, or 76 percent of acres characterized, as either moderately severely impacted or moderate impacts to very severe impacts. If you add that last column there, where you add the thirty-one-and-a-half acres of the low-severity impacts, but still a detectable impact, you get up to 158. It's considerably more than the six acres of impact that was in the permit.

DR. WHITTLE: I don't know if this is your next slide, but does it show it like geographically by areas, as going out? Does it get less severe? Is it closer to the channel is the more severe?

MR. WILBER: Yes, but we're only doing that at sort of the macro level, and so Area 1 and Area 2, the top rows here, those were the two that were closest to the channel, and so you can see that they had the higher levels of impact, if you just sort of do kind of gestalt across the left-most three columns. As far as how to pick apart within those areas, it's something we're still thinking about how to go about and do, and we think the belt transect data will help us do that, but we haven't really gotten into analyzing those data fully.

MR. HART: Are you expecting to see any natural migration of that sand further out from that transect?

MR. WILBER: Oh, yes, and so, if you dive the site, you can see a lot of bedforms on these sediments, and I mean maybe Clark can educate us on the difference between a bedform and a sand wave, but those words kind of get thrown around interchangeably in this conversation, and I think a geologist probably would separate them a little bit, but there is definitely indications that there is this mound of sediment that seems to be migrating through the area.

Now, whether that mound of sediment is entirely dredge material or whether it is natural material that moved from outside the impact area into the impact area coincidentally at the same time, as the dredging occurred, is where a lot of the discussion is occurring.

This is kind of the wrap-up slide. The thing that I wanted to kind of stress is that this is just one survey. It was done in December, and it's from this area of Middle Reef north. There were five other areas that need a close examination to determine the extent of the impacts in those areas. In early April, we did a set of dives that within our agency we call them the bounce dives at these other areas, and we're beginning to work up those data now to determine the extent of the impacts in these other five areas.

Then all of that information from April, as well as the December data, is feeding into the development of a scope of work that the Port of Miami is doing to contract out the surveys that it's required to do under its Florida DEP permit to assess the extent of the impacts, from the Florida permitting perspective, and then determine the mitigation bill from that perspective.

AP MEMBER: Just a real quick question. Are they going to try to do those surveys before hurricane season?

MR. WILBER: Yes. Well, actually, before the peak of the hurricane season. The hurricane season starts like next month.

MR. CHAPPELL: Will there be a Natural Resources Damage Assessment related to this?

MR. WILBER: I don't think so. The NRDA stuff applies to certain locations, and I don't believe this meets the requirement for a NRDA assessment or a NRDA case, but many of the folks who are guiding how these surveys are done and participating in the surveys are folks from NOAA who regularly do NRDA casework, and so a lot of the methods and ways of just managing logistics that are done in NRDA are being incorporated here.

MR. KELLY: Pace, I don't know if you have the answer to this or not, but is there any sense of how this stacks up to the beach replenishment programs that are pretty frequent in those areas, especially in Fort Lauderdale, in terms of the magnitude of it and what happens in the long term here? It seems like Acroporids have managed to flourish fairly well off the Fort Lauderdale area, in spite of those replenishment activities.

MR. WILBER: I don't have an answer to that. The usual additional context that gets added to this discussion is for Port Everglades, which is going to impact roughly seventeen-and-a-half acres of coral reef habitat for its outer entrance channel expansion, and so there is a lot of effort that's already been underway, and then it was heightened by the results of these surveys and other work, to kind of take lessons learned from Miami and apply them to Port Everglades but I haven't heard anyone talk about it in the context of beach nourishment.

MR. KELLY: Then I do know that there was a pretty heavy effort to relocate corals, hundreds or perhaps thousands of them, prior to the dredging. Is there any plan to move them back into those areas, which in and of itself is pretty interesting, that they managed to flourish in spite of the activity that takes place in that area?

MR. WILBER: There was, during October and November of 2014, a staghorn coral rescue operation, and so when the dredging went through or the project went through its Endangered Species Act consultation, there was a forecast and an authorization to impact -- I am trying to remember the number here, but roughly thirty staghorn coral.

Once the extent of the sediment plumes became evident, and given that they had identified staghorn coral over a much larger area, it became clear that the impacts to staghorn coral was going to be greater than 200 colonies, and so the Army Corps and NOAA and the port all worked together to mount an operation to rescue as many of those 200-plus corals as possible, staghorn corals, and move them into a nursery operated by the University of Miami, where they were then fragmented and grown up to a larger size and are now being out planted by the University of Miami to

appropriate recipient sites, and the schedule of that out planting is all worked out through an agreement between NOAA and the Army Corps of Engineers.

In addition to that effort, there was also an effort that was really done under the state's umbrella to relocate some corals from the direct path of the dredging to mitigation reefs that are part of the project and that have been built. I really don't know enough to kind of comment exactly on numbers or extent of that, but the Corps has done some mitigation already for these impacts, because there was a certain forecasted impact in the DEP permit, and they will get some mitigation credit, likely, for some of the additional out planting that's tied to the staghorn rescue effort, but exactly what the total mitigation requirement for the project is going to be, that's something we won't know for several months, until after the additional surveys are completed.

AP MEMBER: With this type of dredging, were there any types of like turbidity standards, and do you happen to know how long this plume was going on before any actions were taken to stop dredging activities or minimize dredging activities or is that a question I shouldn't ask?

MR. WILBER: No, you can ask. The DEP permit requires monitoring of dredging on a daily basis, where they compare turbidity from a reference area to a measurement, and I think the standard measurement in Florida is 150 meters downstream from the impact. Sometimes there are additional distances that are required by the DEP permit, and you have to basically, within a certain band, usually twenty-nine nephelometric turbidity units of what the reference area would be. Now, inside a Florida aquatic preserve, there is tougher turbidity standards to meet there.

Now, turbidity and sedimentation are loosely correlated with each other, with the emphasis on loose, but the difference is that, with most equipment today, turbidity is something you can measure instantly, whereas total suspended solids is something that you have to take into the lab, and so you can get more real-time feedback if you focus on turbidity.

Now, when the dredging operations become obviously, to some people, more sediment than what was expected, there was a lawsuit to try and shut the dredging operation down. One thing led to another, and the judge decided the dredging operation could continue, but there were some requirements for that to happen. Yes, there is daily monitoring. The daily monitoring, DEP would have to tell you whether any of those monitoring events exceeded the state water quality standards, but the dredging itself was not shut down.

Then the other slightly complicated issue too is that, like most of these channel expansion projects, they also have to do a maintenance dredging event before they start to dig into the new material that is the channel expansion stuff, and so sometimes the monitoring for the maintenance phase is different than the monitoring for the channel expansion phase, and it can get a little messy.

MR. GEER: Any other questions for Pace? Thank you very much, Pace. We appreciate it. We are on to the last item of our agenda and, appropriately, Roger is going to talk about the Climate Change Science Strategy and how it relates back to the regional action plan, which is, as we said earlier, we don't have one for the Southeast at this point. Take a look at that document when you get a chance. It's a pretty quick read, Attachment 10. It just came out not too long ago, and it highlights different aspects and different issues in the United States by region, and so it's kind of an interesting read, and it's pretty quick to do. Roger, you're up.

MR. PUGLIESE: I think we've actually had both the document provided previously and some presentations on stages, either preliminary, both to the council and to previous advisory panel meetings, and what I wanted to do is update everybody on some of the next steps that the climate science strategy was really initiating, and, as the strategy, the national strategy, as Pace indicated, just came out not that long ago, it set the stage to provide some more direct avenues to collect and identify and provide information to support fisheries management needs relative to the evolving information and effects of climate in the different regions throughout the country.

With the national climate science strategy, it essentially had set forward a couple of major overarching efforts to look at conducting climate vulnerability analyses, establishing ecosystem indicators, developing capacity to really conduct the management-based strategy, and I think that's one of the biggest things that this whole thing is trying to really look to, what the management needs are going to be into the future and, within the next three to five years, actually initiate providing that information.

Now, it's not saying that it's all going to come from NOAA Fisheries. I think, once we get into the weeds on these different individual regional plans that it will be identifying that some of the other partners in the region may be tackling some of the information needs or other ones, and I think in some of the discussions we had today that it was highlighted that there are other avenues in our region, with the USGS Climate Science Centers, that may be able to meet some of these tasks.

We're in a stage now of the national plan is out. They're initiating the individual regional action plans in the Southeast. They have developed a draft of the Gulf of Mexico, and these are supposed to be developed in cooperation with partners. Of course, one of the primary is the council, in terms of implementing the management activities for fisheries.

With that said, the intent of those plans, again, are to strengthen the climate science capabilities, to develop these individual regional action plans so that they can be customized specifically to the individual regional areas, and that is, again, a very important component. Establish some standard climate smart terms, and provide an adequate resource, and that's going to be the real key, is that if, really, some of these, as they're put in place, really can actually find the resources, whether through NOAA or other partners, to make sure that they happen.

In order to advance this process, after some of the other initial efforts were done, the South Atlantic was -- I just came from the review of the ecosystem efforts through the Southeast Fisheries Science Center. They initiated the process to look at the South Atlantic region, and one of the things I identified is the fact that we had already began a process with integrating some of the climate considerations, through our participation in the past with an Atlantic Coast Climate Workshop back in I think 2014 that was sponsored by the Mid-Atlantic Council for all three Atlantic councils.

That was followed by a more recent climate workshop that was held in cooperation directly with the National Marine Fisheries Service, again looking at longer-term needs for management that would be addressing climate science, and so a lot of those things set the stage from which the first step of developing this regional action plan has been taken, and the Southeast Fisheries Science Center has initiated the process, in cooperation with the Southeast Region, and have identified members and a draft component of a regional action plan.

What we want to do is integrate our efforts that we're working on, the climate team that is already building information tied directly to management, to knowledge, and everything in our region, and collaborate together, and so we're using a fairly similar process that we're doing with the FEP sections. They are going to build a Basecamp and a coordination on document development, and that process is initiated.

I wanted to at least identify the fact that that is in process and, ultimately, the intent is that that regional action plan be integrated as part of the Fishery Ecosystem Plan, for the longer-term needs and very specifically, as I said, tied to management needs for the council and for National Marine Fisheries Service and for our partners.

Things are moving, and I was really glad to see that ability to have a true collaboration, because sometimes they just get advanced and be put together and then put aside. Here is an opportunity to make sure that, in the internal, it's addressing the longer-term needs, plus it acknowledges some of the other opportunities of all the different partners we've talked about in the last two days, about trying to address some of those bigger needs for climate information. With that said, are there any specific questions about our advances? As Pat said, this is a fairly short read, and, truthfully, they are trying to tailor it very clearly to what is being set as some of the baselines that are in even the national plan.

MR. GEER: Are there any questions for Roger? Hearing none, that's the last agenda item that we have. Is there any new business that anybody wants to bring up? Hearing none, everyone wants to go. We're going to forego our break. I just want to, in closing, I just want to comment that I've been on this committee since 2002, and we never used to talk about sound and ocean acidification, never. Climate change, maybe a little bit, but every meeting I go to now, climate change is a major, major issue.

It's several hours at every meeting. At the commission last week, two or three of the board meetings talked about climate change. They are forming a committee to look at this and ocean acidification as well and sound. We have got great presentations on that today. We are developing new tools for all of these things, with the people at this table and all of our partners, which is great. We're gathering lots of data, which is wonderful too, but we all still have a limited amount of time and a limited amount of money on that, and funding in that regard as well, but it's just amazing the shifts we've seen in these issues coming up, and they're here.

We're just going to hear about them more and more, and it's good that we have people who have come to this meeting and presented some of the information, and it's just really, really interesting in what they're able to do and how they're able to present this information, and so it's going to be an interesting ride.

I mean if you sit in any kind of resource management, like I do, with the fisheries, these things are going to be major players, especially climate change. We're seeing it in almost every single fisheries committee now that I sit on. When I said earlier that Connecticut and Massachusetts are saying we want in on this cobia thing too, ten years ago, that was never even a consideration, and so it's kind of becoming like a new world. For us old people, we're kind of like, god, I thought the end of my career was going to be a little bit easier, but it's a challenge, and I see most of the people in the council, and in the commission as well, that are up to the task, and we're going to do the best we can with it. Do you have any closing comments?

MR. PUGLIESE: Other than, of course, I continue to talk about these things that are near and dear to my heart, and so I think, as Pat has indicated, it's amazing how far we've come in terms of the scope and the capability and what is available. I think what I would, again, like to reiterate is a thanks to all the members for sticking with this and moving forward, because, again, this body is the one that provides the foundation for the council's consideration towards ecosystem management, toward climate issues, toward habitat, toward all the foundations for what really make our systems productive and capable and useful in the Southeast.

I guess one of the other things is hold on, because one of the biggest things is the technology changes. As we've seen in the last couple of days, in terms of the ability to see this information -- When you've got sonar imagery that is as high-resolution as video, it's starting to get interesting, but the capabilities and the ability to take that information and process it into a useable format that actually means something in management and for the long term and is digestible by managers and by the public, it's going to really set the stage to give us good tools, and we will move forward and do better, and I think we're in that stage right now, and it's all good. Again, thank you, everyone, and thanks, Pat, for keeping the ship steering in the right way.

MR. GEER: We made it through a meeting without discussing a policy statement. If nothing else, you should all pat yourselves on the back. With that, I wish --

MR. HARTER: Just one thing. It was nice to meet everybody. I hope I can be of assistance, and thanks for giving me the opportunity to serve on the panel.

MR. GEER: You're very welcome. With that, I would like to just wish everybody safe travels. The meeting is adjourned, and I will see everybody in November.

(Whereupon, the meeting was adjourned on May 12, 2016.)

Certified By: _____ Date: _____

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