

# **SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL**

## **HABITAT PROTECTION AND ECOSYSTEM-BASED MANAGEMENT ADVISORY PANEL**

**Crowne Plaza  
Charleston, SC**

**May 21-22, 2019**

### **Summary Minutes**

#### **Habitat and Ecosystem AP Members**

Anne Deaton, Chair  
Paul Medders  
James Geiger  
Bill Parker  
Laura Busch  
Dr. Steve Ross

David Webb  
Thomas Jones  
Bob Martore  
Jeff Soss  
Dr. Laurent Cherubin

#### **Council Members**

Stephen Poland

#### **Council Staff**

Julia Byrd  
John Hadley

Cierra Graham  
Roger Pugliese

Other Observers and Participants Attached

The Habitat Protection and Ecosystem-Based Management Advisory Panel of the South Atlantic Fishery Management Council convened in the Crowne Plaza, Charleston, South Carolina, May 21, 2019, and was called to order by Chairman Anne Deaton.

MS. DEATON: Good morning, everybody. Welcome to Charleston for our spring meeting. I would like to start by doing some introductions. If we could, let's start with Jamie, and introduce yourself.

DR. GEIGER: My name is Dr. Jamie Geiger from Seabrook Island, South Carolina, retired U.S. Fish and Wildlife Service.

MR. WEBB: Good morning. David Webb, and I'm a recreational angler currently residing in Islamorada, Florida, and I'm a member of the West Palm Beach Fishing Club.

DR. CHERUBIN: Good morning. I am Laurent Cherubin, and I'm a professor at Florida Atlantic University, Harbor Branch Oceanographic Institute.

DR. BUCATARI: Good morning. I'm Dr. Jennifer Bucatari. I am not Brian Hooker, but I am here on behalf of BOEM and Brian Hooker. I'm an Environmental Protection Specialist with BOEM's Renewable Energy Group.

MS. BUSCH: Good morning. I'm Laura Busch, and I'm the Natural Resources Program Manager for the U.S. Fleet Forces, U.S. Navy, in Norfolk, Virginia.

MR. MARTORE: Good morning. I'm Bob Martore with the South Carolina Department of Natural Resources, right here in Charleston.

DR. LANEY: Good morning. I'm Wilson Laney, and some of you may be wondering why I'm here, because I retired from the Fish and Wildlife Service on March 30, but the council got creative and made a new liaison position from the Habitat AP to the council, and so I will be working with you all in that capacity from now on.

MS. DEATON: But you're also now on our Habitat AP, and so welcome. Again, I'm Anne Deaton, and, for you new people, I am with the North Carolina Division of Marine Fisheries, and I'm in the Habitat Enhancement Section and the habitat assessment and protection programs.

MR. PUGLIESE: Roger Pugliese, Senior Fishery Biologist with the South Atlantic Council, responsible for our habitat and ecosystem activities.

MR. MEDDERS: I'm Paul Medders, with the Georgia Department of Natural Resources.

MR. JONES: Tom Jones, Georgia recreational fisherman.

MR. PARKER: Captain Bill Parker, charter, South Carolina.

MR. SOSS: Captain Jeff Soss, Georgia, charter/recreational fisherman, Georgia and South Carolina.

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

MS. DEATON: Thank you. Also, we have some other people with us, and I see Steve Poland, who is on the council and works with me in fisheries, and he's the Chair of the Habitat Committee. We have David Whitaker, the Vice Chair, and then we have Julia Byrd. Thank you for joining us. Now we need to approve the agenda, and there's a few changes that Roger made since you probably looked at it, and do you want to go over those?

MR. PUGLIESE: Yes, I will touch on -- It's really on tomorrow, day-two, but we have Deborah Hernandez is going to join us with the SECOORA, and she's actually going to do her presentation immediately after the energy development activities, first thing in the morning, and it's going to shift the FEP II Implementation Two-Year Roadmap discussion that I was going to highlight in the afternoon, the last two sessions, and so we just have some shuffling around, and Deborah was able to join us, instead of just doing a summary, and so she'll be doing her presentation earlier in the day, and that was it.

MS. DEATON: Is there any other changes that anyone sees needed to the agenda or otherwise a motion to approve the agenda?

DR. LANEY: Madam Chair, I will move that we approve the agenda as modified.

MS. DEATON: Thank you. Next, we need to approve the November 2018 minutes. Has everybody looked at those? It's pretty lengthy. Are there any suggested changes needed, for those that were there? Otherwise, is there a motion to approve the minutes? Motion by Tom to approve the minutes, and is everybody okay with that? Motion approved.

We have a pretty full agenda here, and I would just like to say that it's good to see everything tying back into the FEP Implementation Plan, and so, as I looked over the agenda, I pulled out my roadmap, because it's a two-year roadmap, and we're in year-one, and we still have time, and so I just want to kind of periodically check and see how we're doing and what's being done, because there is many moving parts and many people and projects that all that information has to get pulled together to move forward and complete the priority actions in that implementation plan.

Tomorrow, Roger will be going over that status, but, as we go through these, you can see how they relate to those priorities, and so just, for example, the first agenda item is mapping and characterization of South Atlantic deepwater ecosystems, and that really relates to the whole connectivity issue, and then the next topic about the prey for the dolphin and wahoo fisheries relates to the food webs and connectivity policy that we have, and so, as we go through these, just keep that in mind, and did you have anything to add before we start?

MR. PUGLIESE: Just I think that's an important point. One of the things that you will see is we're going to have an update from NOAA Fisheries on a number of different activities that were identified both in their implementation plan as well as our implementation plan and connect into the two-year roadmap, and what essentially we're going to do is we're going to lead down to the end of tomorrow afternoon, where I'm going to highlight and touch on the FEP two-year roadmap.

Giving the timing on some of the activities that are ongoing and being developed, et cetera, what we're going to do is really just set the stage for having a more complete review and discussion at the October meeting, which we already have the dates, and we already have the location, and we're going to be meeting back again at FWRI, and so what we want to do is really have -- Originally, that was supposed to be done at our spring meeting, but there are a number of those big items, like the climate vulnerability analysis and some of the modeling activities and different things, like the ecosystem status reports that we're going to get a heads-up on, that will be closer to completion or parts of them will meet some of those very specific recommendations that are in the roadmap that it will be important to get further down the road, and I think it will be a more substantive review and discussion when we get to the October meeting, and so just kind of setting the stage for where that's really going to go.

A lot of what you're going to be seeing over the next couple of days, some of them are direct follow-ups from our last discussions at the meeting. Again, as Anne said, our meeting was addressing pretty high-end components of the implementation plan for FEP, but we have advanced further, and I think that's going to be exciting, and we're using a little bit of everything, from YouTube presentations to live presentations during lunch tomorrow, and that one -- What we'll do is probably get a lunch menu and circulate it around, so we can eat here and then watch the presentations on pile driving and on the windfarm activities, because I think that's actually going to be a representation of how they did sound characterization on Block Island up in the New England area, and so I think it should be -- It links very much into our discussions in the past on renewable energy, plus also on looking at sound activities in our region, and we have some other related ones, Laurent, very specifically, on the use of sound and technologies.

A lot of them are either connected together or addressing major parts of our FEP implementation activities, and so I think that it should be very good, and plus catching us up on some of the other related council activities, such as citizen science and how those can also fit into long-term needs that we're doing and some of the forage species discussions, too.

With that, I would pass it back, and I guess what I should do is just go ahead and introduce what we're going to do. We wanted to have another step on activities relative to mapping and characterization, and we had a fairly extensive presentation at the last AP meeting on how much had been done during the last year, and we're lucky enough that actually there's a number of different cruises that are occurring in the South Atlantic, and the Ron Brown cruise has just occurred, and there is additional Okeanos Explorer cruise time that is going to be in the South Atlantic this year, and so this will set the stage for the preliminary discussions on what's come out of the Ron Brown, and it will then also set the stage for planning for the Okeanos activities in our region, and so we've been lucky enough to have even more advanced information on mapping and that really more detailed characterization of all the different species and habitats that are being encountered.

From last time, if you remember, the more we look, the more you find, and the more complex and the more extensive, and I think that's kind of the message that I got from the last presentations, and we have representatives with Kasey Cantwell and Heather Coleman and I think Caitlyn are going to be doing to the presentations this morning, and, with that, I think we're going to go ahead and unmute them and give them control. I think it's going to be coming from Kasey's machine initially, if I'm not mistaken.

MS. DEATON: Jamie, did you have something?

DR. GEIGER: Thank you. Just a quick question, and I probably should have asked it for new agenda items, but, Roger, is it possible that you can give sort of an overview, or some of the NOAA folks, give an overview of what you foresee in terms of any significant budget activities in the South Atlantic and any kind of new emphasis or new focus areas or things that we need to be aware of that may be coming down the pike, in terms of either budget execution or budget development that we can be aware of, especially relating to coastal protection and restoration and conservation? Thank you.

MS. DEATON: That might be appropriate for when you talk about the implementation plan update.

MR. PUGLIESE: Yes, and I think maybe we can ask directly as part of the NOAA discussion tomorrow what their insight is. We're just coming off of a CCC meeting, Council Coordinating Committee meeting, and that gave a lot of the national perspectives on it, and kind of some of the take-away I'm seeing is that, while there may be some new directives, there isn't necessarily any new resources, and we're hearing that again, and that's the mantra I've heard for a number of years.

While you have the more significant emphasis on ecosystem-based fishery management, guidance documents to address, movement toward climate initiatives, all different types of things, we're not seeing, necessarily, associated resources being put next to those to make sure that they happen, and so it's going to have to be reprogramming internally, in many cases, for some of these, which is a tough thing to do, but I think we're at the stage where, if there's real commitment to some of these implementation plans that are being touted nationally, that some of those -- They're just going to have to be done, and I think just the fact that you're seeing some of the things being accomplished in our region getting done are the acknowledgement, but that's still just the beginning, if you remember how much else needs to be done.

MS. DEATON: I think that we're ready to start, and so Kasey -- Is there a question?

MR. PUGLIESE: It's Caitlyn, and so we'll make Caitlyn the presenter.

MS. DEATON: All right, and so we're going to start with the folks that are on the phone, the webinar. The people that were at the St. Petersburg meeting, the last meeting, met Kasey, and I guess she's with Heather and Caitlyn.

MR. PUGLIESE: The other one is Caitlyn Adams that will be also providing updates.

MS. DEATON: They will be speaking about mapping characterization of South Atlantic deepwater ecosystems, and so, whenever you guys can start, that's fine.

MS. COLEMAN: It's really nice to virtually be here and to give an update on some deep-sea coral and sponge discoveries that have been made possible by OER and by the Deep-Sea Coral Program. I will let Caitlyn and Kasey do most of the talking, since they are the ones that know a lot more about the Okeanos discoveries than I do, and on the Ron Brown too, and so I will give a few slides at the end, but I would just like to introduce Kasey and Caitlyn from OER. Thank you.

MS. CANTWELL: I am Kasey Cantwell with NOAA's Office of Ocean Exploration and Research, and we have Caitlyn with us here today, and so I will let her introduce herself.

MS. ADAMS: Hi. I'm Caitlyn Adams, and I'm also with OER, and I will let Kasey start us off.

MS. CANTWELL: Today, we're going to talk a little bit about some of the new ocean exploration data that's coming out of the Southeast Region. By leading national efforts to explore our ocean and making ocean exploration more accessible, NOAA OER is filling gaps in our basic understanding of the U.S. deepwater areas, and you can see here a couple of the areas that our data is used. Of particular interest to you guys will be the assessing populations and habitats of managed marine species, but you can also see a number of other opportunities that exist within our datasets, and just to say that these are some of the things that our data has currently been used for, but, at the same time, there's always new and exciting data that are coming out of our office, and NOAA in general, and new and exciting things to be found.

I am going to talk a little bit more about the Okeanos Explorer and our plans for the coming year after Caitlyn talks a little bit about Deep Search today, but, in the coming year, and in the last year, we really have a nice suite of data that is coming out of the Southeast Region. In particular, we have the Deep Search cruise that you will hear a little bit more about and then our upcoming planned cruises on the Okeanos Explorer, and we'll have two cruises again this year. On the Ron Brown, there will be a mapping cruise in the Southeast Region, as well as on the Nancy Foster. Then we're beginning to scope our FY20 schedule as well, for the upcoming year, and I'm hoping that you guys will help us provide some input to help guide our operation.

MS. ADAMS: First, I will be telling you a little bit about the Deep Search project. I think you've heard a little bit about this in past presentations, but I'm going to try and give a better overview of what we've done so far. Deep Search is a four-and-a-half-year project co-sponsored by the Bureau of Ocean Energy Management, USGS, and NOAA, and so the way that these projects work is that BOEM is the prime science contractor, and so they have established a relationship with TDI-Brooks, and Erik Cordes at Temple University is the project manager. There is a team of six PIs that Erik sort of leads up, and then USGS is also supporting five complementary science teams led by Amanda Demopoulos.

The goal of the project is to understand the ecology and distribution of sensitive deep-sea habitats within BOEM's Mid and South Atlantic planning area, and so that's basically the area where they could, in the future, choose to open for oil and gas or other energy resources, and so we are basically trying to figure out what is there, in advance of any sort of management decisions that might be made in the future.

Last year, we had an expedition on Atlantis, with HOV Alvin, last August, and so we did eleven dives, and we visited three canyons north of the Pamlico and Wilmington Canyons, and we visited two seeps, Pea Island Seep and Blake Ridge diapir, and then we also visited four coral sites, the biggest finding from that being that we characterized eighty-five miles of discontinuous lophelia reef, about 160 miles off of Charleston, and we collected over 1,200 samples, most of those with the HOV, and we also did a number of CTD casts, monocoast and multicoast operations, and the really nice thing about last year's work was that the EX, as you have heard before, was in the area in advance of us, and so they collected a lot of mapping data, and all that mapping data is shown

in the map to the right, and, as you can see, we were able to do almost all of our dives on newly-collected mapping data, which was really excellent.

Then, this year, we were out with the Ron Brown, and we were just out last month, and so I'm still getting my bearings a little bit, being back in the office, and so we were out for twenty-two days in April. We also did eleven dives, though the difference between ROV Jason dives and Alvin dives is that those dives range from anywhere from four to twenty-four hours, and so we had significantly more bottom time this year, and we only visited one canyon, Pamlico Canyon, and the Gulf Stream was not on our side this year, and we weren't able to get into any other canyons.

Then we also were able to visit four seeps, two up north, off of North Carolina, with Kitty Hawk and Pea Island, and then we turned to the Blake Ridge seep, and we also went to Cape Fear, and then we visited five coral sites, and so, this year, knowing what we knew about that Richardson Hills area, we spent more time there, and we did two dives, one actually exactly where we were last year, because we were picking up some of the coral growth experiments that we deployed on the seafloor last year, and then we went to two other areas in Richardson Hills, to the western edge of the feature and closer to where we had been the previous year, and then we went up to Savannah Bank and did another dive in Blake Deep.

One of our most exciting finds this year is that we actually found a vestimentiferan tube worm at Pea Island and Kitty Hawk seeps, and these are chemosynthetic tube worms that have been found in other ocean basins, but they have never been found in the U.S. Atlantic, and so that's a really exciting find, and we're still working to understand what those worms might be, if they're a new species, and hopefully we'll have more on that in the coming year.

I have a video here, just to show you a little bit of what we saw in our coral habitat dives, and this is just a couple of minutes, and I will try and talk through it as best I can. Some of you in the room might know corals better than I do, but we saw, again, extensive lophelia habitats throughout our dives at Richardson Hills, and we also saw significant lophelia habitat at Savannah Banks.

All of these coral habitat dives, with the exception of our deep dive at Blake Deep, were within the coral HAPC, and so there is significant habitat there, which you already knew, but we can continue to confirm, and so we saw a lot of really amazing corals, and we saw a golden crab at all of those dives, except for the super deep dive at Blake Deep, and we saw madrepora, and we saw a number of different stony coral species, and some fish diversity as well.

We did a good bit of lophelia sampling on these dives, because both Erik Cordes's lab and Sandra Brooke's lab will use live lophelia in experiments back in the lab, to understand more about their tolerance and recent environmental conditions and their reproduction, and so there's one of our golden crabs that we saw, and there's another one hiding out in the lophelia.

Another really exciting thing that we'll be doing with the dive at Richardson Hills is that we put a benthic lander on the seafloor, and that will actually allow us to observe long-term environmental conditions on the seafloor, and so there's a number of different sensors on there, and they will be able to tell us how much sediment accumulates and comes into the environment, and there's a really cool experiment on it where they have a baited camera system, and so once -- I don't know if it's every day or every week, but it will actually release some sardines, canned sardines, purchased at Wal-Mart, and see what comes to those sardines, and so it gives you a really

interesting picture of what's on the seafloor when you don't have a very brightly-lit ROV, and, even from our first short-term deployment, we were able to see some crabs, some hagfish, and some eels as well, and so there's definitely a lot of fish diversity and crab diversity at these sites as well, and then this here is banded coral from Blake Deep, and, on that dive, we saw a lot of banded coral diversity and a lot of really interesting and stunning corals. I think there's one little bit more of this, and then I will advance to the next slide. I'm going to jump ahead.

We saw a lot of sponge diversity and anemones, and I'm going to be honest and say that I don't know what that is. This is just my personal favorite coral, and it's a very exciting looking banded coral, and I will advance now.

At Pamlico Canyon, which is our only canyon dive of this cruise, we saw red crabs, and we saw king crabs, and we saw a lot of brisingids throughout the dive, and then we also saw a lot of cup corals and everyone's favorite, the octopus, and so we had been to Pamlico before, and we would have really liked to have gotten to Keller Canyon, or to Hatteras Canyon, but, unfortunately, when we tried to dive that evening, the surface current jumped to five knots, which is not a favorable condition to put an ROV in the water by any means.

At Blake Ridge diapir, we were actually diving right outside the protected area, but we did see extensive and sampled extensive mussel beds. From two small tubes of mussels, we collected eighty-two mussels, which made for a very fun day in the biosampling room, as we processed all of those, and we also took core samples, and we do a lot of geochemical analyses on the cores, and then, again, a wonderful octopus.

Then, at Pea Island and Kitty Hawk seeps, these were our shallowest dives, and so those are off the coast of North Carolina, normally about 300 to 450 meters, which for OER is shallow, and, at those, we actually observed really interesting fish diversity. We saw a lot of the rosefish, up on the right, and we also had a hammerhead follow us a lot of the time. Unfortunately, most of the time, the hammerhead was behind the ROV, and so you could only see it in the black-and-white cable cam, and we also had a manta ray follow us back there as well, but, unfortunately, we didn't get any good pictures of it.

One of the most interesting things is that we did see a little bit of lophelia at Pea Island, just one little colony of it on some rocks, but that was a surprising find for all of us, and then, finally, we did see the tube worm, on the left, and we actually collected four tube worms, in total. The first one, we didn't even intend to collect. We were picking up a rock, and the rock broke open, and there was a tube worm, and that sort of set us on the course for trying to find the tube worms the rest of the time were at the two seeps, and so we saw a lot of cool fish diversity and some really exciting chemosynthetic organisms there.

That's sort of just of a little bit of a summary of the different things that we saw on this most recent cruise, and we will continue to work up all of the samples and all of the findings from this project. There will likely be one more short cruise this fall to recover those landers, and we have the lander at Richardson Hills, and we also have a lander in Pamlico Canyon, and we need to get those back from the seafloor in the fall, but this Ron Brown cruise is our last major field effort for the project.

The way that these large-scale BOEM studies work is that the scientists will spend the next two to three years working up all of those samples and all of that data, and they should put our final report



through BOEM, I believe in 2021, and so we will have more news to report in the future, and I will turn it back over to Kasey to talk about her plans for this year.

MS. CANTWELL: Starting at the end of May, on May 30, we will start our next iteration of the Windows to the Deep Expedition, and we're going to be working in the Southeast again this year for two cruises, and we will have a mapping cruise that will go from May 30 through June 14, and they will be mapping those pink boxes that you see here on the map, and then we have scheduled a second cruise, which will be an ROV and mapping expedition, and that will start on June 20 and run through July 12.

We currently have twenty-one ROV dives planned in the Southeast Region, nine of which will be in the deepwater coral HAPC on the Stetson-Miami Terrace, and we also are planning to include not only coral dives, but shipwrecks, the North Carolina Canyons area, and water column exploration, and, of particular note, one of the shipwrecks that we'll be looking at is actually within the HAPC. It's a shipwreck that was identified last year during EX1805, and we found a target that we were hoping it's the Bloody Marsh wreck, and it's very close to the charted position of that wreck, which would be a significant cultural heritage find if it is in fact that shipwreck.

One of the things to highlight about our mapping priorities are that all of our mapping priorities were identified by the South Atlantic Fishery Management Council, through working with Roger Pugliese and Chip Collier, as well as through the folks at the Southeast Deep-Sea Coral Initiative and Monitor National Marine Sanctuary.

This is talking about the priorities that were identified by the fishery management council, and the map here on your left is priorities that were given to us by the council, and you can see here, on the second map -- All of the data that is in the foreground is Okeanos Explorer data since 2014, and you can see we're slowly working our way through the Blake Plateau region and building coverage as we go, and then the yellow polygons are the ones that we will be able to map during this upcoming cruise. The upcoming cruise, or the upcoming expedition, will start in Key West, and so we'll actually be able to get a little bit of transit data through the lower portion of the HAPC, but these polygons highlight the areas where we'll be spending focused, dedicated mapping time.

One of the things that we've been doing as a new partnership for OER is that we've been working with the Office of Coast Survey to identify some priority deepwater areas. NOAA has responsibility within the U.S. for contributing to Seabed 2030, and it has made it one of the priorities that we will map and characterize the U.S. EEZ by 2030, and, in order to do that, we have realized that it can't just be OER mapping these deepwater areas, but we need to be partnering across line offices.

What we've been doing recently has been working with the Office of Coast Survey, who typically does work a little bit shallower than this, but they had some time available this year on the Ron Brown and the Nancy Foster, and you can see those polygons here in purple, and so they will be cleaning up some of the areas that are just off the Blake Escarpment and on the Blake Ridge that have been left open from the extending continental shelf project surveys that were done in the early 2000s.

Then, with the Foster, which is much more suited to the shallow-water areas, they will be collecting data in the -- They'll be sort of edge-matching and collecting data in parts of the HAPC, and then

they're planning to address the area just north of the HAPC as well, and these are also areas that they'll be hitting with the Foster that we, the Okeanos Explorer, were not the right ship to be doing those shallow-water areas that the council had prioritized, but, by working through these partnerships, we can help address everyone's priorities quickly. That's it for the Okeanos Explorer's plans for the year, and we're happy to take questions at the end, but I'm going to pass it over to Heather.

MS. COLEMAN: Thank you, Kasey, and thank you, Caitlyn. That was awesome to hear. Even though I already knew most of it, it's still awesome to hear again and see the video. I am Coordinator of the Deep-Sea Coral Research and Technology Program in NMFS, and so we're the ones that respond to any requests for, hey, where are there corals in the area.

Showing on the screen right now is something really cool that our program has just developed within the last six or months or so, and it's a story map of site characterization reports around different regions of the country, and so you can see, in the Southeast, I think we have the most site characterization reports of any region up on this platform right now. On the next slide, there will be a web address that you can go to to access these, and it has a little zoomed-in version of one of the reports.

This is an example of a site characterization report of Cape Canaveral, and most of these ones are on the older side, but we'll be adding them to this story map as we get site characterization reports, and it's just a great way to see what kind of life there is in the area, and we have descriptions of habitat, of corals and sponges, of mobile invertebrates, of fish, and we have images, and we have metadata, and we have all these kinds of things on the story map platform, and so it's kind of a mix of the technical stuff, but in a fairly user-friendly way, and the map that was on the slide before just has a nice view of all of the different site characterization reports in the area, and you can just click on whichever one you want, and it also interfaces with our deep-sea coral database, and so if you want more information on particular dots that you see on the map, you can just click on them, and they will bring you to our database.

The next cool tool that I wanted to show you on the next slide is our southeast geodatabase, and so the Southeast Deep-Sea Coral Initiative, run by Peter Etnoyer, put together this database, mostly with the help of Danny Wagner, and it has a ton of different layers that you can toggle on and off, and it's -- Every time I go on it, I find a new layer, but it has deep-sea coral dots, and it has habitat suitability models, and it has all kinds of things that you might find on marine cadastre, for example, and so it's another fun tool to play with for any kind of planning purposes or just poking around and seeing what's in the region, and it covers the South Atlantic, Caribbean, and Gulf of Mexico, but there's probably the most information, I think, in the South Atlantic.

Then I have one more slide, just to show you another tool that we have available, a deep-sea species guide, and so this is in collaboration with WoRDSS, which is the World Register of Deep-Sea Species, and so it's just a ton of images, really high-quality, good images that we have of corals and sponges, and there is plenty of other types of animals too, but obviously that's what we're focusing on. I know some of the websites are kind of long for these, but I put them in the slides, and we can make those slides available to you, in case any of these tools would be useful. That's pretty much all I wanted to say, and so, if anybody has questions for the Ocean Exploration team or for the Deep-Sea Coral Program, then please let us know. Thank you.

MS. DEATON: Thank you very much. That was great photographs, and it's amazing the clarity of those videos at that depth. Is there any questions from the members?

DR. LANEY: Not a question, but just a comment to say wow. I am thinking about Roger and I, and others of you around the table and in the room, that have been at this for a long time and thinking about where we started and how far we've come, and it's incredible. The work that you all are doing is amazing. It's amazing stuff, and it's really, really great to be able to set these sites up and get this information out there to the public and to the folks that spend time in those offshore systems out there and use them and understand them, hopefully, more about why it is so important for us to try and put protection measures in place for these amazing resources.

DR. GEIGER: A question. Have you noticed any increased diversity and/or abundance of these species over time, and are you willing to possibly speculate on what may be the next five or ten-year impact on these species, given what we know already?

MS. COLEMAN: We don't have the data that has recently been gathered over the last few years in the South Atlantic region worked up and added to the database yet. We're still going through some expert review, to make sure that we have all of our species right, and it takes a long time, and so my plan was -- I have requested to get these moving and finished by the November council meeting, so that I can show more information on that, because I think Roger has lined us up for presenting in November, or October. I think it's October, now that I'm thinking about it. That's the plan that we have, and I can't really say anything right now to answer that question.

DR. ROSS: Jamie, that would be difficult to do anyway, because a lot of these data are snapshots every few years, and they're not always in the same place, and so we don't have continuous monitoring in that regard, like for fish populations or corals in any one place. We've been to a lot of these places over almost two decades now, but it would still be difficult to say, if you saw a large school of say blackbelly rosefish, to know if that's an increase or not, and so the data are great, in terms of increasing our coverage spatially and adding to the biodiversity list, but it's still difficult to monitor populations with what we're doing in the deep sea.

DR. GEIGER: A follow-up. But would there be value to have a set standard of sites that you're going in every year to observe and at least get snapshots to start building up at least anecdotal information in terms of abundance and diversity?

DR. ROSS: Absolutely there would be, and we had always hoped for that to happen, but one of the problems in some of the past projects was that funding was not guaranteed for anything but year-to-year, and so you couldn't count on going back to a site, quite often, and some of the later projects, where we put down landers, like they're doing here, like we did in other sites, we did have that ability to count ahead, but that's pretty unusual, but that would be very useful, to pick some key sites along the coast that could be monitored, and perhaps even monitored remotely or with automated gear now, instead of ship cruise time, and so that's all possible, but it's funding related.

DR. GEIGER: Just a quick question. Can we make a recommendation to do just that from this committee, advisory committee, to make that recommendation to at least set a number of standardized sets that can be done as often as possible, irregardless of funding, at least have some target sites that we can identify and support over time to get those snapshots in time?

DR. ROSS: I would like to add to that. I can't think of any scientist that wouldn't say that that wouldn't be incredibly valuable, not just for looking at the changes in biology, but also looking at ocean physical changes, just the ability to monitor temperature and salinity and oxygen, and that allows you to say something about how the ocean is changing, but only if you have long-term data, and so it's a good recommendation if it can be funded.

MS. DEATON: It seems to me that one question for the experts will be that first we have to -- I think, right now, they've been working on just doing first-time mapping and characterization, and so filling those gaps in a little bit better, so, at some point, you know which sites to go to that would be the most valuable to go to, and so, at some point -- Are we there yet? Do we know enough to even pick some key locations to do repeats?

DR. ROSS: Yes, we do. I mean, we certainly haven't finished the mapping, but we've been at these sites now for almost fifteen years, and a huge number of cruises, and we do have enough data to pick very good sites to monitor, and, if we keep waiting -- There's really no point in waiting any further to find one more site.

MS. CANTWELL: There are certainly equivalents in the shallow-water world of sentinel sites that have contributed greatly to our understanding of shallow-water coral reef ecosystems by having those routine datasets over time, and that might be a model to look at, if you are looking to make some sort of proposal, and you can look through those, and, basically, they've done them now for about fifteen to twenty years, in some places, and you can see what kind of data they've gotten out of them and what kinds of things they have learned from monitoring certain sites over time, particularly in the Florida Keys and a couple of other places throughout the Caribbean and in Hawaii. They have been really useful for scientists, and so I think it's a great idea to make that recommendation, if that's what you guys are feeling that you would like to see done.

With OER's work to try and get a lot of this area mapped in the next couple of years, each time that we're going out on these cruises, we are finding new areas that might be potential coral habitats, and so this region here in the middle kind of looks like a split diamond, and it's an area that -- That one line of transit that is over it looks very similar to what the Million Mounds region looks like prior to the systematic mapping in 2014. There are a bunch of tiny, tiny little mounds over that area, and so there is -- When we are getting more and more of the systematic data, you're going to begin to build out your picture of what this region looks like.

We might not just have -- On the edges of where the HAPC is, that might not be the only coral habitat, but we'll know in a couple of weeks if that's another area where there is potentially large bioherms of lophelia, and so, while I think you certainly can go to a lot of these places now, based on some of the data that's been collected, there's still a lot in this region that we don't know much about that we're hopefully going to learn some more about this summer and in the coming years.

MR. PUGLIESE: I think we really appreciate the presentations and the movement forward, and I think one of the biggest things that we continue to highlight is that the biggest -- The highest priority was to complete mapping within those areas that we have protected. As you know, there is still areas within the HAPCs that are pretty extensive that, just looking at Million Mounds and looking at some of those different areas, have gone back in and identified very significant habitats, and that still is one of the most significant efforts, is to complete those efforts, and I think the

greatest thing is that we're even having this discussion about creating maybe some template areas, but just getting to this next step was one of the biggest things. It's to make sure that the information supports those conservation efforts that have been put in place in the past.

I think one of the big, telling things that's coming out of especially all of what's been presented more recently is how extensive some of these different habitats are, but then how significant some of the low-relief habitats are within these areas, and I think that's a really big, key thing, because they're very complex and very non-descript from say just open survey areas. A lot of them, if you were just going by bathymetry or whatever, would basically be lost.

It's very similar to when you get up on the shelf edge and the same type of thing, where you probably have a lot more hard-bottom areas that essentially would not be identified by just basic mapping capabilities, and so the ability you have, with what's been combined through this collaboration, really not only identifies all these different complex habitats, but they're also identifying the species components within there and really filling in the detailed biological and the habitat distributions within these areas.

The idea of creating those areas, I think you hit it on the head. It's to look to some of the areas where you do have it in the Keys and the Caribbean and some other areas and come up with the opportunity and create a baseline from which to advance into the future. As I said, I think that's a beauty of where we're at, is we can actually begin to have those discussions now and build on what we've had, and so I appreciate all the effort so far, and we look for more to come.

I just think it's -- As we know, what's real interesting is that latest one you were talking about in that big, open box, and the reason that none of those areas were touched and no sampling was ever done within those areas, and so we say there is stuff, and there's still a lot within the EEZ that has not been surveyed that I think you guys are targeting, and it's great to have the initiative on the 2030 initiative that's helping drive this now, and that's a massive opportunity to engage whatever capabilities, and I think you're kind of hitting it wherever we can, and I think we're only going to see more as you complete and expand into some of these other regions.

DR. LANEY: I will pick right up where Roger stopped there, and I think the long-term, or a long-term, goal and objective that the council members are very interested in is being able to tie habitat back to production, and it seems to me, Heather and you folks on the phone, that, to the extent you all are able to characterize these different habitats, especially characterize them biologically, the more data are gathered, the more likely we are, at some point in time in the future, to be able to do just that, and that would help us greatly, in terms of management, because we might begin to understand what the limitations are on productivity and somehow work that into our population models for some of these species, and especially the commercially and recreationally valuable ones.

MS. DEATON: That was one question that I did have at the last meeting that I see more this time, is what managed species are utilizing these deep habitats, or what is that connection, but there's the rosefish and the golden crab that they saw, and was there any other managed species that were seen, possibly through the food web?

MR. PUGLIESE: I think some of the deepwater shrimp may be involved in some of the edge habitats that we're looking at within these deepwater HAPCs.

AP MEMBER: Wreckfish.

MR. PUGLIESE: Wreckfish is extensive through a number of different -- Even in the northern areas, and I think some of the last video they showed from the last cruises last year, and so there are a number of different species, and I think connecting how many of the different species are utilizing this is important. However, this is being managed as a deepwater ecosystem, and so the habitat is just as important as some of the fish species within the system that we're managing these different resources.

I think the continuous effort to look at the complexity is going to be really important to understand that, and one of the add-ons to this discussion on a location -- I think one of the things we're discussing on a coast-wide level is some of the fact that you are seeing some transition of species moving within the areas, and so really understanding the physical parameters within the different areas is going to be important, because it will be interesting to understand, if you are seeing some of those different physical characteristics changing within the different deepwater areas, and, if those are changing, currents and temperatures and acidification, et cetera, are you seeing shifts in habitats, coral species, and other species that may be using it, and so that's something that is ongoing that's being done from an Atlantic coastwide council-based activity, and it will be interesting to see if we can create this to be able to understand and establish it.

Maybe there will be opportunities in using some of the different technologies, such as landers, et cetera, to work with our ocean observing partners in the region, SECOORA and others, to be able to use some of the new technologies to begin to document some of this type of thing on a more long-term basis.

DR. GEIGER: From everything I've heard and that's being said, and I appreciate Steve's comments, it sounds like it would still be a very good idea to identify a set of standardized sites to be added to this study, and that will allow us to play not only the short game, in terms of year-to-year funding, but also have a hook for longer-term funding to alleviate the oscillations of funding you have during a normal three-year budget cycle.

In my mind, this is a no-brainer. We are extending significant amounts of resources here, and just adding some standardized sets will allow us to make a strong case to tie into future climate change and a whole variety of other activities that are becoming more visible and more relevant, and I would urge this advisory board to put a strong recommendation forward to do just that. Thank you.

MS. DEATON: Jamie, do you want to make a motion? Is that what you're saying? We could do consensus.

**DR. GEIGER: I would like to make a motion to propose adding standardized sampling sites for these studies, to allow us to look at more long-term and short-term impacts related to a variety of environmental and habitat issues and that this committee will support, strongly support, additions of that to the various opportunities we have to get this kind of data.**

MR. WEBB: Second.

MS. DEATON: Second by David.

DR. ROSS: Before accepting it, I would just like to make a minor modification to add that these sites would be monitoring and sampling. Sometimes sampling is problematic, and monitoring may be less so, and so it's long-term collection of whatever baseline data we can collect from standardized sites, and so that's a minor modification, and I think, in terms of proceeding with that activity, we could recommend that several people that have worked in the area for years be involved with the council or whoever the council's committees are to select -- Even just three or four sites would be useful, or however many. In the end, not that many sites might be funded, even though the sites may be recommended.

MS. DEATON: Okay, and so there have been some -- This can be a recommendation, and it doesn't have to be a motion, but we have a motion on the table, and so we need to make sure we have the wording correct, and you all talk fast. David, did you want to add some more comment?

MR. WEBB: I think some of the presenters had made a recommendation that we look at some of the existing monitoring patterns from the shallow-water corals, and that might be something to at least reference as we try and make a more specific recommendation going forward.

MS. DEATON: Is there any other comments?

DR. LANEY: Just to comment, and I will certainly defer to Steve and the folks on the phone on this, but, having been a veteran of multiple offshore shallow-water cruises targeting certain species, one thing that needs to be kept in mind too, I think, is the logistical aspect of it, because we're still in the process of doing a tremendous amount of mapping of areas that we know absolutely nothing about, and, when you try and roll into that program, the annual, or whatever frequency you decide upon, visitation of specific sites presents some logistical challenges sometimes, and so I would just ask Steve or others to weigh-in on that aspect of it.

That was the reason why the cooperative winter tagging cruise never did engage in a survey design, but rather we did monitoring, but it was highly biased monitoring, in that we had a goal of trying to tag as many striped bass as possible in a given year, to ensure that we would have a large enough sample size to generate meaningful results, and so we dispensed with the survey design pretty early on in that process, just because of the fact that it takes a lot of time to move the ship from Point A to Point B and go through a specific, pre-determined route, and so I'm just mentioning it as something that somebody needs to think about, in terms of putting together a set of stations, and I agree that it's a great idea, and I think long-term monitoring would be highly useful.

DR. ROSS: I think those are all relevant points, but, to some extent -- I mean, funding is always the issue. If you design the perfect plan, it almost is never funded, and any perfect plan is usually retreated from, in this environment, but I think, to some extent though, Wilson, some of those are details that don't detract from us moving forward with the idea. This is a good suggestion that would provide long-term data, and we're lacking this baseline data.

I think one thing that we should keep in mind is that all of this kind of monitoring and sampling may not be necessarily a cruise every week, or even every month. For example, putting down a benthic lander is two cruises for a year's worth of very intense physical data, and, to some extent, even biological data, if you have cameras. To mount an AUV, in these days -- In England, they

are sending AUVs out from their shore-based lab that stay offshore for a month, mapping and gathering data, and so there are a lot of different ways to mitigate cost that may not take a \$20,000 a day cruise for weeks, and so those are things that we could consider as we move forward with the idea, and so it's the idea, I think, that we need to push.

MS. DEATON: If I could, I kind of made some notes of what I think has been added to Jamie's motion. We've got AP motion to council to recommend to NOAA, recommend to somebody, to add standardized sampling sites, three to four possibly, for monitoring and sampling to look at long-term change in deepwater habitat condition and to base site selection and protocol on shallow-water coral sentinel site monitoring methods and recommendations of expert deep-sea ecologists.

DR. LANEY: It occurs to me, belatedly, to ask -- Roger, I know the council already has a plan in place that we just passed, what, last year for one of the sites, and was that for the coral HAPC site, the one that Chip worked on?

MR. PUGLIESE: You're talking about SMZs, the system management plans.

DR. LANEY: Right. Does that dovetail at all with this concept we're talking about here?

MR. PUGLIESE: There is a historic deepwater research plan that was put together a while back, and that has not been updated in a while, and I would have to go back in and look to see if that actually was discussed. It probably has been already discussed within there, and so there is an opportunity to have an add-on or addendum to that that would address this specifically, and so that is a possibility under, I guess, that plan, but I think this is just a specific request that I think, in the bigger context, when we're collaborating across these, and it's being done beyond just kind of the baseline information, I think, from this group, the bigger ecosystem side is where we're going, and the opportunity to look at change over time and habitat shifts and all these types of things, and I think that can be, in and of itself, a direction.

You have NOAA in there, and it's NOAA and partners, maybe you could put in there, because I think that's really where all of this is really making headway, is you're having a collaboration across multiple agencies to get this type of information really together, and so, yes, to that, Wilson, and I think this is actually something that's a very specific need for the bigger ecosystem perspective in our region.

DR. ROSS: Along those lines of what Roger suggested, I think I wouldn't even necessarily mention NOAA specifically and just say "all relevant agencies", because this would be BOEM, USGS, and the Navy, and potentially, if this is really important to the council and the region, a conglomerate of federal agencies might decide it's worth funding, if the price tag is not too high, and so it would be any number of partnering agencies that might help with this, if the design is appropriate.

AP MEMBER: I think, also, if we're bringing in a lot of these other agencies, we might not want to specify three to four sites. I think we should say as many as feasible.

MR. PUGLIESE: Yes, because I think one of the key things there is going to be able to strategically place them associated with the different types of habitats and associated with the different areas, so that you capture unique characteristics, and so those can be not just one area,



but they could capture the standardization of the Miami Terrace or an area to the north. I mean, that's something that can be developed, but I think that's probably a good tact, is to do it that way, so that you can develop that into there, so you don't pigeonhole yourself into just picking a couple of places and being done with it.

MS. DEATON: I will try and read this again and see if this reflects what you guys want. A motion to the council to recommend to all relevant agencies to add sentinel sites for monitoring and sampling looking at long-term change in deepwater habitat condition. Base site selection and protocol on shallow-water coral sentinel site monitoring methods and recommendations of expert deep-sea ecologists.

DR. ROSS: I think usually the way we've done this is we have looked at it as edited as we see it, and, if you want to leave it at that for now, and then maybe several of us could look at it later and just wordsmith it a bit, and I think it's fine.

MS. DEATON: Okay.

MR. PUGLIESE: That's kind of how we've dealt with some of these before, and so it's by consensus, but we circulate it and have members tweak it and get it to the point.

DR. GEIGER: Anne, should we at least have a second, to allow us to proceed?

MR. PUGLIESE: One last comment related not to this, but really to what Heather was talking about, I think one of the other aspects that's going to be just as significant is some of the work she's talking about and the ability to look at all of this information in context, to see if -- We're talking about specific monitoring capabilities, and looking at this in combination, where you may have some overlap, and so you may actually be able to see the distribution of some of these habitats, and there may have been some shifts in those, and the ability, if you've got the environmental information, to show that there may actually have been some changes in currents or whatever, and so that broad view of a lot of it and the insight that that may derive I think is pretty significant.

It's probably even, at this stage, more significant than -- That's the longer term, and, this one, you immediately may be able to begin to see what is going on and what has occurred over time that any of this different work has been done, and so I'm encouraged to hear that that work is going to happen.

MS. DEATON: Heather, I just wanted to say thank you, and I wanted to make sure that you heard that. Thank you for the presentation. It was really informative, and we wish you the best of luck this summer with the rest of your cruises.

MS. COLEMAN: It was our pleasure. Thank you very much for having us on, and we look forward to talking again at the next meeting in October.

MS. CANTWELL: I second that. Thank you, guys, very much. We continue to really appreciate all the support and help that we receive from the council as we're planning these expeditions, and so thank you, guys, for inviting us today and for helping us as we refine our expedition plans. Also, tune into the dives when they're live. We'll be diving on June 21 through July 11, and so

oceanexplore.noaa.gov. It will be live, and you can see what's right here in the HAPC as we see it.

MR. PUGLIESE: Thank you, and we'll get the notification out. We'll actually probably go ahead and get a link on the site. We had added it last time the cruises were ongoing, and hopefully we can refine and expand that, so that you can go to their web services and be able to link back up directly with your live activities, and we really appreciate that effort too, and hopefully we can refine and expand the web presence too, with all the activities that are ongoing.

MS. COLEMAN: Absolutely. Just keep us up-to-date with the motion that you're setting in place.

MS. DEATON: Will do. Okay. We're going to move on to our next topic, which is Ecosystem Considerations: Prey Supporting Dolphin Wahoo Fisheries. I think that John Hadley is going to do that.

MR. PUGLIESE: Yes, John Hadley is coming up, and we're getting ready to get loaded. This is a follow-up from the last Habitat and Ecosystem Advisory Panel, where we had the detailed presentation by Steve Poland on the species and some of the most detailed information on prey and predator information on dolphin and wahoo that had been compiled. What John is going to go into is actions the council was advancing on consideration of specifically bullet and frigate mackerel as significant prey for dolphin and wahoo.

MR. HADLEY: Thank you, everyone. As mentioned, my name is John Hadley, for those that I haven't had a chance to meet. I am, among other titles, the dolphin wahoo species lead for the council, and what I'm going to be running through is, as Roger mentioned, and he kind of gave a brief intro there, a very good intro, but kind of picking up where you left off at the last meeting, where you came up with a recommendation based on the predator-prey relationship and that science and then where the council is at least initially going with it. This is an adapted version of the scoping presentation, and I will get into the details of how this may move forward.

Just a little brief background, the council is considering adding bullet mackerel and frigate mackerel as ecosystem component species in the Dolphin Wahoo Fishery Management Plan. There was some initial discussion on considering other prey species as well, but the council ended up concluding that they wanted to, at least for now, focus on these two species.

The council is considering action and acknowledgment of the role that the two unmanaged mackerel species play as important prey for both dolphin and wahoo, particularly for wahoo, and the South Atlantic Council is currently soliciting public input through scoping, and we just actually just wrapped that up, but the council will be taking into account the comments received at their upcoming June meeting, and we'll determine how to proceed, or if to proceed, with adding bullet and frigate mackerel as ecosystem components in the Dolphin Wahoo Fishery Management Plan.

Really, this plan, the dolphin wahoo plan, is pretty interesting, in that it covers the U.S. EEZ from Maine through the Florida Keys, and so you're going well beyond the typically jurisdiction of the South Atlantic Fishery Management Council, and so a change to the fishery management plan has the potential to affect some fisheries in the EEZ along the entire U.S. east coast, and the council, the South Atlantic Council, serves the lead fishery management council for this fishery

management plan, but it manages in cooperation with the Mid-Atlantic Council and the New England Council, through seats on the South Atlantic Council's Dolphin Wahoo Committee.

As a bit of a refresher, as far as the background of this topic came about, in March of 2018, the Mid-Atlantic Council requested that the South Atlantic Council consider managing the two mackerel species as ecosystem components in the Dolphin Wahoo Fishery Management Plan, and, really, the major reason for them doing so is that they originally considered these two species for inclusion in the Mid-Atlantic's unmanaged forage omnibus amendment, but this was disapproved by the National Marine Fisheries Service towards the end of that amendment, before it went into place, and the agency cited concerns over inconsistency with National Standard 2 and an insufficient connection to the Mid-Atlantic Council's managed fisheries.

We'll jump into some of the information on bullet mackerel and frigate mackerel and their connection to dolphin and wahoo. Bullet mackerel are found from Cape Cod through the Gulf of Mexico. Frigate mackerel have a slightly more compressed distribution, and they are typically found from North Carolina through Florida.

Both species have been identified in the diets of dolphin and wahoo, which you got a very in-depth presentation on last time, but the point being that wahoo have a particularly strong reliance on bullet and frigate mackerel, and the two mackerel species have been observed as the most dominant forage, by mass and number, in wahoo diets. Dolphin tend to have a more diverse diet and a lower reliance on the *Auxis* species, but the bullet and frigate mackerel have been identified as important prey for dolphin at times.

Looking at some of the fishery information, commercial landings over the past twenty years, with a terminal year of 2017, were examined, and there were commercial landings of frigate mackerel, specifically, from dealers in the Mid-Atlantic and New England regions, which was interesting, because, as one of the previous slides showed, the distribution of frigate mackerel tends to be a more southern distribution, but that's how it is shown, according to the ACCSP, and so the dataset shows all commercial landings as frigate mackerel, and there is certainly some species ID issues that are potentially in there.

Looking at the commercial landings over the past twenty years, approximately, on average, it's about 4,500 pounds per year, and this has an ex-vessel value of approximately \$2,400 and an ex-vessel price of just under a dollar per pound, ninety-three cents per pound, and there were some years where landings greatly increased beyond that average, particularly in 1999, when there were 37,000 pounds landed, and in 2000, where there were 20,000 pounds landed. However, commercial landings in recent years have been typically low.

Moving over to recreational fisheries for the two mackerel species, recreational landings of bullet and frigate mackerel have been variable and sporadic. On average, it's approximately 4,700 pounds of both species landed, combined for both species on average. However, in many years, there are no landings that show up in the recreational data. On the other hand, there are some years, much like the commercial data, where you do have spikes in landings. Of note is 2012, when there were 52,000 pounds, and, in 2013, there were 18,000 pounds of the two species landed, and recreational catches have largely occurred in the South Atlantic region. However, there are some catches reported in the Mid-Atlantic region as well.

That was specific information on bullet mackerel and frigate mackerel, and we're kind of switching gears here to some of the regulatory parameters, and so kind of a conceptual standpoint of adding ecosystem component species to a fishery management plan. There is no mention of ecosystem component in the Magnuson Act itself, and so the basis for the concept is derived from multiple references to ecosystem and the authority for councils to conserve target and non-target species and habitats through their fishery management plans. There is some guidance captured on ecosystem component species and appropriate considerations for councils in the National Standard Guidelines, which we will go over in just a bit.

Looking at the definition of ecosystem component species, at least in the National Standard Guidelines, they are defined as a stock that a council or the Secretary has determined do not require conservation and management, but a desire to list it in a fishery management plan in order to achieve ecosystem management objectives.

One step, should the council choose to move forward with adding the two mackerel species to the Dolphin Wahoo Fishery Management Plan, is specifying what ecosystem management objectives these two species may address, and so, as it stands now, the ecosystem management objectives have not been fully developed in the Dolphin Wahoo Fishery Management Plan. Should they decide to do so, I imagine that the council would probably rely on their APs to help formulate some of those objectives.

There is the question of conservation and management, and this comes up several times, and how is it determined if a species is in need of conservation and management. If it is determined that a species does not need conservation and management, then that species has the potential to be listed as an ecosystem component, and it does not require ACLs or other reference points or accountability measures, and so, according to the National Standard Guidelines, a council should consider a list of ten factors when deciding whether a stock or a species requires conservation and management.

I have them below, and, really, some of the considerations are the importance of the stock to the marine environment, the economy, or user groups, whether the stock is caught or is a target of a fishery, whether a stock can develop a fishery, resolve conflicts, whether a fishery management plan can help a fishery resolve conflicts, improve the stock, or enhance the economic condition of a fishery, and the extent to which a fishery is already managed.

Once the council moves through that list of items, they may choose to identify stocks as ecosystem component species, and these species may be identified at the stock level or the species level, and they may be grouped into complexes, and management measures can be adopted in order to, for example, collect data on ecosystem component species, minimize bycatch or bycatch mortality of these species, protect the associated role in the ecosystem, and address other ecosystem issues, and so this is an interesting -- It's underlined there, in that it's sort of a catch-all phrase, but it might provide some flexibility in how a council can move forward.

It appears that bullet and frigate mackerel may have the potential to be listed as ecosystem component species for dolphin and wahoo. However, before that can happen, the council and the Secretary must agree that the species do not fit the requirements for implementing conservation and management measures and if it's determined that the species are important in relation to the ecosystem management of dolphin or wahoo stocks.

Looking at some of the mechanisms for adding unmanaged prey species as ecosystem components in an FMP, an amendment must take place, and we'll get into some examples on how other councils have tackled this, but some councils, such as the Pacific and Mid-Atlantic, have designated ecosystem component species through a comprehensive approach that added these species to multiple FMPs at once, and so, essentially, they had one amendment that amended multiple fishery management plans all at one time and added the chosen species as ecosystem components in all of those FMPs at once. However, this comprehensive approach certainly isn't required, and a council can add ecosystem component species to a single fishery management plan.

Getting into some of the examples on how councils have tackled the unmanaged prey species and how adding them as ecosystem components in their fishery management plans, the Mid-Atlantic Council developed an unmanaged forage omnibus amendment, as I mentioned earlier, and this became effective later in 2017, and, really, again, this is a comprehensive approach, and so they comprehensively implemented management measures for seventeen species or groups of species, with sixteen of them being designated as ecosystem components in all of the Mid-Atlantic's fishery management plans.

Really, the goal of this amendment was that it was intended to prevent development of new or expansion of directed commercial fisheries for ecosystem component species until adequate information could be gathered, and so kind of freezing the footprint, so to speak, until information could be gathered, and then directed fisheries could move forward after that information is available.

The Mid-Atlantic received input from their SSC on how to narrow down the important forage species, and that's one of the steps they took along the way in developing this amendment. In the end, the Mid-Atlantic established a possession limit, and so they had a 1,700-pound possession limit for all ecosystem component species combined, and they had a permit provision, where all commercial vessels or operators that catch or possess those ecosystem component species had to have a commercial vessel and operator permit.

There was a transit provision, and so this was specified for vessels, that they may have those ecosystem component species in excess of the possession limit, and they may transit through the Mid-Atlantic's area of jurisdiction, provided that their gear is stowed and not available for immediate use while in transit, and they also had a recordkeeping and reporting requirement, and so all vessel operators and seafood dealers were required to report the catch and sale of the ecosystem component species on existing vessel trip report forms and dealer reports.

Moving over to the Pacific Council, the Pacific Council developed their Comprehensive Ecosystem-Based Amendment 1, their version of CEBA 1, and it became effective in May of 2016, and, here again, the Pacific Council comprehensively implemented -- They took a comprehensive approach, and so they comprehensively implemented management measures for multiple ecosystem component species in four of their finfish fishery management plans, and so they did this all at once.

This was much like the Mid-Atlantic, and it was intended to sort of freeze the footprint until more information could be gathered, and, in doing so, that last part on how to gather adequate information, the Pacific Council adopted Council Operating Procedure 24, and, really, this was a

standard process to consider exempted fishing permits for ecosystem component species, and this was intended to -- It was intended to develop scientific information that could lead to developing potential future directed fisheries.

In the end, the Pacific Council had general measures regarding ecosystem component species that they established, and they also had gear-specific measures, in this case-trawl-gear specific measures. They had a retention limit, a trip limit, an annual limit, and so this is an annual vessel limit, and then a processing limitation, and so there was a prohibition, with limited exceptions, of at-sea processing of the ecosystem component species.

Moving over to trawl gear, this was largely focused on the ecosystem component squid species that they identified, and there was a trip limit where a vessel could have one metric ton of all ecosystem component species onboard, with the exception of ecosystem component squid species. However, there was an annual vessel limit implemented of forty metric tons combined weight of any ecosystem component squid species in a calendar year, and so they had a trip limit kind of exemption for several squid species. However, they did have an annual limit, to sort of cap the maximum landings per vessel.

Moving over to the North Pacific Council, the North Pacific recently classified squids, several species of squids, as ecosystem component species through amendments to their Bering Sea, Aleutian Islands, and Gulf of Alaska Groundfish Fishery Management Plans, and this became effective in August of 2018. The North Pacific noted that squid are important prey species for marine mammals, fish, and other squid, and, although squid do not require conservation and management, it is still appropriate to take measures to minimize squid bycatch, to the extent practicable.

Whereas the Mid-Atlantic and Pacific Councils were focused on freezing the footprint and preventing unplanned expansion of fisheries, the North Pacific tackled it more as a bycatch concern approach. The North Pacific ended up establishing a recordkeeping and reporting requirement for catch, discard, and production of squid. It had to be recorded on logbooks or catch or production reports, and, also, there was a retention limit implemented, where the maximum of squid could not exceed 20 percent of the total landings.

Last, but not least, the South Atlantic Council has listed several ecosystem component species in the Snapper Grouper Fishery Management Plan, and this was not directly implemented, due to concerns over the protection of unmanaged prey species, and so they weren't coming at it from necessarily a prey standpoint. The species that were listed as ecosystem components were longspine porgy, cottonwick, ocean triggerfish, bank sea bass, and rock sea bass.

In this case, there were no regulations associated with the listing. However, the species stayed within the fishery management unit, and the listing did prioritize the species for continued data collection that may help with future ecosystem modeling and ecosystem-based fishery management efforts.

The implications of listing an unmanaged prey species as an ecosystem component really vary and are dependent on the management measures that are put into place around that species, but, in general, it does recognize the role of those species as prey for species that a council directly manages and can provide protection for species from an unexpected ramp-up in directed effort or

landings. It allows for orderly growth of directed fisheries, and it can address bycatch concerns, and it may prioritize the species for future research and monitoring. There is the potential cost to fishery participants, by capping potential revenue streams, and, also, the administrative costs to the council and NMFS by dedicating resources to listing the species in a fishery management plan, implementing regulations, and providing necessary monitoring.

Finally, we'll go over some potential options that the council may have for moving forward. Through the past actions of the South Atlantic Council and many other councils, there are several options that the South Atlantic may have if designating bullet and frigate mackerel as ecosystem component species, and there is seemingly, there again, somewhat flexible guidance in the National Standard Guidelines that encourages novel ideas, provided that they remain within the existing constraints.

The council could request guidance from their SSC on identifying prey species to be listed as ecosystem component species. They could also designate ecosystem component species with no management-related items, such as trip limits or possession limits, and so this is really taking the approach similar to that of what is currently in the Snapper Grouper Fishery Management Plan, and, again, it may elevate the importance of the species for future research and monitoring purposes.

The council could prohibit directed fisheries for ecosystem component species by establishing a trip limit, which can be based on a total amount or a percent of total landings, and this trip limit can apply across all gears, or it can be specifically focused on a certain gear or a certain set of gears. There is the option to prohibit directed fisheries for the ecosystem component species also by establishing an annual vessel limit.

Moving forward, the council could establish reporting requirements, such as through existing logbooks or dealer reports, or potentially implement a permit requirement for landing the ecosystem component species. Also, the council could establish a mechanism or protocol for allowing the development of a directed fishery for the species that are listed as ecosystem components, and so, there again, similar to the approach that the Pacific Council took. There are potentially other options. There again, management measures can be adopted in order to address other ecosystem issues, and so there are potentially other ecosystem issues out there, and I imagine, if the council chooses to move forward, they will probably discuss that quite a bit.

Then, finally, just looking at the timing, this issue went out to scoping, and it will be discussed at the council's June meeting. Should the council decide to move forward, the timing really is dependent on which amendment and how that amendment moves forward, but there could potentially be regulations -- The council would potentially take final action on any amendment around September or December of 2020 and looking at implementing regulations in the spring of 2021, or summer of 2021, and so that's all I have, if anyone has any questions on that.

DR. LANEY: Thanks, John. That was an excellent presentation, and so I've got three questions. The first one has to do with the recreational landings estimates for these species, and my thinking here is, and Steve Poland may want to jump in to give me a reality check, but the question to you is have you looked into any detail at all for those landings, because that 52,000 pound one kind of jumped out at me, and I know the way that MRIP works, and I'm assuming that all of that came from MRIP, is that just one encounter a lot of times can lead to a fairly robust estimate which is of

questionable reality, and I see Steve Poland nodding his head, and Bill nodding his head as well too, and so that is one thing that I guess needs to be taken into consideration, and certainly the council will take that into consideration when they're looking at the recreational landings.

The second question is, Steve Poland, I know I have at least read your presentation that you gave to the council last year, and so, if recollection serves me correctly, it is a really -- These two species are hugely significant in wahoo diets, correct? Steve is nodding his head in assent, and so he may want to hop to a microphone and address that, for the benefit of the advisory panel, for those of you who haven't heard that presentation.

MR. POLAND: Yes, absolutely, Wilson. Bullet and frigate mackerel were very prevalent in wahoo diets, and not so much in dolphin, but, seasonally, they did appear to be important in dolphin, but dolphin had more of a generalist foraging behavior, and they probably only preyed on bullet and frigate mackerel when it was very abundant in the environment, but wahoo, on the other hand, there was a lot evidence to suggest that they were more of a specialist predator on bullet and frigate and other large free-swimming prey fish, but, at certain times of the year, and looking holistically over the time period of my study, and it was about four years, or four spring to winter time periods, bullet and frigate mackerel averaged anywhere from 30 to 40 percent of the total mass of prey items recovered from wahoo, and that was pretty consistence across all seasons.

DR. LANEY: A follow-up, Madam Chairwoman. Was there, and help me out here, because I don't remember, but was there a real evident peak in the length frequency of the prey being consumed? I mean, in just looking at the two species, one would expect that, with a much smaller gape, that dolphins would be eating smaller bullet and frigate mackerels and wahoo would be eating larger bullet and frigate mackerels, and did that appear to be the case, from the data?

MR. POLAND: As far as dolphin, and I can certainly go back and confirm this, but, just from my recollection, bullet and frigate mackerel really didn't appear in the diets of dolphin until dolphin reached larger sizes and weren't as gape limited. Wahoo, all sizes of wahoo consumed all sizes of bullet mackerel, and there really wasn't much evidence of gape limitation, because wahoo forage, much like bluefish, and I think there's a paper from about a decade ago that coined the term of I think it was ram biting, and so akin to ram feeding, and they bite everything in half and come back around and eat it, and so I recovered bullet mackerel and frigate mackerel from the diets of wahoo from around 150 centimeters on up to 600 or 700 centimeters, and the average was about 300 millimeters, but it was certainly a fairly even distribution of sizes in the wahoo diets.

DR. LANEY: Thanks, and so it's pretty much the whole spectrum, the whole age structure, of bullet and frigate mackerels would be important as prey. Then the last question is one for John. John, in those other council amendments, did any of those consider the prey demand of seabirds or marine mammals in addition to the council-managed species?

MR. HADLEY: I am not sure about the Mid-Atlantic or Pacific. They very well could have, but I'm not sure about that. I know that the North Pacific did specifically mention that, sort of the whole ecosystem picture beyond just their managed species, to marine mammals and birds. There it is. From their fishery management plan, squid are important prey species for marine mammals, fish, and other squid, and so kind of the broader picture there.



DR. GEIGER: First of all, that was an excellent presentation. It was very beneficial and very helpful. I guess, whenever I see these kinds of presentations, I ask myself one question, is the juice worth the squeeze, and, right now, I have a real question on is the juice worth the squeeze, but the question I would have to the council would be has the South Atlantic Fishery Management Council prioritized all prey species under current and joint fisheries management plans, yes or no?

MR. PUGLIESE: No. I mean, this is the beginning of the discussion.

DR. GEIGER: Okay. With that being said, I would suggest that a more beneficial exercise, rather than expanding work that will take resources away from more priority fisheries management plans and other activities, I would ask that the council may want to consider prioritizing work in this arena, given what previous and other councils have done, as well as other activities, and, again, it has to do with resources, activities, and focus, and, right now, my gut tells me that this isn't ready for primetime, but I do think the council needs to have a robust discussion on how and why we do these things and have some kind of prioritization or protocol to prioritize what these important prey species are and how much resources we need to apply for them. We prioritize fisheries management plans, and why not the prey to support them? Thank you.

MS. DEATON: I had one question, just to change the topic, but, on the commercial landings, I was just curious what fisheries are catching those mackerel incidentally.

MR. HADLEY: I would have to go back and look, and I actually have it right here, but there were some -- I know that there were some gillnet landings, and there were some trawl landings. It was noted, actually, that -- I remember the Mid-Atlantic noted that they were caught in some of the summer flounder trawls, and so trawl and gillnet I think were the primary gears for those fisheries.

Steve brought it up, at I believe the last council meeting, that North Carolina has, and I think other states are in the same boat, where some of these mackerel species may have been reported commercially, sort of at an aggregate level, and so maybe a mackerels kind of catch-all category, and I know North Carolina has changed their trip ticket system in 2018 to have a specific bullet mackerel category, and so that's probably another artifact of the commercial data, where you may be missing some of those landings or particularly how all the -- There were no bullet mackerel landings, and so it could be a species ID issue, and it could be a species code issue there, but I believe that North Carolina did see some landings in 2018 with the change of that species code. As that data becomes available, I think it will become a little bit more apparent.

MS. DEATON: I saw gillnets, and I just didn't think the gillnets were that far out where the mackerel were, but I don't know.

MR. POLAND: I was just going to add to that. North Carolina didn't add codes in our trip ticket system for bullet and frigate mackerel until early 2018, and that was in response to the Mid-Atlantic Council's measures under their omnibus forage fish amendment. I think they were added in February of last year, and we started receiving landings that same month, and I think, the last time I looked at that data, at least for 2018, we had about 2,500 or 3,000 pounds of bullet mackerel, and no frigate mackerel, to the species level. The gillnet fisheries that I think those bullet and frigate mackerel are coming from, from historical landings, I think those are our near-shore gillnet fisheries for other mackerels, like Spanish and king and cobia, and it was just really kind of

intermittent. It was probably just if there was a school around and they interacted with the gear, that's when they saw it.

AP MEMBER: Were these always connected with say sargassum weed, like flyingfish or some other species that really hang close to the sargassum weed, or are they in open water?

MR. HADLEY: I believe these two species are more of an open-water schooling, and they're not necessarily a structure-oriented species.

AP MEMBER: I did notice back there that it said they're using incidental catches, and I believe they're important to the wahoo fishery. In the future, as things change a bit, it could be more important to the dolphin fishery, but, as far as options, this Table 4 sounds pretty safe to designate this with no management, Option 2 of Table 4, to designate EC species with no management-related items, because Option 1 requests guidance from the SSC. The council is not going to do much of anything unless they get guidance from the SSC at some future date, after research and the numbers of these prey species, and so the Number 2 option there sounds pretty good, because the other options are just not going to happen until Option 1, guidance from the SSC. That's just my thoughts on it.

MR. WEBB: I might be having a moment, but did not we already make a recommendation from the AP that the bullet and frigate mackerel be included in some manner? Didn't that start this whole thing? The Mid-Atlantic requested us, because of the failure, and I think you and I did the work on a draft of this, and so we've already made a recommendation.

MR. PUGLIESE: Yes, and this is a follow-up from the review of the information that was provided and the recommendation that was advanced to the council and the council taking the next steps on considering how they would begin to look at it, because there was a lot of discussion at the council level on whether it be just bullet and frigate or look at a broader scope, and there was a lot of opinion of advancing this based on -- I mean, we're talking about species that have a connection, and some of those levels are higher than any other species I know. 40 percent consumption rate is pretty phenomenal. You have advanced it, and the council has taken this out to scoping, to look at where we're at.

One quick point that I would like to make, and I think is important -- Two aspects. One is on the bigger picture and looking at that. While I say that, no, we are not looking at -- We are relative to our ecosystem modeling. We have very specifically been compiling all the diet information to support that, and we're also advancing a very focused effort to look at what we know and what we need to know, and we're having the first group of the SSC, in cooperation with the modelers, meet in July to actually make those recommendations to collect the information from the fishery-independent and other surveys, and so there's active effort to do that very detail.

The other aspect I think that's important to put on the table is that, last week, we had the Council Coordination Meeting, the CCC meeting, in Charleston, the national level, and one thing that did come up during that is there is action moving forward, and it sounds very significant, to look at forage fish, directives to look at forage fish nationally, and so we may be advancing discussions on this sooner than later.

Just as a heads-up that it's probably good to know that that's a -- It sounds, from the discussions that were at the table, that that's got more legs than not and advancing those things, and I think the point that was made before is that you all, in context of a summary recommendation, start with something small and advance that, and I think that's kind of what the council is looking at. This is a very focused, very highly supported action, and so just the two things. I wanted to identify that we are looking at some of the bigger-picture things, and we're actively going to advance that, regardless of what other things are working in the background, but this is the first step of the council beginning to look at how we deal with prey-predator and how we deal with the concept of using the ecosystem species.

MR. WEBB: Does the council -- What would be appropriate for this panel? Do we need to re-emphasize or add more support or whatever, because I remember we had the conversation when we were looking at this that we were trying to get ahead of the curve. We were trying to not wait until the aquaculture industry decided this is going to be a great new source for feed and it goes out there and starts having huge commercial operations and to at least have some kind of identification of importance to the overall system, and so is there anything that we should do that would be beneficial to help the council get further down the road here?

MR. PUGLIESE: I think that's one of the reasons we're bringing -- This has gone out to scoping, but bringing specifically what was being considered at scoping to this group to advance it, and those are some of the positions you have from the group, and it would help the council to advance their discussion on how to address this and continue to be proactive, et cetera, and so, I mean, you have options that have everything from just deferring to the SSC discussions, which I'm not sure we're ultimately -- To actually putting in regulations or some type of limitations that are precautionary and proactive.

I think it does lay out different actions to go, and, if there's something that does seem to address this idea of precautionary, that's an opportunity to weigh-in on something that the council is going to be specifically looking at, and so, if there is the support, based on what was heard from the last meeting and the details and the science behind this, but also on the desire to advance a precautionary approach.

One point that came from our Mid-Atlantic partners that came up at the CCC meeting was -- I think they reemphasized the point of chub mackerel, where, before they started their efforts, there was no fishery, and they went in and did the ecosystem component and set a level at five-million pounds, because the fishery started and immediately came in in one year. Essentially, it was one year, and so, just as a precautionary approach, if there is demand for some of these resources that can come out of literally nowhere, and I think they were just trying to re-emphasize that it did on them, and that's where they ended up for the baseline.

MS. DEATON: I guess one option -- I mean, this advisory panel could choose to support any of these options, or you could reinforce the last recommendation, which I remember being on the line and not remembering exactly, but it was that we needed more information and research, right, to see what actions were needed, and so the reporting would also get at that, and I was just going to mention that.

MR. HADLEY: Before I came up here, I looked up the last recommendation, and, in summary, the AP recommended a proactive approach to monitoring the prey species, and the rationale there

was, since the harvest appeared to be stable for the time being, and so I just wanted to throw that out there. That's where this AP left off.

MR. POLAND: I was just going to speak, since there were some questions about the intent of the council or specifically what the council is looking for, as far as input from the AP. Certainly, after reviewing the scoping information that Mr. Hadley provided, if there's any additional feedback that you can provide to the council to help in our deliberations on this and, also, in the context of habitat and ecosystem plans and the implementation plan and the roadmap, if you have any comments to that and how this fits into that, the convoluted jigsaw.

The last point is I just want to reiterate that we are the South Atlantic Council, but, as John said at the very beginning of the presentation, we manage this species and this complex from the Keys to Maine, and this was a request from the Mid-Atlantic Council, because they are seeking protections for this species, and we manage this species, with their input, but we take the lead on that, and so I will just throw that out there, as far as please don't think just in the context of the South Atlantic, and that we've got a responsibility to manage this resource up and down the entire Atlantic coast, and so just please consider that, because there is an active fishery in the Mid-Atlantic and New England for other species in this complex, and so, realistically, it probably wouldn't be too difficult for them to shift focus over to bullet and frigate mackerel or other similar species in the food web out there, and so I'm just putting that out there for further discussion.

MS. DEATON: I would just add, to Steve's point, is that, in that roadmap, under the food web connectivity policy, there is an action that gets at getting better information on forage fish and that it's a priority. It's addressing council forage science priorities, including predator dependencies, and then the sub-bullet is identify species for which diet data are lacking and prioritize future research and define and prioritize the major forage groups in the managed species diet composition and characterize the life history of primary prey for council-managed species, including blah, blah, blah, and dolphin and wahoo. I mean, it is identified here for the FEP roadmap, and it is a priority.

MR. WEBB: I would be reluctant, just speaking for myself, to try and second-guess what options the council might find most useful, but I really think it would be important for us to send a message strongly supporting and reinforcing that, while there is a lot of unknowns in the interconnectivity between these forage fish and the managed species, there obviously is connectivity, and, before we decide that something should be -- I just think we should reinforce our position that we really strongly recommend that this be included at some level, whatever the council feels is the most likely success pattern here to get through, and that we support them in that.

MS. DEATON: I would ask Roger or John or Steve, and is that helpful, to say that we support you, whatever you think is best, or do you want to know what this advisory panel thinks is best?

MR. PUGLIESE: I was just going to say that I think the message I'm getting here is the strong recommendation to be proactive, and I think that's one of the most significant, whether it be how you limit that -- I mean, what I see is you don't want to get into some of those weeds about saying, well, it should be a trip limit, or it should be this, but whatever the mechanism to be a proactive action by the council under this suite of options to advance and understand the importance of prey species in these fisheries, that's where I would think the recommendation comes in.

MR. POLAND: I would just add, from the council perspective, I think, right now, what we're looking for -- We received a ton of public comment on this, more so than we receive on a lot of other actions, especially regulatory actions, which sometimes it's kind of aggravating, but there's been a lot of public input on this, and, really, I think all we're looking for right now is just some affirmation from the experts, subject matter experts, sitting here on the AP of if the science is sound, or sound enough footing, to consider further action, before we springboard off into getting in the weeds.

MS. DEATON: I think that you are hearing that, and Wilson wanted to add something.

DR. LANEY: Just kind of responding to Dr. Geiger's earlier comment. It sounds to me, from what you just read, Anne, that the broader concern of identification of forage species for every council-managed species and across the ecosystem as a whole is certainly captured in the FEP roadmap, and so I think that's addressed.

The way I look at it, you've got to start somewhere, and I think Bill and Tom Jones and Jeff would all concur that, if you've got to pick some really key recreational fisheries off the South Atlantic, and, as Steve pointed out, not just the South Atlantic, but the whole east coast, dolphin and wahoo certainly are way up there, in terms of importance, and we've got robust science here that documents, beyond a shadow of a doubt, how important these things are, for wahoo especially, but also for dolphin, and so I think it's a good place to start.

Jamie, your concerns about resources and priorities are always there, and certainly are valid points, and, again, I think those are going to be addressed, to a certain extent, in the FEP roadmap, but I think it would be totally appropriate for the AP just to reinforce their concerns about being proactive and moving this ahead to establish precedent for other important prey species that the council may choose to deal with later.

DR. GEIGER: Certainly I agree with everything that's been said. The question I would raise is I don't want to dilute the importance of prey species and the emphasis of this advisory board supporting those kinds of activities. The question I would ask is, is this the best complex to do it with? Are there other fishery management plans under the South Atlantic Fishery Management Council that may be either more focused or more along that we can use as a real strong case example? I don't know. I don't know the answer to that question. I do know that prey species is -- We need to be proactive, and we need to be involved. We need to be active, but we also need to have some kind of prioritization on what we do and why we do it.

MR. PUGLIESE: Just to try to address that, I think that, from what I've seen, in terms of the documentation and the level of detail of the complexity of understanding the prey-predator components in this situation, this is probably the most supported information that I have seen, and, truthfully, what I want to do is I want to see the same type of analysis that Steve did for these species done across-the-board for many of the other species we have, and we just don't have that level. I mean, that's the most complex diet analysis for any species that's under council management that I know of.

MR. POLAND: I just wanted to reiterate too that there is a fairly large body of work for pelagic diets, and it's not just my study. I think, when I gave the presentation back in September or October, I touched on some of the work that Paul Rudershausen and Jeff Buckel had done at NC

State, and John Graves has done plenty of work out of VIMS. There is studies out of Florida, and I know that they've looked at diets in the pelagic food web, and there are studies from the Mid-Atlantic and New England by Michelle Staudinger and others, and so there's a fairly robust body of literature out there on this.

I am not going to say that there is other managed species we have where that body of literature is as robust, but I certainly think the council has prioritized it through the FEP plan, and there are other researchers actively looking at diets, not only of dolphin and wahoo, but snapper grouper species and billfish and other HMS species, and so the work is being done, but, as always, it takes prioritizing that at this level to get people out there and continuing to do it.

MR. PUGLIESE: I appreciate that, Steve, because I think it's frustrating for me, because one of the things I see is that some of the most significant work that needs to be done are the things that are having to get trimmed out of some of the activities that are ongoing, some of the fishery-independent surveys, and some of the things that we've had to pull back are some of the collection mechanisms that were collecting some of the diet information, et cetera, because it's either keep sea days or drop some of the collection components.

This idea that we can move forward with ecosystem-based management and address a focus on understanding the prey-predator interactions without making sure that those resources are there is a problem, and we're trying to do as much as we can to make it come forward, and I feel at least a little more encouraged in the bigger picture with all the work we're doing on ecosystem modeling right now, because we have been partnering with FWRI, and we are going to advance what we know and then how to direct getting the most -- You talked about the inefficiency, and we are able to -- The way this last matrix material was put together for this model, we're going to be able to identify species that will actually enhance the model greater, and so we can prioritize some of those, and so the collection recommendations to those different organizations, whether it be fishery-independent or fishery-dependent, can be very specific that will give us the best collection information, and it needs to go beyond that.

That's baseline type of thing, and I think we have to go far beyond this, but at least we're beginning to move down there, and we have a focus on the bigger picture, and we have a focus on some very specific actions right now.

MR. WEBB: Would it be appropriate to make a motion that the AP drafts a document reaffirming our strong support and recommendation to the South Atlantic Council to move forward on this, based not in small part to the body of scientific data that shows the critical link between these two forage species and the highly migratory species of wahoo and dolphin? If so, I so move.

MS. DEATON: Okay.

DR. LANEY: I will second it.

MS. DEATON: Okay. We have a David Webb motion to write up a recommendation, and it's seconded by Wilson. We have homework for tonight. Okay. One last thing that I was just curious about, and you said public comment, that there's been a lot, and has it been mostly supporting actions or opposed to actions on these ecosystem species?

MR. HADLEY: I don't think I've ever seen a fisheries management topic that has shown this much broad-based support for moving. I mean, it's almost across-the-board positive, encouraging the council to move forward, which is interesting. You usually have split opinions on these things, and there are different opinions on how to move forward and which options to move forward with, but there is general -- The comments received were in general support, and it seems like, the ones that were opposed to moving forward, there was some misunderstanding there, where it was perceived that the council was thinking about opening up a new fishery or that sort of thing, when I don't think the point that these species are unmanaged kind of was coming across, but, yes, quite a bit of comment, and it was pretty impressive how much feedback we got.

MS. DEATON: That must feel good for a change. Thank you, everybody, for that good discussion. I think we should take a short break, and I know I've been waiting, and so how about ten minutes. It's 11:06, and so that's 11:16 that we'll be back.

(Whereupon, a recess was taken.)

MS. DEATON: There's only one more agenda item before lunch. Julia Byrd is going to talk to us today about citizen science that the council is starting to do, and so we thank you for joining us, Julia.

MS. BYRD: Thank you for having me, and let me get this started. Okay. For those of you that I don't know, my name is Julia Byrd, and I am the South Atlantic Council's new Citizen Science Program Coordinator. Amber Von Harten, who some of you may know, held the position before me, and she has left the council for another job opportunity, and so I have kind of -- I was in the SEDAR world, and I have shifted gears a little bit, and I have come to join the Citizen Science Program.

What I wanted to do today was give you a little kind of update on the program, and it's my understanding that the Habitat AP hadn't been briefed on the program yet, and so I'm going to give a little background information on kind of the reason why the council was interested in pursuing citizen science as well as a little bit on the program development and then talk a little bit about two pilot projects that we're hoping to launch later this year and about kind of updating our citizen science research priorities and how we would love to have a couple of representatives from this AP kind of get plugged into that process.

First off, why was the council interested in citizen science? We were interested in kind of pursuing citizen science as a tool to help address some of the long-standing data needs within our region. Resources are limited, and so we thought that citizen science may be a good avenue to help address some of those needs. We have a ton of fishermen on the water, over three-and-a-half million anglers and over forty million trips in our region, and, over several years, we've heard from fishermen that they really want to help collect data, and they want to be involved in the data collection process.

The council did a snapper grouper visioning process a number of years ago, and that was one of the things that we heard repeatedly from a number of fishermen, and so the idea was, well, maybe citizen science is an avenue that we can get fishermen and scientists working more collaboratively to help kind of fill some of the data gaps within our region.

The council really kicked off their efforts to pursue a citizen science program back in January of 2016, and we held a workshop here in Charleston that was a citizen science program design workshop, and so what we did was we brought together over sixty people from around the region to come together and discuss kind of what a citizen science program could look like in our region, and so participants ranged from fishermen to SSC members, and we had state agency and federal agency scientists and researchers and university researchers and Sea Grant outreach specialists and data managers, and so a wide variety and a diverse group of folks came to participate in this workshop.

The workshop participants came up with recommendations on what a program could look like in our region, and that led us to draft what we call the citizen science program blueprint, which kind of outlined the framework of what a program could look like in our region. Then, in September of that same year, in 2016, the council formed a Citizen Science Committee. Then, in December, they kind of approved the initiation of a citizen science program and supported hiring a position to kind of develop that program, and that was originally Amber Von Harten.

The overall kind of mission for the program is to improve information for fisheries management through collaborative science, and this is kind of a list of our primary goals. I am not planning to walk through them, but I did want to say a little bit about kind of the approach the council is using for citizen science.

We really want to use citizen science as a way to kind of help fill data gaps and help address some of the priority research needs identified by the council, and so we want to make sure that we're kind of complementing existing data collection programs and partnerships and that we're not competing or trying to replace them, and we want to have kind of intentional design on our projects, and so we want to think about how the data could potentially be used in kind of science and management decision-making when we're kind of designing it, with the hopes that that will lead to a more successful project, where the data may be able to be directly applied to things that the council is doing.

When the council started developing the program, they kind of made an intentional decision upfront to develop program infrastructure first before launching individual citizen science projects, and they did this by putting together five volunteer action teams, and we called them A-Teams, and they were tasked with developing kind of programmatic components in these five topical areas of Volunteers, Data Management, Projects & Topics Management, Communication and Education and Outreach, and then Finance & Infrastructure.

The A-Teams were comprised of fishermen, staff from resource management agencies, researchers from universities or from federal or state institutes, data managers, outreach specialists, and it was a wide variety of folks who were interested in fisheries in general and interested in seeing how citizen science could be used in fisheries, and so these guys met in 2017 and 2018, and they held over fifty kind of virtual meetings, and they produced a lot of kind of best practices and recommendations for the program, and so this slide is just kind of a summary of all the different products and inventories and things that they produced for the program in general.

All of these things are available on our website, and so, if anyone is interested in seeing any of these individual items, I am happy to kind of point you where to find them, and they are available, and so, if other folks are interested in kind of developing a citizen science program, these tools are



available to them as well. The A-Teams really did an incredible amount of work over a year's time, and we wouldn't have been able to develop all of this infrastructure without their work.

That is just an update on kind of programmatic development, and I wanted to quickly highlight some of the key activities that took place in 2018 and then talk a little bit about 2019 activities and then get into some of the pilot projects and the kind of citizen science research priorities, and so, in 2018, the main focus was on developing this program infrastructure, and, again, that's what all of these citizen science A-Teams, or action teams, worked on. We also worked to develop kind of partnerships, and we secured funding for our first pilot project, which I'll talk a little bit more about in a few minutes, and it's to try to collect more information on scamp discards.

The initial version of the citizen science research priorities were adopted, and then all of this work culminated in the council approving and adopting the Citizen Science Program's standard operating policies and procedures, or SOPPs, and so that took place in December of 2018.

In 2019, Amber kind of left the council, and I have been transitioning into this new citizen science position this year, and the kind of focus has shifted a little bit on programmatic development and more to trying to launch our first two new citizen science projects. Again, one is a pilot to collect more information on scamp grouper discards, and the second one is trying to use historic headboat photos from the 1940s to 1970s to document historic catch and length estimates, and I will talk a little bit more about both of those projects in a second, and then the main programmatic component that we're going to try to address this year is to update our citizen science research priorities.

I wanted to talk a little bit more about that with you guys, and I would love to have a couple of representatives from this advisory panel get plugged into the process that we're going to use to update these research priorities, and so, on the screen, the table on the screen shows you the research priorities that were adopted by the council last year. The goal is to try to update these every two years, in conjunction when the South Atlantic Council updates their overall research and monitoring plan.

2019 is the year that the council is going to update that overall research and monitoring plan, and so we're going to be updating our citizen science research priorities as well, and the reason these priorities are so important is that they're going to help guide the projects that we as a Citizen Science Program pursue, and so having input into this kind of research priorities process can really help provide focus to where the program will go to try to pursue projects, if that makes sense.

This is the first time that we'll be updating our research priorities, and so I wanted to talk a little bit about the process that we're planning to use and then how we would love to have you guys kind of plug into the process, if you're interested. It's kind of a three-stage process. The first stage is to kind of review and provide input on the council's overall research and monitoring plan, and so staff does this, and this plan is also reviewed by the SSC, and it's informed by SEDAR stock assessments and by discussions that may be going on in advisory panels or in the broader council discussions throughout the year.

This document will go to the council for review in June of 2019, and so in a few weeks when they're meeting. Once they adopt that overall research and monitoring plan, we're going to work to develop the citizen-science-specific research priority document, and so what's that going to do

is we'll look at the priority research and monitoring plan that the council approves and see what things or items in that document may be able to be tackled through citizen science.

We want two groups to kind of work together on developing the citizen science research priorities document, and the first is the Citizen Science Operations Committee, and that's a group that is already established. A lot of the representatives in that group were on these action teams that developed a lot of programmatic components, and that group is tasked with kind of overseeing the policies and procedures for the program. Then the other group we would like to help kind of contribute to this process is this Citizen Science Projects Advisory Team.

That's a new group that we're hoping to form, and that would be made up of kind of one to two representatives from each of the council APs, to give perspectives on what may be important data needs or citizen science needs from each of the different FMPs, and so the idea is that the council will kind of either finalize their research and monitoring plan in June, or maybe September, of this year, and then this group would come together this fall to try to put together this citizen science research priorities document.

Then there's kind of a third stage here that I have grayed out a little bit, because it's something that we haven't developed yet, but we would like to kind of develop it in the upcoming year, so that we have kind of a third tier of information being fed into the citizen science research priorities, and what we're calling it is a citizen science project portal, and so that would be kind of an online portal where members of the public, fishermen who may not be directly involved in our advisory panels or in the council process, could potentially submit ideas for citizen science projects that could then feed into the discussions about what citizen science research priorities should be for the council's program.

I want to say a little bit more about the Citizen Science Projects Advisory Team. Again, this is a new team that we're hoping to form this summer, and it would be made up of one to two representatives from each of the council's advisory panels. One of the primary roles of this group is they would help identify citizen science research and data needs kind of across all of the fishery management plans and help develop those research priority needs for the program in general. We would also love the folks who would be involved in this advisory team to have a strong interest in citizen science and may be willing to serve kind of as ambassadors for the program.

As far as kind of time commitment, they would meet via webinar maybe one to two times per year, and the first meeting would be in the fall of this year, to try to kind of, again, draft that citizen science research priority needs document, and so we would love to try to identify any kind of Habitat AP members who might be interested in participating in this process, and so I kind of want to pause here for a second, to see if anyone has any questions on kind of what serving on this team would entail or to see if anyone may be interested in joining this team.

I think it's really going to be helpful to have representatives from each of the different APs involved, because you guys will have different perspectives on data needs, and so I think it would be really helpful to have someone from Habitat kind of participate in this process, and, if this is something that you all want to kind of mull over and think about, I can follow-up maybe with Anne and Roger later, if no one is kind of interested or willing to raise their hand right now.

MR. PUGLIESE: Let me jump in real quick. I think the way this group works is we have four state sub-panels, and we have large members, and so discussing how that can most efficiently provide input into that group I think is what we need to just hash over, what the best avenue is to select individuals to do that, because you do have those differences. I mean, the best-case scenario is you have one from each of the sub-panels, but that's too many for this thing, and there's got to be a way that we can figure out a way to coordinate it and provide whoever ends up being the representative, the funnel from which the input from this group can be provided into there, and so we can discuss that. If members have other thoughts about it, that's --

MS. DEATON: I was also wondering, since it's a citizen science team, if it would be better to have more of the non-agency folks, or like one non-agency folk and one agency folk, because they have different knowledge skills and interest.

MS. BYRD: Yes, and I guess I will kind of leave that up to the discretion of your committee, but I think it would be good to have kind of two different groups represented by kind of the folks serving on this panel. Again, Roger said that you guys have kind of a wide-ranging group and different kind of sub-groups, state sub-groups and that sort of thing, and so I know, when we've been talking to some of our kind of species-specific advisory panels, we've been trying to get representatives from commercial and recreational fisheries, just to make sure we have as many perspectives kind of adding to the discussion here.

MR. PUGLIESE: I think we opened this discussion earlier on -- Well, we haven't looked at the product that's being developed through the council right now, and this is timely to advance it now. We started some of these discussions with our coordination with the Ocean Observing Association. At the last meeting, we had some direct presentations and talked about the potential for individuals to be involved and provide environmental information, and so, I mean, we've begun to have some of these discussions, and, actually, we talked about potentially coming up with a project that could be done through coordinating with SECOORA, and I know you already are connecting in, but we did get a little springboard into some of these discussions on citizen science earlier on, but this is going to help kind of advance it even further, with the focus on specific council species and plans, et cetera.

AP MEMBER: I may have missed this, but so you decide on the projects, and people scurry about out there and collect a bunch of data, and how are you managing and quality controlling and then analyzing these data, or making them available?

MS. BYRD: We'll be doing our first projects this year, and so I think that's kind of a project-specific question. We have a couple of internal projects at the council itself, where I am serving as the project lead, and then we're also kind of a collaborator on an external project, where someone else is serving as the PI and we're just kind of contributing to the process.

For the scamp project that will be getting underway, we are partnering with ACCSP as our data partner, and so all the data that we will collect will go to them, and there is some quality control built into the data collection tool, which is a mobile app, and then we will be doing kind of the quality control of that, and that data will be able to be downloaded from ACCSP, for someone who may want to use it. Are those the kind of -- Am I answering your question?

AP MEMBER: Partly, and I think so. Depending on the project, who manages and uses the data, it may vary? It's not going to be just one centralized place that does everything for every project, and it could be tailor made?

MS. BYRD: Exactly.

AP MEMBER: Okay, but the idea is that people will just -- One of the problems that I see with volunteer programs that I've been involved with is that the volunteers become pretty frustrated with collecting a lot of data that goes into a box and nobody ever uses it, because they don't either trust it or it's not the right data or they don't like it, and it becomes secondary data, in many cases, and so I was just wondering how you're going to try to head that off, where people lose interest.

MS. BYRD: I think that's a great point, and that's something that we've heard within our region and throughout the country, and the Southeast as well, and so what we're really trying to do and target with our program is to try to help fill data gaps, and so places where data does not exist. For instance, I guess I can go ahead and switch gears a little bit, but there is very little information on the size of released fish that is available for use in stock assessments, and that's very helpful to characterize the size of the discards.

For instance, our first project is to try to collect information on length of discarded fish, to help kind of fill that data gap, and so we're trying to have kind of intentional project design, so we're not designing a project that may be competing with another data source that may already be out there that is statistically designed, because a volunteer data collection program isn't going to be inherently kind of statistically designed, and so we're trying to pick projects where we think citizen science is a good tool to collect data where no data exists, and does that make sense?

AP MEMBER: Yes, it does, and the next question I have is how much time do you think it would take from your panel volunteer members to do this activity?

MS. BYRD: To do this activity, I think it would take probably one to two webinar meetings, which would be maybe two hours each, and I would be providing kind of documents beforehand, to kind of get folks up to speed on things, and so I don't think it will be a huge time commitment, and that would probably be over a two to three-month period.

MS. DEATON: I was just thinking about some examples. Just in North Carolina, UNC-W has a volunteer program in citizen science where they do spat monitoring for oysters, and they have a really nice website that you can look at for ideas, because they take the data and make graphs of it, and so there's an interactive map, and you click on the map, the site, and it gives you the data, ups and downs of the spat counts, and it's a pretty basic training.

Another example is I know we use citizens to do rainfall monitoring for shellfish sanitation folks, to get rainfall throughout the coast more specifically, and I don't know if South Carolina does that or Georgia for their shellfish stuff, and so that works out really well, but it definitely takes more time than you think to just manage the people and manage the data and to put that up on a website with graphs and all, and so that's just something to consider. If you're the only person in the program, and other people are adding this to their existing workload, I would just keep that in mind.

MS. BYRD: I think that is a great point, and I am kind of jumping into this position right when we're trying to implement a couple of projects, and it is a lot of time to kind of -- These projects take a lot of time, not only in developing whatever tool is it, but recruiting and engaging volunteer participants and then keeping them engaged to collect data over a long period of time, and so these are our first two kind of pilot projects that we're going to be launching, and I will tell you more about them in a couple of slides.

We are really interested, and we know that we have fishermen who are interested in helping collect data, and we're trying to identify projects that will collect data to fill a specific research need, so there's an idea of how it can be used in management or science decision-making, and then we're going to have to kind of see how things go, and hopefully we'll be learning on the job about how to keep people engaged to collect data over a long period of time and to help make that data kind of more useful for the decision-making process.

DR. GEIGER: I am struggling, in my own mind, how this Habitat Advisory Panel can offer appropriate input and value-added activities to what you're trying to achieve, and, again, I really appreciate what you guys are doing, and I don't want to be duplicative, in terms of across other avenues, and, also, you have various state representatives here that have their own individual interests and so on.

May I suggest that maybe an opportunity would be that -- We have two meetings a year of the collective Habitat Advisory Panel. Would it not be beneficial, sort of as a trial, to have the collective wisdom of the entire panel input, is for you to identify an agenda item where you may want input and add it to our next meeting for an hour or two block and try it that way? This would give you a focused attention of the entire group, and you could lay it out with some introductory materials, to make that one-hour or two-hour session productive, and walk us through it and then, whatever input you want us to provide, do it in that kind of a forum.

I would think that would maximize everybody's time and give you the benefit of the collective wisdom of the group across disciplines and across states and across backgrounds and across interests, and it may allow you to achieve more goals than you would with maybe just one or two representatives. That's just a suggestion.

MS. BYRD: Thank you for that suggestion. I think one of the reasons we want this team to be a cross-section of folks from each of our different advisory panels is to get input from all of the different kind of -- Input from AP perspectives from all of the different FMPs and then take that and have the group determine together what the priority research needs should be, and so this group will focus a lot on habitat, and we have a lot of the species-specific groups which may be focused specifically on what data needs are for the mackerel fishery or the snapper grouper fishery, and so, somehow, we want this -- We're going to need a group to come together to take all of these many different research priorities and cull them down into a list together.

I think it's a great idea to have the collective group weigh-in on kind of what they think the research and monitoring -- What citizen science could help with research and monitoring needs, as far as kind of where habitat is concerned, but I think it would be helpful to have members from this group participate in discussions with members from other APs, so we can kind of get a comprehensive view of what the priorities should be across FMPs, and does that make sense, kind of where we're coming from?

That's where we -- Again, this is the first time we're doing this kind of research prioritization process and updating it, and so we've kind of put together this process, and we want to see how it works, and so, once we do it once, we'll see how it works, and, if we need to tweak it, and if it's better to ask for individual input from APs, then that may be something we move towards, but we kind of want to test out the process that we've put in place for this first go-round.

MS. DEATON: I was going to say though, if they don't have Habitat AP members and they are meeting, then they're going to do all fish projects, and so the only way you can get your priorities addressed is to go their meeting.

DR. GEIGER: I just would offer advice that, again, I would strive to, obviously, get the appropriate input that you're looking for, but I would also try to exhibit a little flexibility in terms of how you do it, and, again, I don't think one-size-fits-all -- This group, I think, from my observation, works good with some specific tasks, with some defined objectives that we're trying to achieve and come up with a product. You may want to think about that. I mean, you can see the interactions of how we go around here, and, based upon that, you may want to modify or adjust your approach accordingly, and, again, this are just, hopefully, constructive comments for you.

AP MEMBER: I think there's a structural issue that may not be clearly identified here, and I would be reluctant -- If I volunteered, I would be reluctant to speak for the panel. The panel only has authority when we're here in a group, and we have our discussion, and we go back and forth, and then we come up with a consensus, and then we vote on it, and so it would be very difficult, and maybe even inappropriate within the council, to have an individual member attending and saying, well, this should be the priority, and so I think that's a structural obstacle, and I think Jamie's recommendation that you get the input from the panel, while that would be more cumbersome and it wouldn't be as flexible for what you're trying to do, I'm not sure there's another way we could do it and actually be legitimate.

MR. PUGLIESE: What is the timing to -- You're going to have this looked at in June. What I'm trying to figure out is if we could still accomplish what you're talking about, because I've raised this with you, because this is such a unique group, in the way you function and how everybody has input, and the collective is usually always more powerful, and it's easier to represent the collective when you do it that way.

If there's any way we could do it and then provide -- If you are having still representatives, that you still have the group be able to review it and provide it and those be the individuals that carry the messages, but somehow work out something that at least accomplishes both aspects of it, and I raised this, because it's such a unique situation we have here, and, truthfully, I think a little bit also goes back, and this I will put on myself, is that I want to look again, when we begin to look at the bigger council research and monitoring needs, that we may actually partition out habitat and ecosystem beyond what it has been in the past, and so then there's a nice, direct connection back, so that, when you do this, you're actually looking at something that is already front-filled, and then we can back-fill, and that's something that has to happen next time, beyond where we are with the one, because, if it's going to be approved in June, it's going to take a little while to at next year's and probably where we do that, but that's not something here. The thing I was looking at was that opportunity, if we could figure out a way to have the collective input into that, so that the members can carry that to the bigger group.

MS. BYRD: Yes, I think that makes a lot of sense, particularly based on how you guys normally operate, and, again, this is my first time coming before the Habitat AP, and so I'm kind of learning as I'm going about how you all kind of operate, and so the general timeline we have is we would love for the citizen science research priorities to go before the council at their December meeting of this year.

We're waiting to kind of get started in doing the citizen science-specific research priority needs until after the council approves their overall research and monitoring plan. They will be looking at it in June, and then they may adopt it in June, or it may be pushed to September, and we'll have to see how that goes, and so, ideally, I would like to have a webinar with this group here sometime this fall, and so I'm not sure of the dates of when you guys are kind of meeting again, but maybe we can try to figure out a way where you guys will be able to collectively talk and then representatives from the group can pass along those ideas to kind of this webinar meeting, and does that make sense? Are people more comfortable with that sort of an idea?

MR. PUGLIESE: We meet in October, and so have the dates. We've already got the dates, and we're meeting at FWRI, and we actually have the hotel. We're all set up. We're set for October, and so however you want to deal with that, and I think it would definitely fit within that timeframe to provide the broader group's input, very focused, and we have some lead time, and so we actually could do some homework in advance even, because I think there's going to be a number of things that come out of this meeting that we're going to set the stage for that October meeting, to get in the weeds on a number of different things, and this can be one, very specifically.

MS. BYRD: Okay.

MS. DEATON: All right. We'll be brainstorming on citizen science ideas for habitat and getting back to you, and so thank you very much.

MS. BYRD: Sounds good, and then I just want to run through, quickly, a few more slides, just to give you kind of an update on two of the projects that will be getting underway. These are kind of more fish-focused projects, but I just wanted to kind of update you guys on what's going on, and so we have two projects that we're going to launch later this year, and the first one is -- We're calling it SAFMC Scamp Release, and it is a project that's focused on collecting more information on released scamp grouper, and so we're recruiting fishermen from all sectors, commercial, for-hire, and recreational fishermen, to collect information on released scamp grouper via a mobile app that we're in the process of developing right now.

It's specifically focusing on collecting kind of length, location, and depth of released scamp grouper, and there's an upcoming stock assessment for scamp that will get underway in late 2019 and into 2020, and so one of the areas where there is very limited, if any, data is in the length of discarded fish, and so we're hoping that the data collected through this app will be able to be considered for use in that upcoming stock assessment.

In the development of this project, we put together kind of a planning and design team that was made up of a variety of folks, fishermen, kind of an assessment scientist from the Southeast Fisheries Science Center, Sea Grant folks, data management partners, kind of software developers, to all come out to map out kind of the initial app design and layout.

Where we are in the project right now, we are wrapping up testing of an evaluation version of the app, and we're developing kind of training materials and outreach materials, and the target is to have the app up and running and ready to collect data later this spring, and we're actively trying to kind of recruit and identify scamp fishermen who may be interested in participating in the project, and so, if any of you guys know of any scamp fishermen that may be interested, I would love to chat with you more about that.

Then the second project that we'll be launching later this year is a project that we're calling FISHstory, and it's basically using historical photos from the 1940s to 1970s from the for-hire sector to try to document historic catch composition and length composition estimates, using kind of an online data collection and crowd-sourcing approach.

What we're hoping this project can do is help fill kind of a historical data gap, and so we're trying to project data back in time, prior to when fishery-dependent surveys started in the for-hire sector, and so we're working with a fisherman on our Snapper Grouper AP down in Florida, and he is providing photos from a Daytona Beach headboat fleet that are his family members, and so the idea is that these photos will be loaded to an online crowd-sourcing platform called Zooniverse.

I don't know if any of you guys are familiar with Zooniverse, but they have a number of different kind of online crowd-sourcing citizen science projects, and so these photos would be loaded into the Zooniverse platform. We would develop kind of online tutorials and training, so that members of the public, interested folks, could identify the species in those photos, and then we're going to have a team of fish ID experts that will help validate the species identification information. Then, once that's done, we're going to try to identify one key species, and we're going to kind of test out methodologies, to see if we can get length composition estimates from species using an open-source software called ImageJ, and so we want to see if we're able to get accurate lengths, and, if we are, kind of establish standards, so that may be able to be expanded and done for more species.

This project is just getting underway now, and we're hoping to launch the online platform in Zooniverse later this fall and winter, and so those are kind of two projects that we're getting underway now that will kick off later this year, and they're kind of our two pilot projects for our program, and so, again, that's just a quick overview of kind of what's going on with the program and how it got started and the first few projects that we're going to kick off, and then it looks like our discussions will continue with you guys in the fall, talking about research priorities and how citizen science may be able to help kind of fill some of those research priorities for habitat. I would be happy to answer any questions, if you guys have any questions, or you're welcome to contact me later, and my contact information is on the screen, if you have any other questions about the program or projects.

MS. DEATON: Thank you. I think what impresses me most is that a lot of thought has been put into this, like with your action teams and volunteers and data management and project management, and so hopefully that will address problems that can happen with citizen science, because the worst thing is that people do this and then the scientists say it's not good enough to be used, and so you want it to be a good, sound process.

MS. BYRD: Yes, and I think that's one of the reasons that the council was really interested in taking time upfront to develop all this program infrastructure and develop all these best practices



and recommendations before launching a project, because one of the things that we heard loud and clear from our fishermen, is that we want to collect data that's going to be used that will be helpful and used in decision-making, and so, by developing that program infrastructure, we're hopefully giving kind of individual projects a better chance at success.

MS. DEATON: Thank you. Does anybody have any other comments? That is the last item on the agenda before lunch, and it's 12:03. We're on schedule, and I guess we'll take a lunch break now, and we have until 1:30, and so you get an hour-and-a-half for lunch. Thank you. See you in a little bit.

(Whereupon, a recess was taken.)

MS. DEATON: I think we're going to start back up. We have two agenda items for the afternoon, and so, first, Wilson is going to go over some of the impacts that he has noticed or documented with this last hurricane, Florence, but it really ties into the climate change policy in our roadmap, climate change and extreme events kind of going with that, and so I'm just going to turn it over to Wilson.

DR. LANEY: Okay, and I will say that we're going to have a dramatic shift in the level of the dialogue here, because I made the mistake last fall of sending a presentation to Roger that I had given at the request of one of my friends at church to the Raleigh Host Lions Club, and he said, hey, Wilson, why don't you put together something about all these hurricane impacts on fish, and I said, well, I really don't know much about it, but I know a bunch of people who do know a lot about it, and so I'll try and pull all that information together, and so that's what I did, and then Roger said, hey, why don't you update this for the AP, and so it's somewhat updated.

I will qualify it further by saying that, those of you from Georgia and Florida, please don't feel slighted. I just didn't have time enough to gather a whole bunch of information on what had happened and what has happened historically in Georgia and Florida, but, as you will see, the hurricanes are a big deal.

As I said, none of this is information original to yours truly. This is all gleaned from other people, and here's a list, and I'm not going to read it, but there's a whole bunch of folks in North and South Carolina and in the news media that documented what was going on, mostly after the storm, because those of you who lived in the path of the storm and were affected by the extreme flooding know that you couldn't move around very easily. I mean, Wilmington was an island, basically, and so it took a while for a lot of this information to get documented.

Real quickly, I will just go through hurricane frequency, the flooding and organic debris inputs, what happens and why do fish get killed, and most of you are familiar with all of these terms, and I will define them anyway, just in the interest of completeness, for those folks that may be listening in on the webinar, and I will talk a little bit more specifically about what happened in the Roanoke and Cape Fear Rivers, and we did have endangered species losses, specifically of Atlantic sturgeon, throughout North Carolina, and I believe Bill Post told me, and maybe you know, David, whether or not -- I think there were some documented sturgeon mortalities in South Carolina, maybe, as well.

There are a number of endemic species in this region, and they may have suffered some impacts as well, and striped bass in the Cape Fear River definitely took a hit, and then I will talk a little bit about mitigating the losses, and so some of you may have seen this photo in the past, and this one is from Floyd, and, in any case, one of the big issues in southeastern North Carolina is all of the hog operations, and the animals suffer along with the people. The *Raleigh News and Observer* and other news outlets did a pretty good job of covering the event, but they noted that we have more than two decades of hurricanes that have impacted North Carolina's shores and have had lasting negative impacts.

This just shows you the North Carolina hurricanes from 1890 through 2000, and this is from a Jerod Bales et al. USGS publication, and you can see there have been quite a few of them. Fortunately, most of them have been less than Category 4 or 5. Most of them have been 1, 2, or 3, but, still, they are all not desirable, from a human or from an ecological perspective, for the most part. I guess there are some ecological benefits, possibly, and we can talk about that shortly.

Here are the recent ones. Again, I won't read the list. You all are very familiar with them, because most of you have lived through some or all of them. Then, for South Carolina, the South Carolina Climatology Office has an excellent website. If you want to know a whole bunch about South Carolina hurricanes, go to that website, and they have information like this that shows you the spaghetti web of past hurricane storm tracks that affected South Carolina, and this from 1950 to 2003. What would be nice, Roger, maybe for the future, and it's something we can do for the council, is try and compile the information that shows the hurricane frequency from 1950 through the present for all four South Atlantic states, and so there have been a bunch of them, and that's the bottom line.

Here are the ones for South Carolina, and there have been a ton of those as well, all the way up through Florence in 2018, and we don't know what's coming in 2019, although, I guess, from the predictions, it's supposed to be a little bit less of a problem this year than it was last year.

There are folks at NC State and the University of North Carolina Chapel Hill that some of you know that have taken advantage of these storms and have looked at how they have shaped the Tar Heel State's coastal ecology, and some of the impacts include this increase in potentially deadly algal blooms, which certainly can cause fish kills, but definitely produce water quality that is a safety issue for humans.

There are more fish and shellfish kills and localized death of fish populations and then dead zones, or areas with excessive nutrient pollution, and we'll talk about that shortly a little bit more, but, basically -- Anne was just showing me some data earlier from the North Carolina ferry monitoring site that basically shows that the Neuse River is just now getting back to being an oligohaline, or possibly mesohaline, estuary. It's been fresh pretty much since last fall, since the hurricanes happened, and, in the Cape Fear River, it went thirty days without any dissolved oxygen, basically, and so huge, huge impacts, but, again, you guys are all familiar with these terms, I think, anoxia and BOD, dissolved oxygen, endemic, and hypoxia, and so I'm not going to read all of those. You all pretty much know all of those.

I talked about the oxygen solubility curve as a function of water temperature. Basically, the hotter the water, the less oxygen it holds, and Fox News also covered it pretty well and did a pretty good job, and they summarized the North Carolina Wildlife Resources Commission information that

they put out after the hurricane, but, basically, you had water flooding these vast areas of swampland, which are naturally lower in DO anyway, but then you have these big inputs of biologically oxygen-demanding waste, and so it's the natural stuff that's on the flood plain, all the leaves and debris and detritus, but then we have all these hog lagoons, and some of those did get flooded, and so what happens is the optimum background oxygen level for most fish in fresh water is like five to six parts per million, or higher, but, when those levels drop down to two parts per million, the fish are gasping at the surface, they become lethargic, and, in a lot of cases, they croak, and we will see evidence of that shortly.

Here is Hurricane Florence on September 14, just as it was crossing the coastline at Wrightsville Beach, near Wilmington. Here's another shot of Florence as well, and it was a really big, big storm, and you can see, from the track here, it moved very, very slowly. It came ashore on Friday, and, by the following Monday, it was inland, to a certain extent, but it hung around for a long time, and it dumped up to thirty-six inches of rainfall, depending on where you were located under the rain shield there.

There were a bunch of North Carolina fish kill locations, and I have -- David, I've been unsuccessful in getting the same kind of information for South Carolina, and I was hoping that Bill Post might be able to provide some of that for me, and the data may exist, but I don't have them, but there were a whole bunch of fish kills documented after Florence in North Carolina, and here they are in this red circles and ellipses, and you can see, even though the brunt of the flooding was in the southeastern corner of the state, the fish kills that were documented extended from northeast all the way through the southwest there, and so it covered pretty much the whole coastal plain.

Fortunately, we have, we being a group of partners who have collaboratively funded continuous water quality monitors now on the Roanoke River, we've got good records of what happened during this storm event, and so this will give you an example. This is the November record after the storm. This happened to be the week before I gave this presentation for the first time, and so you can see the oxygen level had recovered by that time, and it's up between six and eight parts per million, and it's doing very well.

If you go back and look at September, or, actually, before September, you can see there is the usual seasonal decline that occurs in the Roanoke anyway in the summertime when it gets hot, and the DO levels drop down below four, kind of routinely, but then you notice that big drop in September there, about the second week in September, and, if you pull that out and we look at it more closely, you can see that the storm hit, and I think it was on the 14<sup>th</sup> or 15<sup>th</sup>, I believe, and then the DO started dropping, and, by the 17<sup>th</sup> or 18<sup>th</sup> there, it had bottomed out at zero, and this is on the lower Roanoke, and it stayed that way for several days before it started climbing back up again, and it still hadn't gotten above four by the end of the month there, and so this was a way to graphically illustrate to the Lions Club folks what happens. If fish can't breathe, if there is no oxygen in the water, this is why you get a fish kill.

My sturgeon mortality data here are dated, because Anne tells me that we now have documentation for at least a dozen or so in the Cape Fear region alone, but a bunch of sturgeon were found dead, either during the storm or shortly thereafter, and we can't necessarily attribute every single one of those to dissolved oxygen death, but some of them definitely we can, and this graphic here is just to remind us all what the status is of Atlantic sturgeon and why they got listed in the first place.

If you look here at the landings records from 1880 all the way through 2015, I think the graph goes up to, you can see, way back when in the 1800s, there were a lot of them, and my colleague, Dave Secor in Maryland, refers to the clear-cutting of Atlantic sturgeon that occurred basically by the commercial fishery. You can see when the fishery picked up again, after World War II in the late 1950s up there, the scale on the graph changes, and, for a good long period of time, it was sort of sustainable around sixty metric tons or so, but then, in 1998, the ASMFC recognized that things were not very rosy, and so they put a moratorium on the fishery, and those black bars that you see after that are the bycatch, estimated bycatch, which is still occurring in some of the commercial fisheries.

Here is an Atlantic sturgeon that we caught on the cooperative winter tagging cruise offshore, and that's Matt Breese, who got his PhD working on Atlantic sturgeon, and we put fourteen acoustic transmitters out that year, and we re-located all of those fish subsequently, and this is one from the Roanoke River. That's Jeremy McCargo and Joe Hightower, and we managed to get a few transmitters, acoustic transmitters, out in Atlantic sturgeon on that river system before the species was listed in 2012, and we were able to document fall spawning on the Roanoke, and so there's a fall spawning population there.

Then what happened during Florence? Well, this is one that was found in the Cashie River, which is on the lower Roanoke, after Hurricane Florence. This is a big female that was over six feet long and weighed about 140 pounds or so, I think, and, unfortunately for us, was a gravid female, and that's what it looked like when they cut it open. It was full of eggs, a whole bunch of eggs, and one big female like that could possibly -- It's not inconceivable that she could certainly contribute substantially to a whole year class.

In the Cape Fear River, the striped bass population there, a lot of them were observed dead in the Battleship North Carolina parking lot or floating in the basin, including one tagged fish, which wasn't recovered. We could see the tag in the photo, but the folks who were there couldn't get a hold of it. That's what we like to see. This is one that was captured offshore, and that's Steve Taylor with the Division of Marine Fisheries, and Steve was participating in a cooperative winter tagging cruise. These are the migratory fish offshore that we like to get tags in, and most of those migratory fish don't come from the Cape Fear. Very few of the Cape Fear fish migrate. I think we've got one record of one that was tagged in the river that was caught back off of Massachusetts, but, for the most part, those fish stay pretty much in the river, and in this case, they really got hammered by the hurricane. There are a bunch of dead ones in the parking lot at the battleship, and there's a close-up.

In addition to the striped bass, and this may be sort of a silver lining, a lot of the big, invasive catfishes, like the flatheads and bluecats that were present in the river, also got hammered by the low DO, and so it killed a lot of those, and one of the things that the Wildlife Resources Commission is doing is, given that the population of these invasive catfishes was knocked back, they are trying now to -- They are planning to propagate the native species, which is white catfish, and reintroduce white catfish to the river and try and build that population up while these other species that eat native catfishes, among other things, are at a low ebb.

For the most part, and I think I will talk about it here later, and so I won't say any more about stocking, but there are some endemic fish species in the area, and the Cape Fear shiner is up in the headwaters of the Cape Fear, and it was affected more by Hurricane Michael, I think, in addition

to the flooding from Florence. The Deep and the Haw Rivers, where that species lives, as well as the upper Cape Fear, was in flood stage for a long period of time, and there have been no systematic surveys for that species since 2007, and so we have no clue whether or not it was affected.

Brena Jones with the North Carolina Wildlife Resources Commission did get out and look at Carolina pygmy sunfish after the storm, and we had a fairly recent survey for that species of both North and South Carolina, and my understanding is -- I haven't talked directly to Brena, but, through the grapevine, I heard that she did get out and look at twenty of those sites and found it at about ten, and so about half the sites they found the species still present, but we can't say, I guess, whether that's storm related or not storm related.

MS. DEATON: I don't know, but I went with her one day, and we found a bunch, but only in one spot, one location, and they're way up in little ditches and not near areas that I think would be impacted highly.

DR. LANEY: Right, and so, hopefully, and there was some speculation, I think, that that one could possibly have been a species that might have benefited, through dispersal, as a result of the flooding, but you don't know. Again, it goes back to our discussion earlier this morning about the value of long-term monitoring and survey programs. There is no substitute for having long-term monitoring and those stations that Jamie was talking about in place.

The other one is the Waccamaw silverside, which occurs only in Lake Waccamaw and the downstream river there, and, again, I don't think -- As far as I know, there has been no post-hurricane look at that one, and so, whether or not that one was affected, we don't know, and there they are, the three very nice little fishes, freshwater, again that occur nowhere else on the planet except in North Carolina and South Carolina.

Locally, on the ground, this is Greenfield Lake in Wilmington, North Carolina, and those of you who live in the area, or know more about it, feel free to chime in, but these are just some photos that were taken. I image that most of you saw photos, or videos, of the Penderlea Fire Department that were out hosing down I-40 after the storm, to wash all the fish off into the road shoulder. It was really remarkable. There was dead fish everywhere, including one largemouth there, which apparently was in the process of chomping down on a gizzard shad.

All of us think of American eels as being very robust and very tolerant of low DO conditions. Well, you can see that tolerance only extends so far. When the DO goes to zero, they don't do too well, and so this is a photo that was taken by the lock master up at Lock and Dam Number 2, I believe, and it just shows the eels trying to get oxygen. The same thing was true for common carp and for the catfishes that were also in shallow water here and gulping for air, and also, in similarity with the battleship parking lot, the apron of the lock and dam there was also covered with dead fish and the boat ramp.

What can we conclude from this? Well, there are lots of hurricanes and tropical storms, and they impact North Carolina, South Carolina, Florida, and Georgia. Depending on the circumstances, the amount of the rainfall and the state of the river discharge and the extent and duration of flooding, temperatures, BOD, and DO, we will probably continue to have fish kills following hurricanes. Kills can continue long after the storm has passed, as long as the DO remains low, and the case there is the Cape Fear, where we know it went on for at least a month.

Fish populations that were at healthy levels prior to the storm will usually recover eventually, and this is based on my conversations with Wildlife Resource Commission folks. Obviously, it's going to take longer to restore a population of fish that lives to thirty years or longer, or, in terms of the Atlantic sturgeon up to eighty years, than fish that live to ages three to five, and so hopefully they will recover on their own.

Stocking in coastal rivers can help expedite the process of bringing some of these populations back after a catastrophe, but the best remedy may be one of the oldest clichés, which is that time heals all wounds, and I think the WRC policy pretty much is to take a look at it on a case-by-case basis and only stock when they feel like it's appropriate.

If you want to know about North Carolina fish kill information, you can go to that website there, and there's a whole bunch of additional reading, and, as a matter of a fact, there's one that -- It's the very last one on the list there, and it's S.D. Paul et al., and it's a 2019 paper that came out in January that is entitled "Brief Communication: An Analysis of the Fatalities and Socio-Economic Impacts Caused by Hurricane Florence", and I will circulate that. I don't think I did that, but I will send it to the whole AP, because it's got an analysis of the environmental impacts as well, and it's sort of not real in-depth, obviously, because they just wrote it in January, after the storm came in September, and so they didn't have a whole lot of data, but they did the best they could with what they had, and there have been peer-reviewed publications that address the impacts.

There is my contact information, and I think that's the end of it. Now, if you wanted to -- Kyle Rachels, who is with the North Carolina Wildlife Resources Commission and is the district biologist that covers the Cape Fear, sent me, literally last week, and I was in California all week, and so I didn't get it until yesterday when I got back, a PDF file, and we can roll through that real quickly, just because he had a lot of cool photos in there.

This is another very cool photo of Hurricane Florence, and here is the WRC response plan, and I presume, Anne and Steve, the Division of Marine Fisheries has something similar to this, to try and ensure the conditions are safe prior to making field assessments. That was one of the biggest problems during Florence, was there was just so much water and so extensive, from a geographic standpoint, that the folks who were capable of taking the data just couldn't get out there and take the data, and so we were all relying a lot on the news media, who had people out there taking pictures.

They do, and they have in the past, and WRC has done a really good assessment of the extent and duration of hypoxia and fish kills and where those occur, and they were doing a survey in the fall of 2018, and they are surveying this spring to look at adult abundance and to document the spawning stock. Then, in the fall of this year, they're going to survey juvenile fish abundance to assess recruitment and then implement any recovery strategies, and, here again, it's a different map that shows you where the worst areas were and hardest hit areas, in terms of low DO.

This one is the graphic for the Waccamaw River, which extends into South Carolina, of course, and empties into Winyah Bay, and you can see that, for a good many days after landfall, it still hadn't gotten -- It just barely got above two milligrams per liter at the end of that period, and so, on the day of landfall, it was already down, or it went considerably below one and stayed there up until September 20<sup>th</sup>, and then it finally got above two thirty-two days after landfall.

The same thing in the Cape Fear, except it was worse in the Cape Fear. I think it stayed at zero for a much longer period of time, and this is actually the Northeast Cape Fear, and then the Cape Fear did some goofy things, but, again, it stayed low for a good long period of time. Then just another shot, and this is a closer-up shot of the fish dead at Lock and Dam Number 1, and you can see a lot of those are catfishes, but there is some common carp in there as well.

Then a similar photo of the eels on the shoreline and then dead sturgeon at Lock and Dam Number 1, which I feel fairly confident we can attribute to the low DO, and this one was on Oak Island, again after the storm, and, for that one, we weren't sure how that one would up on the beach. It's possible, because that low DO plume extended offshore, and so it could be that that fish was killed and then wound up being pushed out the river by the discharge and wound up on the beach at Oak Island, which is immediately outside the mouth of the Cape Fear.

Here's more dead striped bass in the battleship parking lot there, and a good shot of Sutton Lake, which was overtopped during the storm, and that is an impoundment associated with a deactivated coal fire plant on the Cape Fear.

MS. DEATON: It's a coal ash pond.

DR. LANEY: Yes, and so a coal ash pond that was overtopped, and this is Gum Swamp Lake in Scotland County, a dam breach, and here's a dead eel on the shore of the Northeast Cape Fear River, and there are lots of birds, I think, benefitting. This is at the Waccamaw River. Then more dead -- This looks like a lot of eels there, and then Kyle is showing us the -- I haven't even looked closely at this, and I just went it and shot it to Roger, and so I'm not even sure which one this one is, and so it looks like it's the breakdown for some of the fish species, I guess, pie charts, kind of, but we already said they're doing the surveys, and they're going to proactively stock native species, where it's appropriate, and they're going to engage stakeholders to promote recovery efforts.

I thought I had some other photos, and I may have them on my hard drive at home and just didn't put them on here, but there is some very graphic photographs that some of you may have seen and satellite footage showing the discharge from all these coastal rivers immediately following Hurricane Florence, and people tend not to think about the discharge and how that affects near-shore coastal waters, but it was huge, in this particular case. You could see those plumes going offshore for a good ways.

I will cease commenting at this point, and, if you have questions, then articulate them, and we'll try and get answers to them. I don't know that I will have answers to them, but a lot of our colleagues in the state agencies that are certainly doing follow-up on this will have the ability to answer them, and hopefully there will be some reports coming out at some point that will thoroughly document the impacts.

MS. DEATON: Thank you, Wilson. One thing I will also mention is -- Go ahead.

DR. LANEY: One other thing. I didn't roll it into the presentation, but I did talk to, and I would be interested in hearing from those of you who are involved in recreational fishing especially, about what impacts you may have experienced personally directly yourselves. I did talk to several tackle shop owners, and they assured me that, yes, their business just went to zero, the ones that

were in the Wilmington area in particular, and facilities on Oak Island and other locations, Southport.

Then the other thing that Anne or Steve may want to address is I know that, because of the storm, commercial fishermen qualified for disaster relief, basically, and some compensation, and the figure I heard for North Carolina was that there was \$11.6 million paid out to commercial fishermen to compensate them for losses, and I presume, David, some sort of similar payout may have occurred in South Carolina, but I don't know. It just doesn't affect fish, but it affects people who fish for fish and the whole ripple effect through the whole economy, all the tackle suppliers and ice suppliers and diesel fuel and motor fuels, motor boat fuels, and the whole thing.

MS. DEATON: That's the number I heard, but I thought I heard, on the news the other day, that some additional funds were allocated. Did you hear that, Steve, for reimbursing commercial fishermen? It could be that it was a news article that they were -- It might have just been another -- You know they're going out in waves, the checks.

MR. POLAND: I think that just might have been an update. As far as I know, it's still the \$11.6 from the legislature. I think our governor did request relief through the Federal Fisheries Disaster Relief Fund, and the last update I got was that the social scientists and economists at the Southeast Regional Office have completed their report and made their recommendations, and it's in internal review, and so hopefully soon, but soon relative in the federal bureaucratic timeframe, we'll get answer of if we'll receive any additional funds for that, and that was one that was open not only to commercial fishermen, but recreational fishing business entities, charter boats and tackle shops and everything.

MS. DEATON: I have in my notes here from when I was putting together hurricane information, that they estimated that it would cost \$11 million just to dispose of the dead poultry following the hurricane, and so, anyway. One other thing I was going to add was about the oysters, since we've learned in some follow-up monitoring, and that was our mappers were mapping after the hurricane, and they just finished. They are down in the lower Cape Fear, and it confirmed what we've been hearing anecdotally, is that there's no live oysters down there now. They found a very few small juveniles, and so there's been talk about maybe doing a relay to seed those areas, but I don't know if that will happen.

Then, also, there's been a lot of mortality in the sub-tidal oyster reefs in Pamlico Sound, because the problem with having a large lagoon estuary is it doesn't flush out very fast, and so, like Wilson was saying, the salinity was low for so long, and it happened so suddenly, and so we know that almost all of the productive reefs, where the fishermen were still going to, there was very, very little live oysters there, but some of the bays that are away from the main river outflows were fine, and so a lot of it was oxygen, and also sedimentation.

Then, in terms of another habitat, SAV, Greg Allen, who is our shellfish biologist in the Manteo Office, said he is seeing a lot of SAV loss around the inlets from scour and sedimentation, but then, on the other hand, I spoke to Judd Kenworthy, a former NOAA seagrass ecologist, and he saw more eelgrass when he was out monitoring last week than he has ever seen, and so maybe it dispersed the seeds and it wasn't in an area that was intensely impacted, and eelgrass wasn't actively growing at that time, in the fall. It's dormant then, and so a mixture of impacts on fish and habitat, and it will take time.



DR. LANEY: Just a follow-up thought to all of that is that, obviously, hurricanes have been happening for forever, and most of these resources presumably evolved in that context, and so, from a resource perspective, from a habitat perspective, even though we see significant and what we deem severe impacts in the short run, these systems should ultimately recover in the long run, and I think it's wise and prudent of the Wildlife Resources Commission especially to take a really hard look at does stocking really do a whole lot.

Now, in this particular case, on the Cape Fear, where the big invasive catfishes have been knocked back, I think it makes sense, to me anyway, from a biological perspective, to try and put a bunch of white catfish out there and give them a head start, in terms of recovery because that's the native species that was there originally, but I suppose the good news is the systems are adapted to it, and, ultimately, they should recover. It's us. We humans are the ones that take the biggest hit, I guess, from these things, and, to the extent that there are lots of things we can do to prepare for these storm events and to improve our resiliency and our adaptiveness to accommodating the storms, those are the sorts of things we should do, and those are usually addressed in the socioeconomic realm, I suppose, and not so much in the Habitat AP realm.

MR. PARKER: A comment. I have lived in this part of the country all my life, and I've seen what happens every hurricane season, especially in North Carolina and parts of South Carolina, with the pig farms, and probably cattle farms too, but it's always a big issue, and it just seems like nothing gets done or nothing is feasible with moving pig farms like up on a hill, because I guess they store waste or something, and the ponds overflow, and it's a mess, and I'm sure that's not only bad for the fish, but all the people downstream. I remember when it was Floyd, and there was dead cows and pigs floating in the ocean after that, I understand, and they made it all the way down, and is there any talk by any agencies about doing something more about the pig farms and cattle farms, and chicken farms, I guess, too?

MS. DEATON: Bill, I will add that, yes, we're fortunate that we have Governor Cooper, and he said, after the hurricane, that we can't keep doing business as usual in North Carolina, and so we've got to get more coastal resiliency, and the current Secretary for the Department of Environmental Quality, which is what my division of Marine Fisheries and Coastal Management and Water Quality all fall under, he is very proactive to doing something, and so the governor put in place an executive order, and it's called Executive Order 80, and it's to address climate change and transition to clean energy, and so it's really not about hurricanes, but it's about coastal resiliency due to climate change, which hurricanes are a part of, right.

It's calling for a lot of actions across the board, from primarily starting with state agencies and then going down to the local level and industry, and so it calls for -- North Carolina is going to support the 2015 Paris agreement to reduce statewide greenhouse gas emissions and increase the use of zero-emission vehicles, things like that, but it charges every cabinet agency to evaluate how their programs and operations can reduce climate change impacts.

They have to develop a clean energy plan, and they want to introduce -- Like just get more of these zero-emission vehicles in place by a certain year, and so they've got DOT tied into this and DEQ and the Department of Commerce, and it's pretty ambitious, and so my department is involved with what's called Natural Working Lands Committee, and it has to come up with a plan of ways to increase our coastal resiliency.

I don't know how the hog farms -- We already have like -- There is already a ban, a moratorium, on any new ones in the flood plain, and there's been buyout programs, and there has been changing technology, to shift them away from the lagoons, or cover them, but it's just there is more than there is funds to make that happen immediately, but they are working on it harder than I have ever seen or thought would happen before, and so that's positive.

I was going to say that I can forward this executive order, and another thing that might be of interest to everybody is that they formed an interagency council, the Interagency Council of Climate Change, and they did a great presentation, and it's really long, but it summarizes what they're supposed to do, but it also has all of the national climate change information in a really condensed form, and so I can share that with you, and it might be of interest that it would pertain to every state in the Southeast.

MR. PUGLIESE: I appreciate that, Anne. I think we had talked about that as kind of a natural spinoff of these discussions on increased episodic events, hurricanes, et cetera, and what I'm hoping is that we can follow-up from this discussion here to maybe even a more expanded and refined discussion at the next AP meeting. We'll be working with I think Wilson to try to reach out to the sub-panel chairs and reach out to SECOORA to get representations of some of the different events and graphical and other things, but then also pick up on this, because this a major shift for the State of North Carolina, because we went kind of all the way in one direction, and it's coming back all the way in the other direction, which I think is really good.

Back when we were really moving forward on ecosystem-based management, we were talked about nested ecosystem-based management, and the example was used with North Carolina with the Pamlico Sound estuarine program and the State of North Carolina's habitat plan and the Fishery Ecosystem Plan and how they all kind of worked back and forth together, and we have kind of gone all the way back the other way again, and so it's good. It's a good thing, and hopefully we can expand that discussion to the other states and how things are moving in the other states, both on the hurricane activities but then on these, and I think this a great spinoff to do that in the upcoming meeting, and so we'll definitely distribute this to the group.

MS. DEATON: Sometimes it does take like disasters to get -- We need disasters to get motivation for change sometimes, and I was wondering -- I know we don't have too many Florida people, but how are things going there with -- Because of the hurricanes there and you having a new governor, and have you seen any changes?

MR. WEBB: FEMA is coming out with the new flood plain maps next year, and there is expected to be, at least in Monroe County, where I live, and I'm sure it will be similar in all of south Florida, a lot of challenges, maybe some legal challenges, and whatnot. Talking about the commercial fishing industry, if Captain Bill was here, I think there was 600,000 or 700,000 commercial lobster traps in the water right before Irma came through, and they lost about half of them. The longest documented movement of a trap was it was offshore, off of Key Largo, off of Ocean Reef, and, when they recovered it, it had gone under the Channel 5 Bridge in Islamorada and up into the Gulf of Mexico, and so, for a box with concrete in the bottom of it, that was pretty significant.

There is still a lot of infrastructure damage that hasn't been rebuilt, even all the way up to Islamorada and Key Largo, and the storm surge was significant, and what I didn't realize, and I

guess I should have known, was the storm surge physical attributes were similar, if not identical, to a tsunami. Matecumbe Bay, which is where I live, was dry as the storm surge was approaching.

The water completely evacuated out before the surge came back in, and I was commenting to somebody, just anecdotally, that was an area very close to our house that we fished regularly for spotted seatrout, jacks, and ladyfish, just fun fishing, and they have not returned. There is almost none of those species or any bait. The bottom looks good, and the water quality looks good, and everything looks good, but they have not returned to that general area, and so, as far as the governor goes, we have a new governor, and he is focused on the Everglades restoration, and so we'll see how that goes.

DR. LANEY: One thing I didn't mention was GenX on the Cape Fear River. Anne may want to say a little bit about that, but the short version of it is that there is a compound that was only relatively recently -- Has it been two years now, I think?

MS. DEATON: (Ms. Deaton's comment is not audible on the recording.)

DR. LANEY: They knew about it, I suppose, but they didn't know how extensive it was and how toxic it apparently is, and so there's a lot of work going on in that compound, and, needless to say, the flooding event didn't do anybody any favors, from the standpoint of that particular compound, in addition to all the other stuff that was pulled into the river system. That compound was possibly further disseminated, I guess, would be the best way to say it, even though the company that is producing it has reached some sort of a settlement, I think, with the state, and they are doing things to limit the amount of it that's going into the river system, but some of the preliminary, and I guess they would still be preliminary, results that I've heard about from investigations of the accumulation of it in top predators like American alligators and striped bass, are showing at present in fairly substantial levels. That's another thing you have to think about, is, if you have superfund sites, or other sources of contamination that are present in the area that gets flooded, then you have to deal with that as well.

MS. DEATON: That chemical is in a category called perfluorocarbons, and it's common in Teflon-producing manufacturing, and so that was the source in this case, but I've heard that it's in a lot of states, and it's been discharged, because it doesn't get filtered out of typical wastewater treatment plants, and, in some cases, it just wasn't even filtered from the factory when it goes in there, and so the thing is we now have better technology to find these chemicals, where we used to not be, and it's an endocrine disrupter, meaning that it affects the reproduction and metabolism of organisms, and so, when they found this out --

The good thing about it is you're getting research money allocated to see what are the concentrations in the freshwater and estuarine species, and so they're doing research on the oysters in the system, and there was a recent article about striped bass in the river have it, and alligators that they have monitored have it, and so you just don't know what the long-term effects are on the population, but it gets action, because there is a human health risk, because it's also cancer causing, and so I'm just going to mention, thinking about Georgia and the paper mills, that's perfluorocarbons, but it also has chemicals that are a waste product, the dioxins and such, and those are toxic, but they also tend to be endocrine disrupters. If more monitoring is done, this problem could be in other places as well in the South Atlantic.

DR. GEIGER: Let me give you a perspective of what I'm seeing coming up with some of these episodic storm events. We just had a recent stormwater drainage study completed by Kiawah Island that was pretty comprehensive looking at what these episodic storm events are doing and what is offered to the community to try to mitigate or resolve or deal with some of these highwater events, both from episodic storm events like hurricanes and high rainfall events as well as storm surge.

Seabrook Island just commissioned a drainage study as well, to look at the same things, and I think other coastal communities are looking very hard at this to become more aware of these highwater events and how communities can deal with them. What I see coming out of this is some real solid recommendations of what are we going to do with the existing infrastructure and modify it to make it more habitat friendly and more fish friendly and more critter friendly as well as opportunities to look at some really large-scale coastal restoration projects, in terms of maybe dune renourishment and a few other strategies, looking at marsh activities that we can improve or improve flow or fish passage or a variety of different things.

They're talking about elevating roads six inches or twelve inches, and that opens the opportunity for using arched culverts, instead of the round culverts, to improve connectivity between marshes and other bodies of water, and I see a huge emphasis on that being driven by a lot of these storm events, and so I would think this is going to offer us a real opportunity on coastal communities along the South Atlantic really to make some significant impacts and improvements and, again, focusing on an ecosystem approach, like in North Carolina. Again, what's going to be the effect of large-scale breaches of hog waste ponds downstream? What is that going to do to human health and services and everything else along that?

I think it's a real opportunity for the council to really take a leadership role in this and continue to work with the states and partnerships at the local, state, and federal level to try to look at opportunities to leverage some of these activities and interests.

What's exciting, from my perspective, is, just with Kiawah and Seabrook, you have a bunch of high-powered folks, retirees, that have a lot of political influence on these to get these folks engaged and focused on this, and tie it to habitat restoration and improvement is a significant move forward, and tying it to economic benefits, upstream and downstream benefits, the total economy of the various states, is a really, really positive thing, and so I think we're having some opportunities here to get our case well known and made in a more stronger fashion.

I think the South Atlantic Fishery Management Council could really take a leadership role, primarily because of our focus on ecosystem approach and a whole variety of other things, and, with the states sort of working together on this, I think this is going to be a real wake-up call. I am seeing it happen at the local level, and I'm excited about it, and it's just getting everybody to talk to each other, using common-denominator language and leveraging resources. It makes no sense for me for Kiawah to do a dune renourishment project if they're not going to include Seabrook Island to the further south and look at Edisto down farther south as well, and it makes sense to leverage those coastal communities and say, hey, let's make a significant effort and do it together in a partnership.

The same thing with dealing with storm surge advance. There is new technologies coming available, and why do it a leverage thing so that you're getting a significant amount of habitat and

really see if you're making a significant difference. Again, it's an excellent opportunity, and the South Atlantic Fishery Management Council has a real opportunity to do something and make it really beneficial and helpful. Plus, I think we have the political support. In the Southeast, the political support is there.

Unlike some of the other parts of the country, people are concerned about this, and, again, doing the outreach on what we're doing and why we're doing it and why it's important to people from the highlands to the coastal areas makes a lot of sense. These are wake-up events, and hopefully we'll take advantage of them. Thank you.

DR. LANEY: I think that's an excellent point, Jamie, and I was going to ask you this. Do you know if South Carolina Sea Grant has been involved in that at all, in the production of those reports and studies?

DR. GEIGER: To my knowledge, no. There's a variety of basic engineering firms that are in charge of doing it. These are studies that are being done or performed, and there will be significant recommendations coming out of these studies that will basically evolve into, obviously, habitat improvement projects dealing with some of these issues that are being raised. Trying to get the appropriate entities involved in looking at some granting possibilities and what can and cannot be done in some of these communities is I think going to be a real challenge, but that's where the political support can come in.

Just look at this way. If you can reduce storm surge by 15 or 20 percent, what are the benefits in insurance claims on these kinds of things? It will more than make up for anything that would happen on that, and so, if you tie it to cause and effect, a little money here for preventative is going to save you a hell of a lot of money down the road, and it makes sense. People understand that, and I think, again, tying the right federal and state agencies together for the common good and the common objectives -- I see it as better than any other time in history right now to do that, and so stay tuned.

MR. MEDDERS: I just wanted to build on what you were saying and tell you a little bit about what we're doing in Georgia, and, as a matter of fact, some of these -- I didn't know these issues happened in North Carolina, and we haven't experienced that with fish kills after hurricanes. We did have two close calls recently, which really woke us up, but, before that, our Coastal Management Program, which is housed in my same agency that does the marine fisheries work, we have been doing -- You have to know that there is 159 counties in Georgia, and we have a lot of counties, and we consider eleven of those coastal counties, with five of them being right on the coastline.

One of my colleagues has been working really hard, and I've been told we're one of the first states to do this, what they call post-disaster redevelopment plans for all of those coastal communities, and part of that is to answer like with the hog farm thing. It's, after the storm, what should we prevent, or what should the development be like afterwards, and we've gotten a lot of good press from NOAA for this, and it's an exciting time, but you're right that these storm events, these last two storm events, in our area, really brought it to the forefront, because it wasn't too many years ago, like three or four years ago, that we weren't allowed to use the words "climate change" in our agency.

Two years ago, we hosted a climate conference, and our commissioner came and gave opening statements, and we actually have a Republican U.S. Congress representative that's probably going to be run out on a rail because he's supporting these climate change initiatives, because he lives in that area, and he knows what has happened, but just that post-disaster redevelopment plan is all about having a similar theme amongst all those communities, like you're suggesting, and I've got to give credit to a couple of my colleagues for really spearheading this, and it's something that we're real proud of, and we haven't had a direct hit in a long time.

We had two near-misses this past year, and I think we're lucky without the fish kill stuff because of the -- We had the tidal amplitudes, the six to nine-foot tides, and we haven't dealt with red tides, and, when dysteria was the hysteria of the day, we didn't deal with that, and so a lot of those things we have been immune to, but we haven't had a storm sit on us like the storm did in North Carolina either, but we've been real lucky, but I think the importance of those plans to, after things happen, what should and shouldn't by where they were is important, and it's something that I think our agency is real proud of, and so there's sort of a -- There's a plan there that other communities could follow, I think, some work that we've done. Georgia is not usually cutting edge, and so I had to brag a little bit.

MS. DEATON: That would be great to share that information, if you have a document.

MR. MEDDERS: I would be glad to. I would be glad to put you in touch with the person. Jennifer Kline is the person, but I can send you -- Really, it got me thinking about some questions, as Wilson was talking about what he was talking about with what are the -- I don't know that they have attacked some of those responses that should be, from my perspective, the fisheries responses directly after, and that would be interesting, because they're thinking more long-term, or semi-long-term responses of where things should be, and we've got new flood maps, too. You were talking about flood maps, and we got new flood maps the year the hurricane came, and everybody went, really, this is what -- But I would be glad to share that contact information with everybody and get it out to you.

DR. LANEY: This is great. This is a very energized post-lunch talk, in contrast to some that I have given, and so thanks to all of you for jumping in. It occurs to me, and Roger has to give me reality checks on these brainstorming that I have sometimes, but, in listening to you all think, and I said earlier that there's nothing we can do about hurricanes, and, no, there isn't, in terms of when the event comes and hits us, but there certainly is a lot that we can do, I guess in terms of the resilience and the adaptation, and it occurs to me that maybe a role the council -- Well, first, I was going to say that I can think of a bunch of partners right off the top of my head.

The Sea Grant Programs in all four South Atlantic states certainly would be key, but we also have National Estuary Programs in at least Florida and North Carolina, and Georgia as well, and so those would be very significant partners. I think there is local NGOs in every state, and the North Carolina Coastal Federation comes to mind in North Carolina, and certainly the North Carolina Wildlife Federation has a very strong interest in coastal things, and maybe the way to approach it is to say, okay, we know that, most of the time, there's not going to be anything we can do to control the path of a hurricane or its immediate impacts, but we can do things in terms of the landscape that will reduce the impact that those events have on the habitats that are so important to all of us for fish and fisheries production and for our collective economies.

Maybe that's a thing that we could take back to the council as a recommendation from the AP, is first to educate ourselves by getting ahold of the Georgia work that they have done, that Paul just talked about, and these local community studies that Jamie is talking about in South Carolina. I know that North Carolina, in terms of APNEP and North Carolina Sea Grant, have been working with some communities to develop coastal resiliency and adaptation plans as well, and so it would be nice, first of all, to probably assemble all of that information in one place, and maybe, Roger, we could even think about coming up with some sort of another policy statement that says, okay, based on this work that all these other folks have done, then we acknowledge the power and strength of hurricanes and the impacts that are going to come, but always you can ameliorate those impacts, and, based on our review of the literature, here's what we suggest or recommend that the council adopt as a policy, and does that sound like a way to go?

DR. LAURENT: Thank you for the opportunity, and I just want to make a quick comment. We talk here about extreme events, and we think about hurricanes, but what about harmful algal blooms or those types of systems that are not necessarily triggered by hurricanes, but are in themselves extreme events, and so we had one in Florida for an entire year on the west coast of Florida with massive fish kills as big as you saw in those pictures here for all kinds of fisheries, talking about snook, tarpon, goliath grouper, endangered species, and even manatees and dolphin and so on. I mean, it was insane, and then it came on the east coast, and nobody knows how it got there, because the loop current conditions were not favorable for transport from one coast to the other, but still it came, and so maybe it came earlier, but that's six months or nine months in advance, and so I think those events maybe should also be part of a plan of how it can be mitigated.

That requires the same type of actions as you're thinking for resilience to hurricanes, and it's management of wastewater and of storm water and of drainage basins and of canals and all sorts of things that actually the new governor is trying to address right now. He is trying to basically move away from the status quo we've been seeing in the south Florida management industry and in the other water management industry and appointing new people there that he thinks will take actions and move away from these types of things that haven't changed anything in Florida. They want to basically fix the problem without addressing the causes, and so that isn't going well, as we all know here, and so I just wanted to mention that.

MS. DEATON: Thank you, and I think where you can fit these algal blooms in, and the red tides, is coastal resiliency. What we need is more and better coastal resiliency for all kinds of stressors, and those stressors might be a hurricane, or they might be excessive nutrient input for hydrologic alterations, or simply natural, but more coastal resilience, because we have a stressed system, in most places, to some extent, and so I think it could fit, with the right packaging.

MS. BUSCH: I was going to say too, when you're looking at partners, don't forget the DOD, specifically the Navy and Marine Corps. I know Camp Lejeune took a big hit from the last hurricane, and they have realized that they need to kind of look at ways to better armor the bases, especially Norfolk Naval Base and Camp Lejeune and some of the other ones along the coast, and so the bigger Department of Defense may be moving away from climate change, but the Navy is still very much committed, because it realizes that it's one of the ones that is most at risk from it. You can't put ships in places where the ocean overtakes your piers.

MR. WHITAKER: I'm David Whitaker, and I'm a council member, and I'm formerly with DNR. A couple of things occurred to me that you might be interested in. One is the South Carolina

governor, somewhat surprisingly to me, but has developed the Governor's Flood Commission, and he has nominated, or named, about seven or eight taskforces, and these folks have been meeting for two or three months, with the idea of looking at resiliency not just for the coast, but for all areas subject to flooding, like we've had in these two-thousand-year events we've had recently.

Some of his taskforces are a little bizarre, and I won't give editorial comment, but one of them is to take on Navy ships and string them stem-to-stern from the North Carolina line to the Georgia line about a half-mile offshore or something like that to prevent storm surge, and so you can assess that on your own, but, being the head of artificial reef, I wasn't even notified about it, but, anyhow, to his credit, they are taking a proactive approach.

Our concern, or my concern, is that they have been focusing more on the engineering aspects, as opposed to doing something like influencing urban planning and development, where a lot of these flooding issues, inland flooding issues in particular, are problems, but a group of us, in sort of a senior citizen science group that has formed in the state, have been approaching them, and we hope to get more discussion on this urban planning and working like that.

Just FYI, the City of Charleston has been looking at flooding issues, and they have traveled to the Netherlands, and I think that's part of their taskforce name now, is something to do with the Netherlands, but they are looking at pumping water during floods and some things, and I'm not sure how effective all that is going to be, but the city is very much concerned about rising sea level, but mostly from the infrastructure standpoint.

One other thing that might be of interest is the governor just vetoed, I believe, Roger, a bill that was going to walk back some of the shoreline laws that doesn't allow building closer to the shore once erosion -- The legislature passed this, to put some exemptions out, and the governor vetoed it, because it was local legislation, he thought, and so I'm -- Now, they may well override that veto later, but that's a couple of things that I thought of.

You mentioned earlier about looking for fish after the hurricane, and, at the marine lab, Fort Johnson, we've been looking at eDNA for -- You may know, Bob, but the little sunfish in the swamps, it's very difficult to sample, but you can go in and take eDNA, which is environmental DNA, if you don't know, and tell whether it's present or absent there, and it's a unique way of assessing something fairly cheaply and quickly. I think that's all that I wanted to mention. Thank you.

DR. LANEY: Two comments. One is I 100 percent agree with Laurent about the harmful algal blooms, and I would note that, just for the record, that it's not just the west coast of Florida, because North Carolina experienced one in 1985, I believe it was, the red tide event, and it was speculated that that one may have originated on the west coast of Florida and then been picked up in the Gulf Stream and then spun off from one of those Gulf Stream gyres and wound up inshore in North Carolina, and it pretty much wiped out our bay scallop population, and the bay scallop populations have still not recovered to the extent where any sort of significant harvest is allowed.

Yes, David, to the eDNA thing, there's a lot of interest in that, and there's a lot of work going on. In North Carolina, at East Carolina University, Roger Rulifson and colleagues are looking at eDNA as a possible tool for documenting river herring runs, because, in New England, they have the benefit of having very clear water up there and lots of volunteers that are willing to go out and



donate fifteen-minute blocks of their time to be able to count river herring coming back from the ocean and going upstream to spawn.

Down south here, you can't see them. If the water is clear, it's the color of iced tea, and so it makes them kind of difficult to count, and so Roger and colleagues thought, well, maybe this eDNA tool would be one way that we can use to document where we still have runs and also possibly to document run size, if it turns out that the amount of DNA that the fish shed is proportional to the run size and so forth and so on, and so he's been working very closely with the Fish and Wildlife Service at Edenton National Fish Hatchery and putting known numbers of river herring into their tanks there and then sampling the DNA, and then I think there's pretty widespread general interest in it.

One of the companies on the west coast, and I want to say it's Biosonics, maybe, but I am not sure, has developed field gear that you can use now for sampling for eDNA, and so they're trying to make it easier for technical staff to be able to take it out to the field and take the samples and get a readout fairly quickly. Of course, I don't want to oversimplify it. In order to determine whether individual species is present or not, you have to have markers that have been developed that tell you that this DNA is unique to that particular species.

I think there is tremendous potential there, and there's a lot of good papers in the literature. There has been, again, a lot of interest in it in North Carolina, and so I started pulling papers out of the literature, and there is one paper from Japan that looked at eDNA from an estuarine system, and they found that they got more information, better information, about which species were present using the eDNA than they did from using conventional sampling techniques, like trawls or gillnets, and so that's great, and I think it's another one of those tools that has a tremendous amount of promise for the future.

MR. PUGLIESE: Before I go anymore into the discussion on policy, just on this eDNA activity, it's very timely. At the CCC meeting, I did have a chance to talk to Cisco Werner, the Senior Scientist at NOAA Fisheries, and that is one effort that they actually are spearheading on the west coast, to develop this strategy on how to utilize eDNA to not only document occurrence, but also potentially document biomass size, et cetera, and he is under the understanding about some of the complications, where you have a resiliency time, and some of our types of estuarine systems are near-shore, murkier water that may keep the DNA longer than a short period, and it potentially could complicate some of this, but there's a lot of interest from the national level on this with creating proof concept, which is really exciting.

If nothing else, what I look at is not only -- I mean, if you can get to the biomass, that's one thing, but even documenting just occurrence could provide -- I have talked to him specifically about this, is an opportunity to maybe identify areas that you could do additional sampling for occurrence of live bottom or something, identify some species targets and do collection systems, and he was even talking directly with the Ocean Observing Association representatives, with Debra Hernandez, about potentially the future and outfitting different areas with collection devices, et cetera, and the possibility into the future as we go. That, I think, potentially, as a number of these new tools are coming down the pike, has a lot of potential to help with documenting occurrence and documenting impacts and beyond.

DR. BUCATARI: I am recently in Renewable Energy, and so I am putting on my hat from my old job, which is Marine Minerals, and I will talk tomorrow about a study we've doing there in Marine Minerals, and it started following Hurricane Sandy in 2013, and we've been monitoring, and I think Brian has brought it up a couple of times, but we've been monitoring Cape Canaveral Shoals, Canaveral Shoals off of Cape Canaveral, since then. It's the longest-term monitoring we've been doing, I think it set some goals for additional long-term monitoring.

It ends next year, in 2020, and I will bring it up tomorrow in more detail, but I just wanted to say that we do have an interest, in the Marine Minerals Program, in long-term monitoring, if you can tie it to offshore sand features, because that's what we're concerned about, and the concern and the objective for this one was the recovery of sand shoals and the fish, and so it's mainly focusing on the fish that utilize them post-hurricane and post-use of the shoal for beach renourishment or whatever shore protection that you need to do.

It's pretty relevant to other states, I would say now, and Florida is the most limited for sand resources, but North Carolina is getting there, and I know South Carolina -- A lot of states are moving to offshore sand in the OCS and not along the state, and so, to bring it up to North Carolina, we have recently started thinking about, and this would be somebody who is still in the program and I have had discussions, Doug Piatkowski, and I think a lot of people from North Carolina may be familiar with him, but he is our representative in North Carolina, and he and I have talked about moving it to Frying Pan Shoals, since there is interest of dredging Frying Pan Shoals, which is also important fish habitat.

I think he's working now on getting a group together to discuss the potential of doing that and how to do that wisely, without causing too much environmental damage, and we'll have a report out soon, but we have found that there's a lot of similar impacts following hurricanes to these offshore sand shoals and the recovery of fish species that you will see in dredging. They have the same recovery time, and so you can use the dredging almost in lieu of a hurricane to look at impacts, and so, while you can't predict when a hurricane is going to happen, we do know when a dredge event will happen, and so that seems to be helpful for us to do some baseline monitoring before it occurs and get some more information.

We are also very interested in eDNA. We are really interested in it for endangered species, and we thought about using it on Canaveral Shoals, but we have probably invested I think close to \$11 million in Canaveral Shoals right now, and we're just going to maybe move to another area and see what they have, and then maybe get back into eDNA, but we could potentially use it maybe in Frying Pan Shoals or something, once we just start talking about getting in on the ground floor. Thanks.

DR. GEIGER: This is a fascinating discussion, but where do we go from here? Let me just throw out a few more thoughts. I always look at common denominators here, all right, and I think of common denominators, and god bless you, Roger, but here it is. The South Atlantic Fishery Management Council is the common denominator. Why do I say that? It has a distinct charge with appropriate southern states, and it's dealing with most of the southern states that have the right politics, and it's dealing with a core agency with NOAA that has a defined charge and definite relevance to everything we've talked about, and it has a defined history of bringing in partners, DOI, Army Corps of Engineers, and other agencies. It also has a history of bringing in private sector partners.

What better entity could I think of to pull stuff together here, again using an ecosystem approach and looking at these increasing frequencies of episodic storm events, storm surge, king tides, heavy rainfall events, everything else, with a defined economic outcome that is going to affect habitat, fisheries, resources, you name it? It seems to me that, if we chose to do that, and when I say we collectively, through the South Atlantic Fishery Management Council, we have a real opportunity as a pilot South Atlantic, and all the indicators fall into place here, the politics, the economics, the states, the private sectors, the partners, and the communities.

It seems to me that there's a real opportunity here to forge something new and exciting, and we don't have to use the buzz words. Somebody mentioned that we're not able to use "climate change" now, but, hey, what's the surrogate for that? It's increased episodic storm events and sea level rise and rainfall events and drainage studies and population increase effects on fish and wildlife resources.

In my mind, the South Atlantic Fishery Management Council is perfectly positioned as a pilot for the country to pull this stuff together. You've got a history of it, and you have the support of it, and you have the credibility of doing it, and you have the politics on your side, and I would really look hard and think about this. Thank you.

MS. DEATON: We know Roger can do it, right?

MR. PUGLIESE: I think we've been building toward providing guidance and advancing things like this into the future for a long time, and I do take to heart your comments, because I think what we've been doing is setting the stage for those discussions. We have already talked about the foundational activities at the state levels and how those may be able to be drawn on to provide some guidance that we could package together and advance, because it's interesting.

I started thinking, as soon as we got into these discussions of policy directions and everything, that's kind of the evolution we've had in this entire process in this organization, and this advisory panel has set the stage and built on that and then, ultimately, that becomes like the ah-ha moment that we need to advance beyond that, and so I think what has happened today is really setting the stage for the discussions, and we'll go from here and reach out to the state sub-panel chairs and then begin that process of pulling together what activities are at the state relative to resiliency and activities that have been highlighted and with our partners with the Navy and with BOEM and others, and I think we just really -- We have the right people aligned to continue this discussion and make sure we cover all the major event types that we're discussing and begin to pull that type of information for a more expanded discussion at the October meeting.

What will be really interesting is that, while all those things are said, there is one other opportunity that we have been building a collaboration with for a long time, through the Landscape Conservation Cooperative, and we're going to follow-up with a presentation, after we kind of conclude this, to the degree we can, with the Southeast Connectivity Adaptation Strategy, which I think lines up absolutely with everything that we're discussing, and there is commitment at all the state level organizations and all the federal agencies, and everybody is aligning in there, and so there's another ability.

In that whole process, the marine is connected to the -- The whole thing is that footprint, like we did with the LCC, and the entire thing is going from the edge of the EEZ throughout the entire region, and so there's an expanded way to reach into that for other types of information and other capabilities and other guidance.

DR. GEIGER: I could not agree more on that. However, I would use a caveat. Those were developed under previous administrations, and so let's be smart about it and re-brand it and re-label it and use the same basic components, but don't -- Call it something else, but keep the same core components there and re-brand it and re-focus it and re-energize it. Then it has traction. It will have support, and, again, I can't overemphasize that the politics in the Southeast are where it's at right now, in terms of emphasis and focus.

In my opinion, I've never seen it as strong as it is right now. Plus, it's in line with the current administration, whether you hate them or like them, but let's exploit that connection, that connectivity, with the appropriate governors in the states and the other federal agencies. I think there's a real opportunity to leverage something as a real showcase activity here that will benefit and literally float all boats.

Again, just think about it. Think of how you would go about it. Think of how you would package this thing, but get away from previous labels. Focus it in terms of ecosystem principles and approaches and economic outcomes and benefits and tie it all together to, obviously, protection and restoration efforts and the benefits of that for long-term financial health and stability. In my mind, it makes all the sense in the world, and the South Atlantic Fishery Management Council has always taken that proactive, big-picture approach, in my opinion, which makes you unique and separates this group from other fisheries management councils. You haven't been afraid to explore that and move forward. Plus, you've got great political support to do that. That's just an observation from an old, retired guy.

MR. PUGLIESE: I will add one additional point to that, because I think there is another alignment that's happening, and I touched on it, but I think it also aligns very well with some of these discussions, especially how that evolves, and that is, from a national standpoint, I am presently chairing the Council Coordination Committee Habitat Workgroup for -- It's the collaboration between all the council representatives throughout the country.

We are going to be holding an EFH consultation workshop that is intended to work with council and NOAA Fisheries staffs, at the habitat conservation level, on how to refine some of the consultation discussions, whether it be their day-to-day activities or where the council weighs-in and provides input, drawing from expertise from the centers, from the region providing it to us, and then, also, how we can better provide information on essential fish habitat online and web services capabilities, a lot of things that we're doing that I want to share with our partners in there about how we've created a user guide that we've run through this group before that's been refined and advanced and informs the consultation process.

I think there is some real opportunities to inform those with whatever gets developed through some of this process and be able to have and enhance some of those as best practices or whatever that are coming for a specific region or a specific area, and so there is some things that are aligning in the bigger picture, I think that can benefit from this ongoing discussion, and especially if it gets really kind of crystalized down to value that can be used at the state and local levels.

MS. DEATON: All right. Thank you, everyone, for all the input. That really makes a difference.

MR. PUGLIESE: Let's take about a five-minute break, or a ten-minute break, and then we'll come back, and what we have is we have a YouTube presentation by Rua Mordecai, who is now coordinating the SECAS, Southeast Connectivity and Adaptation Strategy, technical side of that that is being run through the state systems, and it does still have wheels. Where the LCCs or whatever -- SECAS has still been moving forward, and so we'll touch on that shortly.

(Whereupon, a recess was taken.)

UNIDENTIFIED: We're going to be hearing from Rua Mordecai, who is the Science Coordinator for the South Atlantic and the Southeast Blueprint, and he's going to be talking to us about what's on deck from SECAS, or the Southeast Conservation Adaptation Strategy, this fall.

DR. MORDECAI: What to expect this fall out of SECAS, many of you might remember that the cycles usually align around the Southeast Association of Fish and Wildlife Agencies meeting in the fall, and so I deliver a lot of the materials, and then, after that, if needed, we kind of finalize stuff, but, every year, we kind of go through this update cycle.

I am going to hit on a few of the major things to expect coming in this update cycle this year, and I'm also going to cover a little bit of some blueprint uses in the works, because those are fairly nice to kind of update on and get a sense of how this is used in general, and so that's what I am going to hit, uses in the works, Blueprint 4.0, and so the next update that should be coming up this year, and then also tracking progress towards the SECAS goal.

Step one is uses in the works, and so a lot of different cool uses of the blueprint. As you know, we --, this is something from back in September, just to get a sense of where we were at, at fifty completed blueprint uses, with about sixty more in progress, and we're actually cleaning up and updating some numbers, and so we'll have some more updated numbers coming up soon, but a whole lot of really fun uses, and these are just the ones we know about, and it's not necessarily all of them, but that's a lot of cool stuff, and I can't really go through all of these, but I figured that I would just pick out a few examples as we go, just to give you a sense of some of the ways it's being used right now.

Let's take a look at the SECAS geography here, and so this giving you kind of a sense of the broader blueprint coverage, and so I'm going to start with a few state-specific uses, or statewide uses, and so, in this case, Arkansas Game and Fish is working on using the blueprint to help create their conservation opportunity areas in their state wildlife action plan. They're working on using the blueprint, again, across all of Arkansas, and then, basically, we've got a pretty exciting use that's about to be finished for the first year, probably in the next few months, which is the South Carolina Conservation Bank, and it's a major land protection funding, through the state legislature, and so they fund land protection. In their priority maps, they're going to be used for picking projects, and the blueprint is one of the core layers in there, and so we've got the blueprint in use for the land protection funding, and that's -- The first year cycle is about done, in a few months, but this will also be they are updating this and improving it every year, and there will be a chance for improved integration over time as well, and so that's very exciting.

We've also been working with the North Carolina Wildlife Resource Commission on ways to potentially use the blueprint in aligning their land protection funds statewide, and so looking at their projects and how they focus their efforts.

Also, the Florida Fish and Wildlife Conservation Commission, they are working on integrating the blueprint holistically across a number of their different programs and statewide efforts, including a way to also kind of map some of their efforts and reviews with the Fish and Wildlife Service in Florida as well, and so those are just a few statewide use examples that are ongoing, and a few of them will have some finished uses very soon, which is exciting.

Then, of course, we also have multi-state uses. One that you will see in this newsletter is Addie Thornton, the coordinator for SERPPAS, kind of wrote up some nice things about the good map effort that they're doing, and so the blueprint is being used, again, in that good map effort, and the SERPPAS is a partnership that includes agriculture, conservation, and military interests, and it's a state-federal really good military integration there, and so that good map is the core component of what they do, and so we're helping with a refresh of what that looks like, and the blueprint is incorporated in that, and so that is very exciting. It's also helping us bring some new resources for user support, in being able to speak to how some of these actions contribute to the military mission and some other key components as well, and so that's a nice intersection and ways of talking about ecosystem benefits that we haven't been able to do before.

That's an example of multi-state uses, and we have a few other exciting ones, at least one in private industry that we can't talk about yet, and I wish I could talk more about it, but we should hopefully be able to say more in the near future, and so that is multi-state stuff, and then, since I've been talking about statewide and multi-state, I wanted to drill down even finer, into something that has actually been a nice expanding use of the blueprint, which is in city and county comprehensive plans.

Here is a few examples that I know about right now, and the green ones are complete, and the blue ones are in the works, and so we've got the blueprint incorporated into Union County in South Carolina and Fort Mill in South Carolina, and the two ones in blue that are in the works is the City of Conway in South Carolina and Wake County in North Carolina, and so those are in the works, and they're starting to find some nice connections into city and county comprehensive plans, which are a really fun experience as well. Those are a few examples of some particular uses at different scales.

Those are a few uses in the works, and, next, I want to talk about the next update of the Southeast Conservation Blueprint, and so this is 3.0, a map that most of you have probably have seen here, and, generally, the first time people see this, either in a picture or in big map form, usually they are drawn to a couple of places within it. Usually it's like these two places in West Virginia and this part in east Texas, and they go, wow, what's going on there, and that's a whole lot of priorities, and the intent, of course, in the blueprint to put these things in different types -- It's apples-to-apples and have a similar amount of prioritization.

Based on the rules we worked out with the points of contact many years ago, this is not working in a number of places, and so we kind of knew about that, but, this year, we're going to do a big push to improve how we deal with overlapping areas, and so this is kind of an example showing these impact overlap areas, and so everything that has got stripes on it is an overlap area, where

multiple plans overlap, and, right now, the approach has been basically to include them both. Whether it's in one or the other, include each, and that resulted in some pretty overprioritized areas, which is a known issue, but, like spots in east Texas right now, it's like 99 percent is some level of priority, and it's supposed to be around 50, at the highest level, and so that's something we're going to be working on with points of contact and work on some improved measures for those overlap levels and get things more in balance, which is the intended purpose, and we're very excited to be working on those, and so you should see improvement in that integration, and there's a lot of different things we're going to be exploring.

That's the first thing people see, and a typical next question is what's going on with the marine area, and why does this sort of stop, because you see it in the South Atlantic there, and then people ask, well, what about the rest, and so, in this next update, we should have some expanded marine coverage going all around the State of Florida, and so that blueprint is now getting expanded to cover the marine area, and so we will at least have a wraparound going from that south Virginia all the way around Florida, in that circular area there, and so we're excited about some expanded marine coverage, and we're still looking into options for the Caribbean, around Puerto Rico and the Virgin Islands, and also around the rest of the Gulf, but this next update will have expanded marine coverage, which is exciting.

The other thing we did in the last year's update was work on an expanded hubs and corridors layer, and so the intent here, of course -- When you've got the whole big blueprint, a lot of people want to find the individual pieces of them, and one thing people have asked for is can you just kind of give us the underlying big hubs and corridors network and not all the speckles and other priorities in between, and so, for the first time, we started adding in a hubs and corridors layer, which was trickier than we thought it would be.

In this current version, what we have is we've got what you see here, and we've got part of the hubs and corridors pulled out of this, and, for the next update, we're planning to have the expanded hubs and corridors layer to cover the rest of Florida, and also out into the western part of SECAS, and so, on the western part of SECAS, in that center thing, we didn't totally have the full corridors defined and their blueprint input at that time, but that's being updated, and so that's exciting. Then, down in Florida, we had corridors, but we didn't have the hubs part, and so we'll have that piece integrated as well.

This is going back to the input and overlap area that you can see my cursor, and the area we're hoping to now have hubs and corridors in is right in this section right in the middle, and so we plan to add that into the next version of the blueprint as well.

A few other improvements we're working on that you will also see updating things, this entire area is also going to be updated and improving some issues with the coastal marsh down in Louisiana as well, and so we've got a few nice improvements for this year in the works with respect to the blueprint, and so you'll see those -- We should have those in a few more months, have some drafts together.

Then the next thing is tracking progress towards the SECAS goal itself, and so you may remember, from previous slides or talks, that it's set -- As of last year, the state directors approved this 10 percent or greater improvement in the health, function, and connectivity of southeastern ecosystems by 2060, this overarching goal, and so now we have some targets and metrics that

we're shooting for, as far as the actual ecosystem outcomes. Holistically, it's off the south, which is cool, and some metrics that can keep us on track, and so a 1 percent improvement every four years and a 1 percent increase in conservation actions within the blueprint every four years as well, and so this is not just holistically across all the ecosystems, but also tracking them within the individual ecosystems, such as freshwater aquatic, open pine and prairie, marine ecosystems, and so broadly across the ecosystems and seeing how we're doing.

The intent is to try to build off of existing assessments that we have out there, the coastal condition reports, state of the birds, the longleaf reporting, and all these various other things, state of the South Atlantic, but to kind of take all those different pieces that are in their own little resource silos and pull them together holistically into an integrated report.

Now, this is a huge and ambitious thing, and so, of course, this year and next year, and probably even the year after, we're not going to have it perfectly locked away and amazingly all done and tracked, but we can make some significant progress every year in trying to track some of these pieces, and we will be reporting -- In the fall, we'll have a synthesis of some of these and across some ecosystems and what we can say so far about progress towards that goal.

You may remember that we talked, I think in our previous web forum a while back, about some of the earlier trends we were seeing as we were pulling together things like the trends from the Chesapeake and how a lot of the aquatic assessments tended to be stable and increasing, and this is the coastal condition index for the South Atlantic and the Gulf and the full region, and so it's just a quick reminder of some of the metrics.

We are also seeing that grassland and open pine, and we're seeing more decline in upland hardwood and forested wetlands, and this is from one of the state of the birds reports, showing the wetland birds and forest birds are doing a little better than grassland birds, and so that's some of the things that we can draw on at the beginning, and this might be familiar to some of the folks.

This is the prescribed fire trend in the longleaf reporting from 2013 to 2017, and so, even though things are still looking pretty tough in open pine, we're starting to make good progress on restoring longleaf and getting fire back in the ecosystem and some of those things, and so that's the flavor of some of the stuff we'll be drawing on and reporting on in this initial cut, but, again, setting expectations, it's not going to be the perfect, flashy, state of the south kind of report, but it will be, okay, here's what we figured out so far, and so expect to see a nicer synthesis of that coming.

That is basically for this year, but I also wanted to hit, super quickly, on what's in the works for next year, and so there's one thing, and I'm not sure how much you've heard of this regional species of greatest conservation needs, and so this is through the Wildlife Diversity Committee, and so each state has their species of greatest conservation need, and so now, across the whole south, we're collaboratively coming together on some regional species of greatest conservation need, and so that can contribute to shared actions, but also in shared tracking of how we're doing for the ecosystems across the south, and so that is in the works, and we should have some good progress and developments by next year.

Then, of course, as I mentioned, yearly updates to the blueprint, and so the Southeast Blueprint 5.0 will be something we are shooting for next year, and there's a lot of cool improvements, especially in the South Atlantic Conservation Blueprint. There's a lot of cool stuff we're working on and



some improved indicators and some finer resolution, and we're hoping to get down into finer resolution, and we'll see how that goes, but I think there's some pretty awesome things that we're going to be able to do in the next version of the South Atlantic blueprint.

We're also working, probably not in this year, but into the -- It will probably be more like next year, but into -- I showed you the hubs and corridors, but also some other ways to slice up the blueprint around aquatic resources and across all of longleaf and across some other things and some things we're working on, and so cool stuff, and I'll keep you in the loop, of course, on those improvements as they're going.

Then the last piece in the works for next year that we have is some discussion of improved governance around SECAS, and so there are two levels at which kind of things happen within SECAS. At the top level, there is the Southeast Association of Fish and Wildlife Agencies, and so the directors there, and the Federal Agencies in the Southeast Natural Resource Leaders Group, and so that's the two groups that have come together, initiated by the states, and they have brought in the Southeast Natural Resource Leaders Group, and so that group has points of contact and folks that are helping make some of these higher-level decisions about where SECAS goes.

At the same time, there's also the very bottom-up approach within these individual inputs on the South Atlantic blueprint, and so that is the sort of broadly-inclusive state and federal and private citizen, kind of everybody working together around these prioritizations, and so we have that going on as well as the kind of bottom-up. At this level, this group is now doing -- It's kind of bringing on some committees and thinking about, okay, how do we improve the governance, particularly in the wake of some recommendations from the Association of Fish and Wildlife Agencies on these kind of broad landscape partnerships and how to better incorporate non-profits and private companies and other organizations.

Take a look at the newsletter or the blog on the website, and Mallory has got a great blog that talks all about some of the background and history and a little bit about some of the governance stuff as well, and so that is something on the horizon as well, and so, with that, that is what's on deck for this year and also what's coming for next year.

MR. PUGLIESE: This was a consolidated presentation that was given as part of the third Thursday webinars that LCC is still coordinating, and it included SECAS's update for one of them, and so this was truncated down from a lot of introduction information to focus really specifically on activities relative to what is going on and the coordination through the states through SECAS and connection with SERPPAS et cetera, but it's relevant to what we were discussing, because there is opportunities, again, for that collaboration and expansion and refinement and drawing information from that into what process we're going to be undertaking.

That's what I really wanted to kind of connect in, and I think that is all that we really had scheduled for today, and I think we've pretty much gotten all the way down to just about the end, and it's a little early, but we've covered a lot of significant efforts today, and we've set a lot of things in motion too for the future that we're going to have to do some coordination on and follow-up for the October meeting.

DR. LANEY: I just had one comment. I really appreciated you incorporating Rua's update into our discussions here, and I would just encourage all of the AP members to, first of all, if you

haven't visited the SECAS site, or the South Atlantic LCC site, to do so and look at those blueprint footprints on the landscape, and, to the extent that you have opportunities to do so, and I will use Jamie as an example, just because I like picking on him, but, in his earlier comments to us about the Kiawah Island and the Seabrook local planning efforts, there is no reason you can't roll the conservation blueprint footprints into those local planning efforts, or at least encourage them to take a look at that.

You heard Rua talk about Wake County's program, and Wake County has a very active and well-funded, as a result of bond issues, open space program, and that's one of the things we did a number of years ago, was put together a program, and Rua came, and Luis Alexander came, and Dean Carpenter came from the Albemarle-Pamlico National Estuary Partnership, and we explained to the open space director and the open space and parks advisory committee how their local efforts within Wake County plugs into these overlapping, hierarchical ecosystem-based planning efforts, and I think that hopefully led to Rua's comment that they're now starting to incorporate those blueprint footprints into their local GIS system that they use for prioritizing the acquisition of open space within Wake County.

I will say it's easier to do that sort of planning in a large, heavily metropolitan and heavily urban area, where you have a lot of support for open space, in many cases, because it's gone already, and so people are really supportive of trying to establish green-ways and trying to preserve what open space is left, and, when you go to very rural, non-urban, agricultural or heavily forested areas, it's harder to put together a program like that, but, still, there's going to be some sort of a local planning body, and I think we can all point out to them that, hey, folks, a whole bunch of experts got together, and they assembled this footprint, and this is what they're telling us that we need if we want to have a healthy, sustainable environment for the future.

It's not only healthy and sustainable for all the plants and critters that live there, but it's healthy and sustainable for us as humans as well, and so, again, I encourage everybody to take a look at that, and, if you're involved in other entities at the more local level, try and get them to take a look at that and incorporate it into their planning efforts.

MS. DEATON: Any other comments or discussion? All right then. I think we'll conclude for today. We have two follow-up items, and one is to craft the wording for a recommendation, the first, regarding the monitoring of the deepwater sites, and the second is to reinforce recommending being proactive with bullet and frigate mackerel, and so I can send out an email with this first thing that I started to everybody, and whoever wants to wordsmith, like anybody.

MR. PUGLIESE: How about -- Jamie, would you like to take on the prey and work on that? I think we've got some wording.

MS. DEATON: You do the deepwater, and you do the --

MR. WEBB: You're going to send me what you started, right?

MS. DEATON: Yes. All right, and so we'll adjourn for today, and tomorrow we start at nine o'clock.

MR. PUGLIESE: I did have one thing, and I sent a note to Laurent, but I think what we're going to do is maybe shift Laurent's presentation to right after SECOORA, if that's not a problem, because I think it lines -- Since we moved that up, it aligns better also with the ocean observing discussions and then some real direct practical application of technology, and that makes a lot of sense, and then we'll go into the EBFM stuff from NOAA Fisheries after lunch, as well as my touch on the two-year roadmap, and that's going to be another setting for October, and then where we stand with Ecopath, and that will conclude the day. If that sounds fine, I think we'll -- Thank you, all.

MS. DEATON: Thank you.

(Whereupon, the meeting recessed on May 21, 2019.)

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MAY 22, 2019

WEDNESDAY MORNING SESSION

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The Habitat Protection and Ecosystem-Based Management Advisory Panel of the South Atlantic Fishery Management Council reconvened in the Crowne Plaza, Charleston, South Carolina, May 22, 2019, and was called to order by Chairman Anne Deaton.

MS. DEATON: I would like to have everybody take their seat and get started. We have a full day. The agenda goes until 4:30, and so we want to try to stay on schedule. First, before we start, we're going to have a webinar at lunchtime, and so everybody should have received, in front of them, a menu, and you're supposed to circle what you want, put your name on it, and make sure you put on there how you want it cooked and what side you want, either just write it on there or circle it, and then Cierra will collect them. Just bring it over to Cierra when it's done. She's going to turn it in, and then they'll come back, and you can pay the waitress later, and you can use cash or card, and so, if you can work on that as we start, we'll collect those. We want those done after the energy presentation, and we'll take a break so we can get that turned in. If you need to check out, that would be a good time, at that break.

Yesterday, we had two recommendations that we were going to have members kind of look at it and wordsmith it and bring that back up today, and so we'll do that first thing after lunch, and that will give everybody time to think about it, and so, David, when you get done, if you want to send that out to everybody, because Steve sent his out to everybody, and then we can all look at that and discuss it after lunch. The first thing on the agenda is Energy Development Activities in the South Atlantic, and Jennifer is here for Brian Hooker to go over that information.

DR. BUCATARI: Thank you. I am here from the Office of Renewable Energy Programs at BOEM, and, as I mentioned yesterday, I started there a couple of weeks ago, but I have been at BOEM since 2011, working in the Marine Minerals Program and the Oil and Gas Program, and so, if you have questions about any of those programs, I probably have more answers than I do for renewables, but I will do my best to go through this with you all.

I know that Brian has shown you a number of these slides multiple times, and so you're probably more familiar than I am with some of them, but this is the leasing and development process for renewable energy, and it just gives you an idea of, when I go through the next few slides, when I'm saying things like leasing, and you will see, in that second column there, the lease issuance occurs, and that only gives them the right to go out and kind of look at what is going on out there, as far as benthic and site characterization, wind energy and things like that, and so giving somebody a lease doesn't mean that they're out there building right away. It takes many, many years after that, maybe five-plus, I think, at least, to get out there and even put out like a met tower or something like that.

Then we'll talk about, after leasing, there is site assessments, which is where, as I mentioned, you go out and kind of check out the characteristics of the area and whether or not the wind is suitable. Then you get to -- You get all your geological and geophysical surveys done, and you get all of your other surveys done, and then you can submit what's called a construction operations plan, and that is where the larger environmental review occurs. There is environmental reviews in the beginning as well, but, typically, like an EIS may occur, and we're working on many of these right now. The construction operation plans have really started to ramp up along the Atlantic.

These are the ones that -- I'm just going to go over the projects that we're currently working. Not all of these are to the point of construction or operations. I think there's maybe three construction and operation plans, and I might have that a little bit off, but these would be areas that have interest, there's a call-out for interest or they have a lease, or it could be any of those steps.

This is starting up in the Northeast, which is probably not as great interest to everybody, but there's a lease there for Vineyard Liberty, which is in that yellow-cream part, and so they actually have a lease. Mayflower, which is in the kind of purple color down there, and these are all Block Island and Rhode Island. They have a lease. Then Equinor, which is the pink color, has a lease, and so we're working on site characterizations of these areas off of Block Island.

Moving to the next few, in this same area, Vineyard Wind has a construction and operations plan in that we're working on right now. It's under cooperating agency review, and so it's one of the furthest along, as far as closest to construction, or potential construction. We still have to complete the environmental analysis. Bay State Wind is doing their surveys, and they have submitted a construction operations plan, or they submitted it in March, and our review is going on. It's underway.

South Fork did submit one. They are currently under pause, which means that the company came back and asked us to hold tight on the environmental impact statement review. The Department of Interior initiated, with the new administration, in I want to say August of two years ago, a new requirement for all of our environmental impact statements to be under 150 pages and completed within two years, and so a lot of the stakeholders love that. That's great, because, if they want to build, it helps them to get it completed faster, but then sometimes they get in the middle of it, and we ask them for additional information, and they don't have it yet, and then you have to put it on pause, because, otherwise, we will get dinged at BOEM if we don't get it completed in under two years.

One of these, and I can't remember which one, but we can ask for a waiver to go over the 150 pages, but we still are stuck with our two years, which has been -- For Renewable Energy, they are on the forefront of it. For DOI, they've been doing really well getting it proposed to be done in eighteen to twenty-four months. Then we have some kind of newer -- Revolution and Sunrise Wind Farms are newer suggestions of wind farms that we're just starting to work on.

Going further south now, off of the New Jersey and New York area, Empire Wind has a site assessment that was approved, and they're working on the construction operations plan to come in during the fall. Going a little further south, Atlantic Shores has a site assessment plan coming in in 2020. Ocean Wind, off of New Jersey, has an approved site assessment plan, and so now they can go out and do their surveys, and we're waiting on their construction operations plan, once they get their surveys complete. There is a transmission line from Anbaric that has been requested, and that means we have to go out and look for competitive interests in that area.

Now we're in the Delaware and Maryland area. Orsted also has the Skipjack Wind Farm, and we received their construction operations plan in April, and so we just started doing that, and that's the teal part, I believe, and then U.S. Wind, their site assessment plan has been approved off of Maryland, and we're expecting another construction operations plan in 2019, and you can see we're getting a little busy this year, which is why they have scrambled to hire a bunch of people and pulled us in from other areas.

Offshore of Virginia here, we have Dominion is doing -- They are proposing a wind farm, and they have a site assessment plan approved, and they're going to start with a demonstration scale, and so just a couple turbines to start out there, and that's that first bullet you see, and then the second bullet would be their larger farm. There is a commercial lease off of Kitty Hawk that the surveys for the site assessment plan are expected to begin in June.

Going down to the last bullet there, it's just a little bit of information about what we're working out outside of the leases in this area, and that would be these South Atlantic Regional Taskforces, and they are scheduling -- I would say late summer. That says summer of 2019, but, from the last I heard, it would be like August, at the earliest, the Virginia/North Carolina Taskforce meeting, since most of our wind energy areas span that border right there of Virginia and North Carolina. By planning, I mean I think we just had the first internal meeting to discuss it, who would be invited and who are the stakeholders and things like that. Then we're still discussing a North Carolina/South Carolina Taskforce meeting.

Other programs, and this first bullet has a couple of grammatical areas, and I apologize. First of all, we have paused our work on the 2020-2025 proposed program for oil and gas lease sales. It was the 2019 to 2024, and I believe they changed it to 2020 to 2025, but, anyway, that's our five-year plan that most people are most familiar with, which did include, in the draft program, the Atlantic plan for oil and gas, and it's been put on pause, as most people probably know, because of the Gleason decision, the lawsuit that Judge Gleason said that we could not open up the Arctic and the Atlantic.

MR. PUGLIESE: Yes, and I assume that also -- That basically stopped everything, and so even the review for the permits for seismic were --

DR. BUCATARI: No, those are still ongoing. That does not stop any potential G&G surveys in the Atlantic, and so that's the next bullet. The Atlantic G&G seismic survey permits, they received their IHAs, and their permitting is still ongoing in BOEM, and all the geological and geophysical surveys are handled by our Gulf of Mexico office, and so I can't speak to much, other than I know they're ongoing, and they have their IHAs, their incidental harassment authorizations, from NOAA.

DR. LANEY: Isn't that also under litigation, too?

DR. BUCATARI: That, I don't know. You might know more than I do about that. I do not know.

DR. LANEY: I think I heard it was, but I won't swear to it.

DR. BUCATARI: Okay. Then our third program would be our Marine Minerals Program, and I'm going to talk about a couple of marine minerals studies. Our Marine Minerals Program is very, very busy, thanks to Hurricane Florence, and there was another one that I'm not remembering offhand, but, in the Southeast -- Michael. But re-nourishing -- I would say they probably have projects in about 60 to 70 percent of the coast of Florida and then moving up North Carolina and South Carolina, and we also have quite a few projects, and, to support those projects, we do quite a few studies, and I'm going to talk about them, but, first, I will go over just an update, and I know Brian has talked to you all a couple of times about these South Atlantic high-resolution aerial wildlife surveys that David Bigger is leading in our group, in Renewable Energy.

This is a quick update. Four surveys have been flown, and the next survey is going to happen in June, and so this is a previous June that you see on here and not the next coming June, and so this is June of 2018 was already done, and that February and June data is already on the portal, and you can find the data at that link at the bottom. So far, the detections, they have found 1,700 large bony fish, about 1,110 sharks, 4,600 rays, and 38,000 incidences of sargassum. The final report comes out in 2020, and, once they go through those cumulative detections, they kind of QA/QC them, and then they put them up on the portal, and that's when you will see more of the information, and then you can get that final report next year.

This is one of the marine mineral studies led by Deena Hansen in our group, and so I started this project with her, and what we were looking for was -- We could get EFH conservation recommendations that kind of varied, depending on who was doing the review, and we would -- We spent a lot of time going back and forth and talking about the science of -- We mainly focus in this study on sand shoals, offshore sand shoals, and so we were going back and forth and talking about the science of sand shoals and who uses the sand shoals and what the habitat value is, and so we wanted to come up with a tool that incorporated science as we could find it up to date on the various sand formations and their use.

First, we had to classify them, and so we actually had a meeting here in Charleston in 2013 with Pace Wilber and a number of other people to get together and talk about how to classify these sand shoals, and then we did a study looking at all the science that was out there, and now we're kind of bringing it all together into a tool, so that you could say this is the area that I want to utilize offshore, kind of circle it, and pull up the sand features and who uses those sand features and any kind of literature that is associated with that that might be helpful for your EFH assessment, and so that's what she is working on.

This is a study that I mentioned yesterday off of Cape Canaveral, and down there on that left figure is our study area, and the circle all the way down at the bottom with the black dots around it, that is our dredge area, and it's called Canaveral Shoals 1, and it's a cape-associated shoal, and it is popular for sea turtles and fishes, and it's popular for dredging, because it in-fills, because it's a cape-associated shoal, and so we use it a lot. It's dredged by Brevard County, Patrick Air Force Base, and it's proposed to be dredged by Kennedy Space Center, but it is dredged by Brevard County and Patrick Air Force Base every couple of years, at least, and so it's used quite frequently. It has a pretty good in-filling rate.

Those little black dots are all acoustic -- That is our acoustic array, and so they're all VEMCO receivers that are out there. We have thirty-some from BOEM, but there were also existing ones that are in that near-shore from NASA, and that's why we decided to kind of partner with them, NASA and some other state agencies, and I believe there's some that go up into the Indian River Lagoon as well, and then we also have a partnership with the University of Florida, who has since put out a few more out there. Mainly, they are on sand features, the BOEM ones, but we do have some that are on a hard-bottom area, because we're looking at red snapper usage.

The point of the study, this part was just focusing on the fish here, and mainly sharks is what we've done a lot of work with, but we want to know recovery post-dredging, and so this is the one I said we started doing after Hurricane Sandy. In 2013, we got Hurricane Sandy funds to look at the recovery of this dredge area, and so we started doing this study in 2013, but it's ongoing until 2020, and we've had several hurricanes come in since then, and so we've gotten to see that, whenever we can find our equipment afterwards, and several dredge events.

The point is to look at recovery, but also to look at the trophic structure, and so the University of Florida is doing an even larger project than this one, and they're talking about looking at phytoplankton and zooplankton and benthic fish and all kinds of things, and that one also is complete in 2020, and so you will see all of these reports out in 2020, and so you can see there the list of fish that so far we have tagged, 747 fishes, and we follow them with the acoustic array, but also that wave glider on the right that we purchased a couple of years ago, and it goes out quarterly and is out there for two weeks and makes a standard track and records all the acoustic pings that it receives. It also tracks salinity and chlorophyll and a few other parameters, and we're going to start, this year, to send it out to listen to just the ambient sound out there.

We have detected fish that have been tagged by other researchers, obviously, and so we have 923 total fish that we have detected. We found them very widely distributed in the study area. The influence for what we found in community structure and diversity is season, water depth, and then distance from shore, which I think is probably not too surprising. We did not find a huge difference between the dredge and the control site for use, either one that wasn't being dredged or shortly after being dredged. They seemed to have a really high mobility in that area.

We found a general northward migration, and this is mainly in our shark species, but also some migration in other fishes in the spring, and many animals return in the fall. We did find a seasonal presence of sturgeon and smalltooth sawfish, and I also put a manta ray, and I think we've seen manta ray, but we haven't actually -- Like you see the surface of a manta ray, but we haven't actually caught any manta ray or anything, and so we have found a seasonal presence of those two fishes, from ones that have been tagged, but we did not believe that they were that present out

there, and I have a draft of the first report, but the final should be out in about a month, I believe, or maybe a little bit longer.

A couple of things that we found that I thought might be of interest we that we did long-lining, and we also did -- Not just to catch the fish, but NASA was already doing some longline surveys out there, and we decided to continue them, and so we started doing longline surveys, and then we also did other various methods of catching the sharks and the fish to tag them, and we found a couple of things that we thought -- We thought we would get the same kind of results from each type of survey, but what we found was that like grouper, for example, is grouper were absent from the longline, but we would find them in like the telemetry surveys. We thought that normally grouper weren't there, but they were there, and so that just shows you that like sometimes it depends on your methods.

Telemetry confirmed that the red drum was there throughout the summer, but we did not catch them by longline during the summer until springtime. From springtime through the summer, we wouldn't catch them by longline, and the longline confirmed that the blacknose sharks were abundant year-round, even though our acoustically-tagged animals were not found. We could find them up in the Carolinas in the spring on another array that was up there, and that is all that I have for you today.

DR. LANEY: Jennifer, you said the report is going to come out within another month or so?

DR. BUCATARI: Yes, and I have the draft.

DR. LANEY: That would be great. Can you give a sense of what are the numbers of Atlantic sturgeon that were showing up in the study area, because I know that, based on some of the email traffic I have seen, that it was kind of surprising to see the sturgeon, and these were south of Cape Canaveral, I believe, weren't they?

DR. BUCATARI: Yes, and it's just off of Cape Canaveral. I don't remember the number, offhand. I remember that we found more than we expected. I would say it was in the tens to maybe twenty. It wasn't high, but we didn't expect to find hardly any, and I think we had one or two smalltooth sawfish, but I can let you know for sure.

MS. DEATON: Jennifer, thank you. That was really interesting. I have one question. Well, two questions. One is, I guess, would that paper then be put on the BOEM website?

DR. BUCATARI: Yes, it will go on two areas. We have ESPIS is kind of our data portal for all of our literature, and it's a little bit difficult to navigate, and so, if you have any problem finding it, let me know. It will be in there, but we also have our Marine Minerals page that has all of our studies, and it will go on there.

MS. DEATON: If you could send out like a reply-all to our group with the link, when it's available, that would be awesome.

DR. BUCATARI: I would be happy to do that.



MS. DEATON: My other question is could you -- I don't know if you know this, but how does Cape Canaveral compare to say the Frying Pan Shoals and the capes in North Carolina? It looked, to me, like it wasn't as long, and how far are they going to pipe that -- They are piping the sand to Florida, and how far is that, relative to the characteristics of the cape shoals in North Carolina?

DR. BUCATARI: Well, I'm not a geologist, but I can tell you that I think that the shoals at Cape Canaveral are probably a little bit compromised by the port. There's a channel right there for the port that's maintained, and so I think they could have been longer, potentially, if that wasn't there, and that's just my guess, from thinking about the shape of it and knowing Frying Pan Shoals and how far out it goes. What was the second part of your question? I'm sorry.

MS. DEATON: How do you compare Cape Canaveral features and the recovery rate, and I was just wondering how similar they are, because there is interest in doing this in North Carolina.

DR. BUCATARI: Yes, and, as I mentioned, we're going to start -- I believe Doug Piatkowski will start digging into that a little bit in more detail, but, just from our understanding, I would say maybe, because of the difference in temperature, it's probably a little bit slower of a recovery. I guess it would depend on how close the Gulf Stream comes right there, and we did find a fairly fast recovery in Cape Canaveral, but, again, it's been dredged so many times that you're looking at a baseline that's already been altered, and, at Frying Pan Shoals, you don't have that, and so it's hard to say how similar that would be, because I'm not sure if the organisms that live there are already the organisms that would repopulate after some sort of dredging event.

MS. DEATON: But in terms of the sand rebuilding? How fast does that happen at Cape Canaveral?

DR. BUCATARI: Well, it doesn't like completely refill, and so we don't give it time, because we dredge it so much, but we do have reports that we can share that were paid for by the Army Corps, who monitors the in-filling after each event, and you will get a -- Gosh, I want to say maybe up to a meter of in-filling after an event, depending, of course, on storm events and things like that, before the next -- It might be more than a meter before the next dredge event. Now, Frying Pan Shoals is a very similar type of shoal. It's a cape-associated shoal, but I don't know that that means that it would necessarily in-fill at exactly the same rate. It's very turbid in the Cape Canaveral area, and I think it probably is at Frying Pan Shoals.

MS. DEATON: Then there's three of them, too. There is like Cape Hatteras, Cape Lookout, and then Frying Pan, and the sand transport sort of stops, and each one kind of acts as an endpoint for sand transport.

DR. BUCATARI: That makes sense, and there isn't that above Canaveral Shoals. We don't have another cape-associated shoal that close, and so that I don't know. That could cause some changes. I am sure, with the number of people, geologists, that have done studies on Frying Pan Shoals, I'm sure there is a much more scientific answer for you out there in the literature somewhere, and so sorry for murdering that, from the geologist perspective.

DR. ROSS: One of the things that's different there is that's one of the closest points, at Cape Canaveral, where the Gulf Stream comes to shore, and the next closest point is Cape Hatteras,

which is probably more similar, and so those two shoals are short compared to Cape Lookout and Frying Pan.

DR. BUCATARI: That's a good point, yes.

DR. ROSS: So the dynamics there are different than the two southern-most shoals off of North Carolina. Jennifer, I wanted to ask a question. As this study winds down, I thought I understood you to say that you might be moving a similar study northward toward other areas?

DR. BUCATARI: Actually, we have one that has just started, and it's almost the same study, and they may be doing some methods different, now that we've done some trial and error in Canaveral Shoals, but on Ship Shoal in the Gulf of Mexico, and our Gulf of Mexico office is doing that one, and then our headquarters office is talking about moving the same one -- We've been talking about it for a while, but moving it further north, and so we thought about doing it offshore of New Jersey, but, now that Frying Pan Shoals has become such a prevalent question for North Carolina, then I think Doug is kind of considering maybe doing something similar in North Carolina, and so starting out with just meetings, I think, and like discussions about should we do this.

DR. ROSS: Maybe we can talk more about this offline or something, but one thing for the committee to think about, or the council, is, in North Carolina, it's one of the oldest shark surveys in existence, even older than the one at VIMS, and it's operated out of the Morehead City lab. It's been going on for like thirty-five years of longlining, and so it makes a good opportunity to couple an acoustic study with a different type of study that has also involved tagging as well as distribution, and so it's something to think about, that there is some background to capitalize on and infrastructure that's already in place.

DR. BUCATARI: I agree, and the biggest issue for us has been -- One of the biggest questions that we've had in trying to start up these arrays is finding somebody close by that can maintain them, because, obviously, we can't do that, and so we were fortunate to find NASA. I'm not sure how that's going to work in the Gulf of Mexico, but you need somebody with that experience too, and, if they're already doing longlining, that's great to pair up with it.

DR. LANEY: Jennifer, have any of these studies looked at I guess what I would characterize as fine-scale behavior, i.e., why are these species visiting the shoals, are they using the ripples for shelter from currents, is there a benthic assemblage there that they are particularly feeding on? Have you all looked at any of those sorts of questions at all?

DR. BUCATARI: I focused on the Navy, and this is a Navy and NASA project that I focused on, but the University of Florida is doing that for us right now, doing gut content surveys and isotopes, and they are doing pretty much anything we can do out there, and they have been since 2013 to look at that, and they would like to come up with -- They are working on an Ecosim model to come up with some more understanding about what's going on out there, and so we haven't gotten to the modeling part yet though, and so I don't know anything about that, but I don't have those results, because their report is not due until later this year, but I remember one question you had about dredge distance, and you were talking about dredge distance.

The dredges here are hopper dredges, and it's like a vacuum cleaner, and they put it in the hull, and so they can go -- In the Gulf of Mexico, they can go thirty miles or so, but, here, I think it's

maybe like seven to ten miles, and then they just pump it from the hull up onshore, and so they don't -- But there are some dredges that do just pipeline it out, but we can't do that very well in the Atlantic, because of the waves.

DR. LANEY: One other follow-up. For the diet stuff, that's great, and so the University of Florida is looking at that, and that, obviously, would tie it to the benthic community, but, as far as the actual physical use of the shoal itself, is anybody, to your knowledge -- I mean, to get that kind of fine-scale behavioral information, you would have to do real-time tracking, probably, and so is anybody out there doing tracking that would allow that sort of discrimination, and I guess your array would have to be configured in order to allow you to triangulate real closely as well, to figure out what an animal is actually doing.

DR. BUCATARI: We have tried that. We have not had much success. We have tried to do that. University of Florida is doing a live tracking, where they follow them, but they just disappear so quick, and they had a really hard time out there. It was mainly like flatfishes, and our array has to be outside of the dredge area or in an exclusionary for a cultural resource, and we can't have it in the dredge area, obviously, because they go out and dredge it a lot, and we would have to move it back and forth, and so that really limits our ability to track fish directly and finely inside the dredge area. We haven't had much success doing it the other way, but it would be great if we could move those receivers around a little bit. We've done satellite tags on sea turtles, and so we know a little bit more detail about sea turtle use within the array, within that area.

DR. LANEY: Just as a follow-up, I will mention this, and I don't know how applicable it would be in a marine setting. I think it probably would be, but -- I never can remember the name of the laboratory, but they have been collaborating with Dominion Generation at the Roanoke Rapids Dam, and they have developed this new tiny little acoustic tag, and they've been working on American eels at Roanoke Rapids Dam, and their receiver array is like three-dimensional and real-time kind of stuff.

This is real high-tech stuff that they're still working on, and so they are getting ready -- I know they're going to present on their results at the upcoming AFS meeting, I believe, in Reno in the not-too-distant future, but there is some summary work out there, and Bob Graham or Pete Sturke at Dominion would be able to give you the contact information for the lab folks that have worked on this, and I'm wondering if that might possibly have application in a marine setting like this, to give some more fine-scale information.

DR. BUCATARI: That may be something helpful for Frying Pan Shoals.

AP MEMBER: I have one quick question. I was thinking about what you said about red drum, and did I hear you correctly say that you all were not getting the red drum in the longline survey, but they were present in the acoustic array?

DR. BUCATARI: Yes. Did I say it right?

AP MEMBER: We have a longline survey that targets red drum, and we have an acoustic array that is for other fish, but we're dabbling in red drum now, and it's interesting to me that there may be times of the year that they're just not catching them with the longlines.

DR. BUCATARI: Their behavior was just different during that time of the year, for some reason, and we weren't getting them on the longline.

MR. MEDDERS: Then I guess I won't spoil the punchline, but I'm curious about tripletail too, specifically, and do you remember off the top of your head, because some of the tripletail we're tagging are being picked up in that area, at like the Fort Pierce area, seasonally. Like we're seeing them move between Georgia and Florida, which means that we're sharing that population, and do you have a specific knowledge? Do you remember seeing tripletail on your list?

DR. BUCATARI: No, I do not, but, if you want more details, I can put you in touch with the biologist at the Navy that did a lot of the more fine-tuned --

MR. MEDDERS: I know they're sharing all the data, but I was just curious, because our tripletail guys are getting the data, because they're all sharing it, but I was just curious if you remembered. Thank you.

DR. BUCATARI: You're welcome.

MR. PUGLIESE: Jennifer, thank you. One thing I think is that caught my attention too, because I chair the SEAMAP Committee, and we've got the long-term longline programs for each of the states for red drum, and, just that behavioral issue, I'm not sure if that's been considered or if that would influence any of the survey activities.

One that I think I was thinking about is it's good to see it advancing, because we've had a little bit of a touch on some of these different activities over time, and hopefully the opportunity to be able to get in and utilize the information that's provided. One of the big challenges was, and the reason some of those were put together, is that the council had designated areas as essential fish habitat areas of particular concern, with regard to the shoals and different areas, and the opportunity to refine what some of those characteristics were with the type of detail we're talking about, species utilization and physical characteristics, I think is really critical and important, and it sounds like it's getting there, and there may be even technologies that can get even further, to kind of really refine that, because some of the spatial presentations are going to be really important as we move down the road on updating and refining and advancing and then also back-filling species use information, and so it's going to see those advancing, and hopefully we can go further. It's interesting to hear that they are going to be doing some modeling, because we're working on entire regional South Atlantic Ecopath model.

DR. BUCATARI: Yes, I saw that.

MR. PUGLIESE: Where diet composition information that's being collected from whatever sources may be really valuable, and it may be species that we don't have in there, plus being able to figure out how some of these things can link together is going to be important, because there's that opportunity to look at multiple sub-regional models that may influence or inform the bigger modeling efforts.

DR. BUCATARI: Yes, and you're welcome to that information.

MR. PUGLIESE: Yes, and I've been trying to -- We're trying to figure out -- We're going to be going into an Ecospace, and I will touch on that just a little later on in the meeting, but going to an Ecospace side, and so a lot of these different types of information are going to be critical to advance this, and it's good to see. Like I said, it's good to see some of these maturing and being available for being able to understand and really kind of characterize it. On the grouper, what species did you identify? Do you remember? I would assume gag and --

DR. BUCATARI: Yes, and I have the list, and I can share it with you. We didn't tag any grouper, and they were tagged from other areas, but there was the gag, and the goliath grouper, I believe it was, and that's all I can remember at this point, and we are focusing like our sampling areas on a ridge and a trough, so that we can see the difference, because we have suspected for a long time that maybe they are using them differently, and maybe, if we just dredge the ridges, we would have less of an impact.

One of our recommendations in our leases is that they leave areas in between that are undisturbed for recolonization, and that actually happens naturally with dredging, and so it's pretty easy to do for them, to make sure that they leave a certain amount of space, and so we've been looking at that possibility in the study, and one of the things that we found on the University of Florida side is they were sampling mostly during the day, and they weren't getting a lot of the smaller fishes out there, and so, when they started doing it at night, which wasn't in the original proposal, their numbers just skyrocketed, and so they found a real big difference there.

MS. BUSCH: I just wanted to mention that I've heard a lot of people talk about they have fish tagged, and I just wanted to make sure that folks know that the Navy and BOEM have partnered together, and we do have receivers up the James River, the York River, Hampton Roads, and at the mouth of the Chesapeake, a little further offshore, and the Navy does go out and check those and keeps a list, and so, if anybody wants to check their tags, Carter Waterstone with the NAVFAC Atlantic puts that list out, but, if you're not aware, we have that list, and you can check for your fish.

DR. BUCATARI: We have some on Sandbridge Shoal that I think -- It was under the same -- BOEM paid for it under the same study, and Sandbridge is about to be dredged, and we'll see how that -- We've had a lot -- Not a lot, but, for us, a lot of sturgeon up that way.

MR. PUGLIESE: I guess it's very timely for talking about some of these different aspects, because one of the things that I think we talked about in working with our regional Ocean Observing System, SECOORA, and Debra is going to be presenting shortly on activities there, is we have always talked about trying to advance the connections of a lot of these different arrays in the system, and so, hopefully, as things continue to evolve like that, that can be something that really provides that connectivity between, because there is so many different pieces of that, and some of those things, I think, she's probably going to touch on and how we can advance that, because that's been something, I think, at the council level that we've discussed extensively and a number of places, and so we'll be able to really kind of build on this and at least begin to do that and then figure out what areas need to be added to, so that we have, ultimately, the ability to monitor throughout the entire South Atlantic, and that would be great.

DR. BUCATARI: I agree, and I know we've worked with SECOORA with getting in touch with our array, but Eric Grier down at NASA is much more in touch with them, and he just kind of

comes up and says, hey, can we do this, and I was like, sure, we don't mind, but we are considering leaving part of the array. After 2020, that circle around the dredge area might be a little bit much for us to maintain, but we're right, now under the consideration of how much does BOEM invest to leave it out there, and how much do we leave out there, and so that's what we're working on right now, but we could reconfigure it, maybe, potentially, and maybe move some of the -- We do have the receivers and so we could just move them around a little bit, if there was interest.

MR. PUGLIESE: I guess that's where I was going, is, if there is opportunities on things that have been established, that we could figure out a way to collaborate to ensure that that continues, instead of it just going away and then having new things, and maybe that's something that we can really advance, through coordination with SECOORA and through other partners you have and throughout whoever else is going to be maybe tied in or potentially could do that and just figure out a way to not lose capability if it's already established.

DR. BUCATARI: Certainly.

MR. PUGLIESE: I think that would be a unique opportunity to make sure that that continues on.

DR. BUCATARI: Yes, and we -- Those receivers have been out there quite a bit of time, and so I would say that probably we could speak with our procurement officers, our contract officers, but they probably have lost their value enough that we could give them to somebody else, if they were interested in maintaining them themselves. I think the maintenance, for us, is our concern.

DR. LANEY: Just a comment, from a long-term perspective, and Jamie could give me a reality check on this, but I just wanted to express appreciation to both the military, especially the Navy, and to BOEM as well for all of the work that you guys have funded and are doing out there to increase our understanding and knowledge about how these systems work.

I think, to me, that's an incredible shift in philosophy from early on, when it was like -- I say early on from like forty years ago, and it was like pulling teeth to get development agencies, water development agencies, under the Fish and Wildlife Coordination Act, which is what our main tool was back then, to do anything, and now it seems like you guys are not only doing it, but you are also making the information publicly available on your websites and enabling the transfer of the shapefiles and everything to the council, for example, for use in some of the modeling work that we're doing.

I, for one, really appreciate it and wish that some other federal agencies, who shall remain nameless, might emulate you all, in terms of putting your funding where your mouth is and doing real environmental baseline work that can feed into the environmental documents required for some of the projects that are being funded and some of the activities that are being proposed, and I think it's great, and I really appreciate it.

DR. BUCATARI: Thank you.

MR. PUGLIESE: Real quick, I think one of the things that I'm really looking forward to seeing is where you're saying that these surveys at Kitty Hawk are going to start in June, and we're in definitely a different realm, in terms of advancing discussions with our partners at Renewable Energy, and I think -- We had a big Council Coordinating Committee with all the councils around

the country last week, and there's a lot of emphasis about all the problems they're having in the Mid-Atlantic and New England areas and the impacts on survey work and on fisheries and different things, and I think one of the things that I tried to stress to Cisco Werner, the Senior Scientist, was that, in the South Atlantic region, we have been trying to work closely, bringing Brian in, bringing BOEM into the process, highlighting how advancing renewable energy is going to be much preferable than looking at oil and gas exploration in our region.

We even had the industry do early presentations, before the survey work, and so there's the real opportunity in our region to get ahead of that and to benefit not only the fisheries, but the industry, and advance this into our things, and so I think the willingness to keep that close tie and the ability to influence both the survey work and the development, and the design and advancement with the industry I think is a huge -- Again, that's, again, another very different perspective from some of the activities we've had in the past, and so I think there's a lot of interest in advancing and keeping that moving forward, so that we can see that go even further.

DR. BUCATARI: Thank you, and I think most people are aware, but the surveys off of North Carolina are like high-resolution geophysical surveys, and so no air gun surveys or anything like that. I almost forgot to mention that, and people hear survey, and they think --

MS. DEATON: I have a question different than the shoals, but on the seismic surveys. There was a public hearing in North Carolina this week.

DR. BUCATARI: I heard that. I think I saw that on the news.

MS. DEATON: Someone sent me something that came up, and it says, in 2017, BOEM denied the seismic G&G permits that had been issued for the coast, including North Carolina, and so we recently had to review a consistency for another company that wants to do seismic surveys, and so I guess my question is what is the status? If they denied those other permits, then what is the process for them to get a permit, and why is that process going forward to allow new companies to do it if the others were already --

DR. BUCATARI: I don't know why they were originally denied, but it could have been a lack of information, or it could have been anything, and so does it say why it was originally denied? You can probably answer this better than I can.

MR. PUGLIESE: We were in the middle of the fray on that, because, originally -- We actually, in our statement back to Zinke directly on oil and gas exploration and on seismic testing, we basically quoted the Director of BOEM by saying that the impact to the resources was greater than the potential benefits at that time, and so we integrated the quote directly from the former director into our statement back, and what I think bottom-line happened is that, basically, they just turned the switch and said that they're going to reopen them without review and allow other groups, and that was an administration direction, and we restated -- All the Atlantic councils have restated their position on this continuously, and so that's why I had thought that some of those were actually being held, is in response to the litigation and some of the --

DR. BUCATARI: It's possible. I know they're still under review, but I don't know if they're paused or -- All I know is that they're under review, and I'm sure the previous director, or maybe that was Director Hopper that made that statement, Abby Hopper, and we didn't have oil and gas

interest, or it wasn't that we didn't have interest, and I shouldn't say that. We didn't have oil and gas open. There was no potential. We had the 2017 to 2022 oil and gas plan that was released, and it did not include the Atlantic, and so I think her statement was pretty much, if we don't have the potential to lease right now, then maybe that was where she was saying that the environmental harm would outweigh the need at the moment, but, now that it has been requested to be reopened, I'm sure that's part of why they reconsidered it, but I am not an expert on this, by any means. Again, it's held in our Gulf office.

MS. DEATON: It's just a little confusing.

DR. BUCATARI: It's very confusing. It's confusing for everybody, yes.

MS. DEATON: So I just was seeking clarity, but thank you very much.

DR. BUCATARI: You're welcome.

DR. GEIGER: Thank you, again, for the update. As you probably are aware, there is considerable interest in many of the coastal communities about the ongoing activities about leasing for wind power development and activities as well as, obviously, seismic testing and the potential for additional seismic testing along the coast, especially along South Carolina. Is BOEM open to providing say a speaker to give updates to say the Kiawah and Seabrook Island communities on the current latest updates, current updates on both wind power development and/or seismic testing as well as proposed future developments along the South Carolina coast?

I would make that request, and I know the communities are extremely interested in what's going on, and, of course, there's a lot of misinformation and confusion over where we're going and how we're going to get there, and, again, the coastal communities, these two coastal communities, are very interested in sea turtle conservation and piping plover conservation and habitat restoration and a whole variety of other activities, and so, again, I would hope that -- I would like to just get an indication of would BOEM be interested in providing an update to those particular communities in the not too distant future. Thank you.

DR. BUCATARI: Sure. Well, I can't speak to seismic testing, because, again, that's the permitting that goes on in the Gulf of Mexico office, and that's not associated with the renewable energy work. We won't be doing seismic testing for renewable energy, but, as far as renewable energy goes, since I've only been two weeks, I don't want to volunteer them to come talk to you, but I do know that they do an incredible amount of outreach, and I'm sure that they would be happy to speak to somebody, and the person who leads the South Carolina area I believe is the same as North Carolina, and it would probably be Will Waskes, but I can get you in touch with somebody. Will is great, and I'm sure that he would be more than happy to speak with you all.

MS. DEATON: All right. Last call on any questions or comments.

MR. PUGLIESE: One thing I think that's interesting is you did make a statement on part of the array activities was to build baseline information, and I think that whole idea of creating an understanding of what the base soundscapes sound like have a lot of importance beyond just the dredging activities and into the future and understanding what that habitat life is like with that specific soundscape, so that, as other things are going on, we can begin to understand how that is



changing over time, and that's something that I think we need to get further down the road, and it's good to see that there's a consideration of kind of getting the big-picture view, so that you have that in advance of anything else that goes on beyond any of the activities we're talking about.

DR. BUCATARI: Yes, that's a great point, and we have an understanding of dredge sounds, but we don't have an understanding of how -- That was done on Wallops Island, and it's nearly as noisy up there, although there's a lot going on, as it is at Port Canaveral, and so we weren't really sure what the ambient noise was in Port Canaveral, and so we wanted to know, and plus it's a right whale area, and so I think it would be really helpful to get more information for that.

DR. LANEY: Just one follow-up. I know acoustics are extremely important, for example, for all of the drum species, for reproduction purposes and spawning, and I know there was some early work done on that, because the Fish and Wildlife Service actually purchased a hydrophone for DMF, I believe, and I can't remember who was using it, but somebody was using it to identify spawning areas in Pamlico Sound. Was it Joe Luczkovich that was doing that work? Hopefully he published it somewhere, but, yes, the whole issue of the soundscape and background noise and ambient conditions and for all these animals to be able to communicate with each other is a really critical issue that hasn't really been looked at until very recently, I think, and so, again, you all are to be commended for looking into all of that.

DR. BUCATARI: We did have hydrophones out there to listen for red drum and other fish, and that data -- We just have a whole bunch of data, but we didn't have the money to analyze it, and we just got the money, and so Stephanie Watwood from the Navy is -- That's her project, and she is going to analyze it for us, and so it will be in the next report, which will be out next year and not the June report.

DR. LANEY: I know that the ECU Blackbird wave glider has the acoustic receivers on it, and I presume that yours probably does.

DR. BUCATARI: We do have receivers on it, yes.

DR. LANEY: So, once again, it reminds me of the conversation that we were having with Steve Poland at dinner last night, where Steve was talking about some of the work he did when he was an undergrad at NC State, sitting in a closet somewhere looking at video footage of nesting Swainson's warblers to try and document behavioral aspects and predation incidence, and this is the same kind of thing. When you have these just tons and tons of acoustic data, somebody has to go through it all, and there's always the issue of, okay, you've got these tremendous time periods of data, and you can't possibly pay to get it all analyzed, and so how do you analyze it? You have to sub-sample, I guess, and that's another whole topic in and of itself.

DR. BUCATARI: There is software to do it now, and so hopefully it makes it a little bit easier.

DR. LANEY: That's true. The computer capabilities, I know that helps a lot with the acoustic stuff especially, because you don't have to actually sit there and physically look at it.

MR. BUSCH: I was just going to say that, obviously, the Navy is more interested in how acoustics affect marine mammals, the sonar, and we're spending a lot of money on that, but we are spending a lot of money on trying to look at passive acoustics and seeing if we can work out density

estimations for marine mammals, and so, if we can figure it out for marine mammals, there's a possibility of maybe turning that into other species that have cues or some type of acoustic signal, and we're also working on deep learning, machine learning, techniques and getting better and better at listening to all of this data and trying to pull out the different species and the different cues, and so both the Office of Naval Research and the Navy's Living Marine Resources are funding it, and we partner with BOEM under some of the different government programs too as well, to fund stuff like that.

DR. BUCATARI: I should point out that the majority of this work I know I mentioned was done by the Navy, but Stephanie Watwood and Joe Iafrate up in Rhode Island, and they've done a great amount of work, along with Eric Grier at NASA.

MS. DEATON: Thank you very much. That was a good discussion, and you can see there's a lot of interest, and there's lots going on in multiple areas. I think, right now, we're going to take a break and turn in your menus, your lunch menus, with everything circled, and make sure your name is on it. If you need to check out, this is a good time, and then we'll be back in ten minutes. All right.

(Whereupon, a recess was taken.)

MS. DEATON: I just want to mention that Paul sent an email to everybody with the website for the Georgia coastal hazard information, and so thank you. Take a look at that, and I have received the recommendation language, and I'll send that out, and we can talk about that after lunch, too. Now we're going to have Debra speak to us about SECOORA activities, and Debra has presented to our advisory panel before, and I will let her take it away.

MS. HERNANDEZ: Thanks, Anne, and thanks to Roger and the rest of you for inviting me to come back. I'm Debra Hernandez, and I'm the Executive Director for SECOORA. We're the Southeast Coastal Ocean Observing Regional Association, and I think most of you I have seen or met before, and so I'm not going to do a whole lot of background on SECOORA. The slides that were part of your background material go into more detail on the program.

We are a federally-managed program, and we're one of eleven regional associations that partner with NOAA and the U.S. Integrated Ocean Observing System Program Office, and I am not Jennifer Dorton, but Jennifer is the lead for our Regional Coastal Ocean Observing Strategic Operational Plan, and that's primarily what I am going to talk to you about today.

Just really quickly, in terms of background, the SECOORA region includes all of Florida and then North Carolina, South Carolina, and Georgia. These are some of the highlights of what we do. Most of our funding goes to operate different observing technologies. Those pie-shaped things are the footprints for HF radar, which capture ocean currents, and the dots are either coastal stations or buoys, and then we also support a glider observatory.

The items you see in red, last year we saw a significant increase in funding that has allowed us to increase the number of observations, and, also, we were successful on a competitive modeling proposal, and so we'll be doing some work in North Carolina, in Pamlico Sound, as well as the St. Johns River in Florida, in partnership with Ruoying He with North Carolina State University, but our primary mission is observing, and I'm going to pass around -- I don't know if I have enough

of everything for everybody, but the paper is just an excerpt from our observing plan, and then the booklet is our most recent annual report.

Really quickly, we have had a couple of opportunities, in terms of -- We're looking to re-compete our data management provider. Axiom Data Science is our current provider, but, in preparation for our next five-year proposal, we do a re-compete and make sure we've got the best people working on our data management for us, because that's a huge part of what we do, and we also offer some student opportunities, and one is currently open. If you know a student in the ocean sciences, I encourage you to ask them to apply. It's in honor of one of our colleagues that we lost a few years back.

Then our annual meeting is in Wilmington, North Carolina this year, and so hopefully, for some of you who might be close, we would love to have you, and the registration is on our website, and we will be focusing on getting some more input on the plan that I'm going to talk about, and so we would love to have you join us there.

Then I wanted to highlight a webinar that we're going to be hosting next week, and Steve Pfaff and Reid Hawkins with the Weather Service Office right there in Wilmington will be doing that webinar and talking about what happened with Hurricane Florence from their perspective, and we'll also be going into coastal hazards and climate issues at our annual meeting, and that's our primary focus, and we should have some great speakers there to address that.

Our plan is a five-year plan, and its primary objective is to outline our priorities for achieving our mission, which is around observing and understanding the coastal ocean. There are three sections. There is sort of an overview and then a focus area section and then RCOOS, which stands for Regional Coastal Ocean Observing System, Technologies talks about the how and do we use gliders, buoys, et cetera, to achieve the observations and the understanding of our focus areas, and what we need this plan to do is guide where we make future investments in research and technology.

The audience is -- It's for the staff and our board of directors, to establish priorities, and it's also one of the requirements from the IOOS Program Office, which is our federal partner, and SECOORA, like the rest of the regional associations, are certified, and, as part of that certification, you have to meet a number of governance requirements, and having this plan as part of that, and there are also a number of data management requirements that we meet that make sure our data management meets all the federal standards.

The other audiences are our members, and the South Atlantic Fishery Management Council is one of our members, and Roger is on my board, and Marcel Reichert, who some of you probably know, is also on my board, and then the additional audience is stakeholders, and, if you don't think of yourself as a SECOORA member, because you're engaged with the management council, you are an important stakeholder, because it's your needs for data and information that drive where we make investments.

We have three focus areas in our plan, and the first is ecosystems, and I'm going to talk almost exclusively about the fisheries part today, but I wanted to make you aware that ocean sound is located in our Public Health Section, and water quality and all of those are in this first ecosystems focus area, and we also do some work around coastal and ocean acidification. The second focus

area is marine operations, and then the third is coastal hazards and climate variability. As you can imagine, there is lots of ways to lump and bend these topics, and so there's a good bit of overlap between the focus areas, but this is the way they are currently organized in our plan.

For each of those three focus areas, we've got six sections. We talk about the challenges, and we talk about priority areas to do work, and we try to, at a very high level, talk about what other people are doing, and we don't have a huge amount of funding, and we don't want to duplicate what either the management council or other federal agencies, et cetera, are doing, and we do talk about the core variables that need to be measured, or monitored, to inform the management challenges.

We give a brief description of where we're currently spending money, and then this last section is the most important, and we want to figure out where the opportunities are to leverage and maximize the funds that we have to help address what the challenges are, and so what I handed out to you all is the ecosystems section of the report, and I need to stress that this is a draft. We have had some subject matter experts, like Roger, do an initial review, and we'll be spending time this summer trying to get more input, and I should have said at the beginning that we're also trying to keep this short, so that people will read it, and so those are sort of some of the guiding principles for how we developed this.

The other section of the report, the RCOOS components, goes into, again, how we do things, and so it's observing, modeling, data management, and then developing specific products for specific user groups and doing some outreach and education as well.

This is what we need from you and what I would like to maybe have a little time discussing today, is sort of do we have the right stuff here, and are there any major gaps, either in documenting what is already going on or what science related to observing and modeling -- Have we captured what sort of the key things are that should be addressed? The timeframe for this is -- It will be 2021 to 2026 is when we'll be implementing. We want the plan done this year, and we'll be writing our proposal for our five-year cooperative agreement early next year, and we would begin implementing in 2021. Then we have a pretty good list. It's going to be really important to identify what the top priorities are and how can we best use our limited resources to address you all's needs and concerns to collaborate with the council on what those highest priority needs are.

As a reminder, what we currently do, in terms of our investments, the first bullet is around collecting data and information, and it's primarily the physical variables, and we also support the FACT Network, which is an animal telemetry network in our region, and it was nice to hear Jennifer talk about the work at Cape Canaveral, and that group there is an active member of FACT, and we support data management for the folks that are doing tagging, and we're also receiving funding directly from the federal animal telemetry -- I don't know if they're an advisory group, but BOEM is a member, NASA is a member, and the Navy also, and then NOAA, and they are funding activities around the country, and we got a little bit of funding this year to pass through to the Georgia DNR to maintain the receiver array there, and we also got funding to support the woman who is the coordinator for the FACT Network and works with all these researchers to get their data into a centralized system, so people can access it, and then we also received some funding to assess nationally where work is going on in the animal telemetry realm, to feed up into this national portal, so you can go in and look at a map and figure out where people have receivers and are doing work.

We are also developing a pilot data visualization tool, and so people are collecting a lot of data, and what are we doing with it, and so Axiom Data Science is working with the folks at Georgia DNR, particularly on the tripletail detections, and trying to visualize the physical and oceanographic data with the tagging data, and, if we do a good job with that, the hope is that all that data from all these other researchers can then be viewed on the SECOORA portal with this new tool, coupled with the environmental data, and so hopefully it will lead to some greater understanding of utilization and what oceanographic features are driving how the fish are using the habitat.

Then North Carolina State University, Ruoying He in particular, is continuing to work on modeling and coupling the physical and ecological aspects of the coastal ocean and producing nowcasts and forecasts, and that data is also available on our portal, and so that's what we're doing right now. In terms of what we want to do next, our priority geographic areas have been identified as the managed areas that the South Atlantic Fishery Management Council, the Gulf of Mexico Fishery Management Council for the West Florida Shelf, because that's also in the SECOORA region, and the National Marine Sanctuaries, and so we can't do everything everywhere, and so those are our highest priority areas.

We also added artificial reefs, and I know you all consider those managed areas, and so, if we're missing something, in terms of priority geographic areas, we need to hear that from you all, and so these, again, in this early draft, after development by SECOORA staff and some of our members, and review by subject matter experts, these are what we think are the next things to spend some money on, and I don't know if it's best to open things up for questions now. That's my last slide, but this is where we are.

We really do listen and want to hear from you directly about what the highest priorities are, and, if we've got something wrong, please tell us. If there's something we're missing, please tell us, and I will stop there and take questions, or, Anne, just open it up for some discussion, and that would be great.

MS. DEATON: Thank you very much, Debra. I will open it for discussion.

DR. LANEY: Debra, could you flip back to the priority geographic area slide?

MS. DEATON: That is pretty broad.

MS. HERNANDEZ: We might have to narrow it a little bit more, because that is most of -- That is a lot of area. Within those, are there some that are higher priorities than others?

DR. LANEY: Well, you heard our previous discussion about sand shoals and cape shoals, and I think that would certainly be one area of interest.

MS. HERNANDEZ: Are those included in -- They are part of your habitat areas of particular concern?

MR. PUGLIESE: Yes, and I think that's where -- We're not coming in totally uninformed, because some of these are highlighted in what we've identified as essential habitat, or habitat areas of particular concern, or managed areas, and so some of those have been focus areas to align

collection of information and refinement of linking the oceanographic with these different areas, and so I think it does have a cross-section, but this is an opportunity to refine how some of those recommendations, I guess in terms of what is produced, that last one, the slide before with the different types of connections and products, and I think that's what we're trying to refine, is how do we look at, within these different management jurisdictions, some of the different components that are going to be really important to refine and connect the oceanographic information with the species and habitat information that will advance management.

The long answer to a short question is a number of those are definitely included in here, and we can clarify that as this develops and moves forward, I think, and some of them are already, with the characterization that we looked at earlier on in those areas, I think some already have some links, and, some other areas, I think we are just beginning to kind of flesh out what that really means.

MS. HERNANDEZ: I would just also throw out -- I mean, we know that BOEM is doing a huge amount of work at Cape Canaveral right now, and understanding where they might go next or what's going to happen there when this study is done, and I think, thinking in terms of time for that five-year period, where this plan will be implemented is important as well.

DR. LANEY: I would love to hear more about the work that you're doing with Georgia on the tripletail and linking their movements to physical characteristics. I know some work that hopefully you guys are aware of is that Matt Breece and collaborators at the University of Delaware did some very interesting modeling work using acoustic telemetry data for Atlantic sturgeon to develop predictive capabilities for their distribution, and they got some very good correlations, and they put a paper out on that, Debra, and I can send it to you if you haven't seen that work, but I don't know how that might relate to the work that you guys are doing with tripletail, and, Paul, how many tripletail have you all put acoustic transmitters in? What is your dataset size so far?

MR. MEDDERS: Actually, off the top of my head, I don't know the number. It's been multiple fish, and we have been actively tagging fish with external tags, two dart tags in particular, and seeing those being returned from that Fort Pierce area, and then we're getting the acoustic tag hits in those areas too, and it something that I am -- It started out as that it was some of the sturgeon money. It was the Section 7 money, and some of that -- That, to me, has been some of the most exciting work that we've done recently, is to learn that sturgeon use Gray's Reef.

If you would have told me that ten years ago, I would have said, why does the sturgeon go to Gray's Reef, and that doesn't make any sense, and to learn that was really exciting, and we're working on some red drum work, and I keep telling our people that, having started my career studying red drum, that these acoustic receivers are going to fundamentally change our understanding in Georgia of red drum biology, and I'm convinced. I haven't seen it yet, but I'm just convinced that, the things that we've said for a long time, we're going to find that we were maybe close, but not exactly right.

I also wanted to mention too that I was in a meeting two weeks ago with Gray's Reef, and you're maybe aware that Gray's Reef is doing a use study about human use, and they are working with Cumberland Island National Seashore to learn the use there too, and it's a group out of West Virginia, and so this is something they've got going on that they are getting at the human use aspect, but then some of their staff is also -- There is the receivers on Gray's Reef, and they are

real interested in the movement of fish between the reef, and they were using some words that kind of rubbed us the wrong way, with the idea of a source and sink, as if our artificial reefs were pulling their fish off of Gray's Reef, and we're not real sure that that's exactly what's going on, but we're excited about putting some receivers on some of our artificial reefs near Gray's Reef.

We're also going to tag some red drum, and we've tagged some red drum, and I started my career tagging red drum, and we were listening with just a single hydrophone and trying to find them, which never worked, and so this is really exciting to try to answer some of this, and so the red drum work that's going on, and there is some work that's going to go on in Wassaw Sound that is specifically going to try to get at escapement of those fish, which is really exciting, and that's going to be more of a localized set of receivers.

Then Chris Kalinowski, the biologist that's working primarily on that project, he and I have had several conversations. If you all are aware of the Navy towers, the towers that are going to become -- They're already permitted as artificial reefs for us, but the Navy hasn't given them to us yet, and they're like little mini oil rigs, if you all don't know what they look like, but Chris and I have had conversations about whether or not those structures are really important to cobia, and we feel like we have an opportunity, and we just don't know how to do it, to put receivers on there now to learn something about how cobia and red snapper use those Navy towers, and then, obviously, the idea is that the Navy is going to drop them to the seafloor to be used as an artificial reef structure and how that changes in the future.

I don't know what that will really, from a management perspective, other than maybe just to know, but, if cobia don't use those structures in the future, because they're on the ocean floor, that would be extremely interesting. Cobia is, obviously, really important for us on the fisheries side of things right now, and so I'm throwing that out there, as the idea of the Navy towers, and it's something that we would like to do. It's a very confined area, and it's a lot easier to put receivers on the towers right now, while they're up, we think, because we would literally just zip-tie them to the leg of the tower, and then they're easy to service. Now, once they're on the bottom of the ocean, it's going to be a different ballgame, but that's something we're really interested in, and I don't know if that helps.

MS. HERNANDEZ: That's great to know. We actually do have some funding this year that we're going to invest in acoustic work, because that was in the five-year proposal that we're working on now, and so I may follow-up with you about -- We are pulling together a team right now to figure out the best thing to do.

MR. MEDDERS: I think we have the vessel and the time, and all of that is something we could work in, and I think that no one has budgeted for the receivers and doing all that, and that's where our problem is, because, as we're servicing those other receivers that are out there, I think it will add additional days to our cruise, but I still think it's something that we can do that wouldn't be overburdensome. I know, as we get more and more receivers, it's going to take more time, but I think we've got a technique in helping with South Carolina and what we've learned from them, and I think we feel pretty comfortable about the method in which we're doing it.

AP MEMBER: Debra, the council and the Mid-Atlantic Council and the New England Council are now struggling with habitat expansion for coastal-managed species and whether these species are shifting or just expanding, but it seems to me, and people who know more about this can

probably do much better at explaining it than I can, but my thought is that, if these species are expanding northward, it's a function of water temperature, and is it the milder winters or the higher low temperatures, if that makes sense, that you might experience going on up the coast, and is that the critical factor, because, if a species can't withstand below twelve degrees, for instance, and it normally gets below ten, then they're not going to move, but, if you find out that they're at twelve or fourteen, and then those temperatures are increasing on up off of Virginia and Maryland, then that might supply some data that those fish in fact are moving, and we can monitor temperature to sort of understand what is causing that movement, and I know some of those gliders are running all the way up and down the coast, but I was wondering if -- It might be summer temperatures too.

MS. HERNANDEZ: Okay. Not just winter.

AP MEMBER: People that know more about the life history of these species could address that, but it just occurs to me that the Mid-Atlantic may have some interest in some of our species that are moving on up into that area. Like sea surface temperatures, but that's not where the fish are, and so I'm thinking to go down and look at those lower temperatures and maybe other physical factors, too.

MS. HERNANDEZ: Thanks. That's really helpful. We actually did get a tiny little foundation grant, \$15,000 from the Munson Foundation, which is primarily focused in south Florida, and, actually, it's a challenge grant, and so I've still got to find another \$15,000 to match it, but what we're doing is adding temperature and salinity probes to some of the receivers, so we get that temperature data down where the receivers are, to look at some of those questions, but doing it in a broader area would make sense.

DR. LANEY: Paul mentioned Gray's Reef and Atlantic sturgeon, and Kent Smith-Paul has a theory that the reason that they were at Gray's Reef, and I talked to George Sedberry about this a number of years ago, is that they like to eat brachiopods, and so I asked George, and I said, are there brachiopods at Gray's Reef, and he said, yes, there are, and, also, just for everybody's information, there are some historic Atlantic sturgeon records from Bermuda, which is 600 miles off Cape Hatteras out there, and it's interesting to know that there were some there, and I would be wonderful -- I'm not sure if anybody has any acoustic receivers out presently in Bermuda, but I think they have done some work on their reefs over there, but I would be really interested to know if they have picked up any of those Atlantic sturgeon, but that would be tremendous to try and focus on answering David's question about is it true species population expansion or is it just distribution shifts.

We have been dealing with distribution shifts for migratory striped bass since that cooperative winter tagging cruise started in 1988. The distribution has clearly shifted north and offshore, whereas we used to historically be able to catch a lot of them inside of three miles off the outer banks during the wintertime, now we're at twenty-five to thirty miles offshore, off the mouth of the Chesapeake Bay, and the fish have not come into North Carolina waters. I think nobody has landed a striped bass commercially since 2011, and so, as David points out, the councils have to deal with allocation and ACLs and how you distribute that equitably among the different sectors and all that kind of stuff, and so North Carolina has this big striped bass -- Well, not big, not particularly big, but they have a striped bass allocation for the haul seine gillnet and trawl sectors, and none of which has been landed for eight years now, and so, as he said, it's a struggle for all the councils to have to deal with that.



MR. WEBB: Thank you for the presentation. You had mentioned that there's some plans in the future for St. Johns River and Pamlico Sound, and what exactly -- How does that play into the overall objective, because I'm wondering, if there is need in those areas, would you be looking at Tampa Bay and Florida Bay, specifically, as well?

MS. HERNANDEZ: That particular modeling work is looking at the problem of getting total water levels right in the estuary and up in the estuarine system and the mouths of the rivers. You have ocean modelers who model the ocean, and then you have folks who model the water coming down the rivers, and coupling those two to get total water elevations correct, particularly during storm events, and so this funding is focused on that work, trying to couple the ocean and the river models to get total water elevation correct.

We are already supporting some modeling work in Tampa Bay. At the University of Florida, Bob Weisberg has a well-regarded model, and he does nowcasts and forecasts already, and they're actually used by Fish and Wildlife, with their HAB forecasts, and so that work is already ongoing.

MR. WEBB: I may have this wrong, but I think, in a previous presentation, did you mention that some of the observations that you're making also include the salinity and dissolved oxygen and temperatures and things like that?

MS. HERNANDEZ: The physical variables, yes. Just about every site we support, even the gliders are getting temperature and salinity. Dissolved oxygen, we're only supporting at I think two or three coastal stations. There is one in the Tampa Bay area, at Big Carlos Pass, and I don't know if you're familiar with that, and then we had one in Charleston Harbor, and it got knocked over by a dredge scow, and we're working to get it put back out there, and so we just have a few where we're getting dissolved oxygen.

MR. WEBB: As you're looking at these and getting the water levels right, that's dependent on natural and manmade events, and is that -- I mean, discharges into the rivers affect the levels. What I am driving to is the quality of that water as well, and so, as you know, in Florida Bay, it's a gigantic issue that apparently the governor is talking about trying to significantly address, and I didn't know if you guys would be able to add any voice to that at all.

MS. HERNANDEZ: SECOORA partners right now with FWC and the University of South Florida and Mote Marine Lab, and all of those three folks, it's my understanding, are getting significant funding this year. It's on the order of \$5 to \$6 million that's being invested to get at the HAB problem. We have a little bit of money that we're contributing to that work, because it is such a huge issue right now.

MS. DEATON: Any other questions or comments?

MR. PUGLIESE: I think one of the big aspects of the whole process was, one, that the material that's being collected, through whatever different platforms, those major components is going to be able to be used to address either information we need to understand species use of different areas relative to the fisheries side, and I think that's going to be important, and I think we captured some in the initial iterations of this.

The other aspect is then how some of those different platforms can be used for different types of capabilities, and I think we definitely acknowledged the fact that, in the discussions we're having with the partners to the north on the movements of the species, whether it be expansion or change over time and how some of those that -- The work that SECOORA is doing, in terms of characterizing the oceanographic functions, whether it be salinity or current changes or whatever, are going to be critical to really connect it into here, and so I think those kind of things really are going to help drive what types of different needs we can see and expand in the efforts, beyond just the baseline collections of the information.

The interesting thing, to me, is there is so many connections already with our partners with the Navy and with BOEM and with the states, and I think we really have the opportunity to refine how this plan moves forward into the future, and I'm really encouraged that we're even looking at the connections on expansion of our fishery-independent surveys and collaborations, so that that can be another aspect that we can more rapidly connect the oceanographic information into the characterization of species use and information needs for supporting everything from assessments to some of the modeling work.

I think some of the investments that are being made already with Ruoying's group are going to be critical for understanding those parameters as they get brought into the developing Ecopath and Ecosim models and also being able to not only into the bigger-picture models, but also influence or inform single-species assessments as they are being developed, and so there's a lot of other aspects, I think, that are going to be refined as we continue down the process to define these different connections and meeting significant management needs, and so we do appreciate all the continued, ongoing coordination here.

MS. HERNANDEZ: Same here.

MR. PUGLIESE: I think we're just going to get even further down and kind of really pin these down, and it's going to be very clear that it's supporting very significant management of all these species, habitats, et cetera, in combination.

MS. HERNANDEZ: If I could, just one more thing, and thanks, Roger. Emerging technologies is in a different section of our report, but we are trying to capture the potential use of eDNA and various omic, genomic, methods as a way to maybe do things more cheaply in the future, and so I just wanted to mention that, and then my email is [debra@secoora.org](mailto:debra@secoora.org). If you have any thoughts, if you've written anything down that you want to give to me before I leave, I would be happy to take it, and thanks again for inviting me.

MR. PUGLIESE: Thank you for bringing up that, because we actually an extensive discussion, the ED and I, about opportunities and how that's being viewed at some of our other partners in the region, because there is opportunities to figure out how that actually can be brought in there. I know, from the national level, and you know, they're looking at it, and so the opportunities to kind of link all of these different things to look at that.

One of the other things that I meant to mention was the opportunity to look at adding in new technologies into existing platforms. I know, with our ongoing SEAMAP and MARMAP systems, we have vessels on the water for -- I think, this year, it's 109 days, with the only environmental component being CTDs being carried, and the opportunities to add in AUVs and ROVs and

mapping capabilities, and the partnership with SECOORA and other individuals to make that happen, I think, is critical. We're talking about low-hanging fruit and the opportunities, and I've raised this at the national level, with the Senior Scientist, but I think I'm going to continue to, and I have raised this before with discussing it.

As we go into the five-year planning with SECOORA, I think those are some really critical opportunities to advance the collection of information that would both inform model components that are being developed through SECOORA or capabilities, but also inform and refine the fisheries information needs, characterizing species distribution and characterizing linkages to the environmental parameters, and this big picture one of about species moving north I think is going to be a really critical one to advance that, and it also provides a nice bridge between our survey systems in the Southeast with the survey systems to the north, which are going to have to be critical. That's another directive that is happening from the national level, also.

MS. DEATON: All right. Next, we're going to have one of AP members talk to us. Laurent, do you want to come over here? He's going to speak about applying innovative technologies to characterize fish habitat and spawning events.

DR. CHERUBIN: Thank you for the opportunity today. Just quickly, based on what I have heard this morning, I just want to show you our latest field survey with the wave glider, where we basically -- So we got funded to do some wave research, just a seed project to see if we can use the wave glider and detect the wave presence using sound, and the idea behind this project is to build a machine that will identify species as we go, and so, since that was -- Also, the idea, because that was done at the end of winter, or the beginning of spring, we were looking also for spawning aggregations, and so basically learn about the dynamics of the shelf between Georgia and southeast Florida, and so all the way south of Fort Pierce all the way to the Georgia line, state line.

This is the survey that took about two months, and, also, it's demonstration of basically, for SECOORA, of what we can do with the glider, in terms of filling up that gap that you guys have identified. Along the way, and I'm going to come back to that in the talk, but we collected, of course, fish sound and ocean sound, basically, I have to say, sea surface temperature, but also at depth temperature, currents, current profiles from the surface all the way to the bottom, chlorophyll, backscatter, temperature, salinity, and, in addition, the glider has its own weather station, and so we collect wind speed, wind gusts, wind direction, air temperature, atmospheric pressure, and surface currents as well, and so it's basically a complete set of environmental data along with let's say biological indicators, such as sound.

I'm going to leave it there, but just so you know that it's something that we're going to start analyzing soon. There is millions of files just for the acoustics, but we have come up with tools to analyze those files in a pretty efficient way, and I'm going to talk about those tools in the talk right now, and so that was a great introduction to follow-up on what has been said, and now let's go through the presentation.

Understanding the soundscape, we talked about sound earlier, and then I just want to emphasize that sound plays a significant role in the life history of marine organisms, whether you talk about marine mammals that use them to -- They use sound to communicate, but also to fish, to feed, and so they use sound as if they were echosounders, but sound plays also an important role, and we've been seeing more and more studies about the effect of sound on habitat quality. When you think

about they have shown that reef fish larvae use sound to basically -- As a cue to find a good habitat where they can settle, and so it has an important role in recruitment processes and population dynamics.

Sound in general is also used a cue to estimate biodiversity and also habitat quality, and, also, sound is also an indicator of different type of habitats, and so, if you go to -- There have been a lot of studies in the Pacific Islands where they showed that different region of the reef, the full reef, the reef, the back reef, et cetera, have different sound acoustic signatures and that fish larvae and other organisms use those particular sound signatures, soundscape, to basically cue where they were going to go settle, and the other aspect of sound -- As you see, there is a diversity of aspects, and the other one, the one I've been working on, is fish -- We have realized that there is about a thousand species of fish that produce sound, but we don't know anything about those sounds and how they use those sounds, but, for some of them, like groupers, we have learned, through identifying their sound, and so now we are able to basically scour the shelf in our regions in the south and listen for a particular fish sound, a particular grouper sound, that can tell us a lot about fish spawning aggregations and grouper spawning aggregations.

Based on the understanding of soundscape and the particularities and the importance of sound in the life history of a lot of marine organisms, basically, we, with the focus on understanding spawning aggregations, because this is basically what sustains a lot of fish population in our oceans and our resources and our fisheries, the idea was for us to build a system that would be autonomous and capable of detecting and basically doing real-time processing and analysis of ocean sound to detect the presence of fish, and so that system is based on the wave glider, which I have just shown you here, that we have taken around in the Caribbean and in Florida, and I just want to give you an overview of what the system looks like.

It's an autonomous vehicle, which is built by a company called Liquid Robotics, which is now part of the Boeing Company. It's the third version of the SV3 wave glider, and it's about a \$400,000 piece of equipment. It is a very interesting platform, because it's self-powered, and so it has infinite power, and it's powered by the sun. It's very efficient, and, basically, that power powers all the electronic systems and all the payloads that you have on the system, and so you can see you have two parts to it.

There is the float, which is at the surface, and, below, about four meters below, is what we call the sub-subsection that has the wing, and the other thing interesting about that system is it is mechanically self-powered using the wave action, and so the way it works is when the -- Let's say the glider is risen by the wave, and the wings will orient so that the sub glides forward, and so the sub glides, and the float follows, and the sub glides and the float follows, and that's how it goes, as it moves up and down with the waves.

In addition to that, and that's why we have in our system that you can tow a payload, which is what we call the towfish, and it basically lays about eight or ten meters below, about thirty feet, and so ten meters behind the glider, and to which you can add a lot of payload, and, for ours, I am going to show you that it has a lot of instruments on it, and you can also add payload on the float, and you see here that it has an RDI ADCP, which measures current profile as you go along, and so you get basically a sort of collection of -- You can collect acoustic data, and you can collect environmental data at the same time.

How do you drive that system around? Well, you have these piloting windows that basically can set up your waypoints, and you can set up different ways to navigate through your waypoints, and you can set to hold a station at a waypoint, and you can go sequentially one from one waypoint to another, or you can define your own course, and you can also turn on and off all your payloads, and you can read the data, and that costs money, a lot of money, actually, because --

For instance, we did that with the ADCP during the last mission, and every sample of data is basically sent through satellite, and then you know how much it costs, and it's about eighty-cents and a minute, and it will upload a byte, and so, when you have megabytes that you send out, it becomes very expensive, and so you need to plan for that, but, anyways, it's a very interesting tool, and every action that you want to do has to be acknowledged by the glider. If you look at the little lines below that, you can read -- That is all the information that you need, where it's heading, what is the desired heading, what is the actual heading, and the latitude and longitude, the time, et cetera, and so that's the data that you can set how often you want to get it, et cetera, and so it's a very convenient tool to work with.

It moves slowly, about half a knot, and one of the drawbacks is that it doesn't handle well strong currents, and so, in order to be able to help you with that, if you look at the sub, in the back, you see a fin, and, behind that, there's a little prop, and that's the thruster that basically you can use to fight current, and you can go up to one-and-a-half knots, or sometimes two knots, but, as you may imagine, it uses a lot of power, and so you can only use -- You don't want to abuse it.

Anyway, we have been able to move around even in places where we have currents, but, if you go into the Gulf Stream, you can't really fight the current. You have to go and use the current to get out of it and come around, and so you need to -- It's like sailing. You need to understand the forces that apply to your system to be able to find the right heading to go wherever you need to go.

This is a little video to show you the current in the Virgin Islands, and this is what it looks like at the surface, and then you go under, and that's what the whole package looks like, and so I will just do a little pause here, if I can. You can see the towfish is behind, and you don't see it very well, but that's what it looks like underwater. This is the payload that we have on ours, and so what I will show you here on the top is the towfish, and so we have Tuner C3 fluorometer, and it measures backscatter and sidescatter, and you have the PAM system, with the hydrophone housing, and this is something that we build in-house, at Harbor Branch, and we have an engineering department, ocean engineering research group, that builds these kind of -- It's basically any sensor you want to build.

That has the hydrophone, and, inside, between the hydrophone and the fluorometer, you have a little box, and that's the processing box that has basically the detection algorithm that we do the real-time analysis of the sound and detection, and that is basically sent to the surface float, and you can access the result of that process, and so there's basically an alarm system that will send a snippet of the data with a little detection file that tells you what has been heard.

In addition to that, we have a sensor that measures DO, pH, and other parameters, and so salinity and temperature and depth, and something that I am going to talk about is one of the first applications of a wave glider was to do fisheries work using echosounders to basically quantify biomass in the water column, and so I added here an example of the system that has been developed for this platform, and that is the equivalent of the EK80 echosounder that you find on fisheries

vessels, and that's the small version that you can basically mount on the gliders, and so we mount the version of that on our glider, on the float, and it works very well, and so, for the future, we want to basically have a full suite of echosounders, transducers, on the wave glider to be able to do fisheries work and look at what is in the water column.

As you may know, this is a science that is really booming right now, and I am showing you here some results from the first use of the glider for that type of application from work that was done on the west coast of the U.S., in California, back in 2013, and so, on the picture, the diagram that you see here, you have basically the backscatter intensity for two transducers, and one is 120 kilohertz and the other one is thirty-eight kilohertz, and so what this is telling you is that, the higher the frequency, the smaller the size of the organisms that you can capture, and so, vice versa, for the low frequency.

What you can see is that you get two different images of what is the water column based on the frequency that you're using, and so, in the fisheries world, the applications for the group in California is that they rigged their towfish with a series of echosounders with different frequencies to be able to do this fisheries work, and so how does that work?

It's basically marine organisms that we're looking at, and they have either an air bladder for the fish, or, for the shrimp and other organisms, they have air bubbles in their body, and so, for each, you can calibrate your echosounders so that you can associate target strength and the frequency response to each of the organisms that you observed in the water column, and so you need basically to take them to the lab and run some experiments and calibrate your echosounder, and so, when you code the program that underlies the acoustic data, you can basically automatically identify the species that you're looking at.

That's how this works, and then, from that, you can quantify your biomass, and so that was the idea behind this type of system that has shown to be very much efficient, and so that's what it looks like in the water on this little video. This is available, actually, on the website where that paper was published.

They did a sort of estimate of the efficiency of using such systems in the water, and so, if you take a fisheries vessel, basically one mission on a fisheries vessel is the cost of one glider, and then you can save that money and buy a glider and buy basically a fleet of gliders, and, if you have a chance to read the text below, they demonstrate that five gliders, each running a survey line, can complete five lines in the same amount of time that the single fisheries vessel can complete the same five lines, and so, basically, you save five-times the amount of money and time to do the same amount of time if you have a fleet of gliders that is big enough, and so it's a very efficient system to conduct monitoring of basically fisheries biomass along your coast on a regular basis, and you can program the mission, and the glider will run these transects at regular times, and all you have to invest is basically one time for the cost of one fisheries survey for each glider, and so it's not only cheaper, but it's also more efficient.

Then, once you build the tools that allows you to analyze the data, then it's a win-win, because, as soon as you get the data, you can basically know what was in the water and get a quantified biomass, and you can build your stock assessments on that, and there are a lot of implications that would be useful for fisheries management.

The other aspect of this type of approach of fisheries is the ecosystem-based survey, where -- Normally, we're looking at what is the marine organisms, or let's say the fish and the prey distribution in the water column, but we're also, by listening to sound, relating the presence of predators, such as whales, and so I'll show you here basically a whale sound and the presence of whales, and you can listen for the presence of whales in the environment and understand the behavior and the foraging behavior of these organisms based on the distribution of prey that you are hearing through the echosounders, and so, if you blend both acoustic and passive acoustic, then you get a more ecosystem view of what is happening in the water and how those scattering layers are used as a feeding zone and feeding habitat, so you can get a better understanding of how those feeding zones are used also as feeding habitat by the apex predators.

I am going to leave it there, but that's just to give you an idea or an overview of how far you can take this technology, basically, and I'm going to talk to you about fish spawning aggregations. I really like that video, and it's a video that I took with an ROV back in 2011 in the Virgin Islands, at a site called the Grammanik Bank, where yellowfin grouper aggregate to spawn, and so the first impression, when you look at this video, is like there is fish everywhere and as far as you can look, and it's unbelievable. It's about 10,000 or 11,000 fish in the water, and all spawning adults, and so the fish in black are the males, and sometimes you see a white fish coming around, and that's the female, and the aggregations -- A spawning event is usually a rush up in the water column, with one female surrounded by ten males.

The other thing that you can also notice here is a few Nassau grouper, and so the Nassau grouper were almost entirely decimated in the Virgin Islands, and I think they were down to ten fish, and so they have no aggregations that could join to spawn, and so what these are doing is joining the yellowfin grouper at their aggregation site, and, over the years, as the number of Nassau grouper increased, they started moving away from the yellowfin aggregation to go back to their historical spawning aggregation site, and so that's very interesting how they sort of took coverage under the yellowfin groupers.

Anyway, what people have been realizing, in studying those aggregations, is that those fish become very vocal, and I should not say vocal, and they don't have vocal chords, but they get very loud, and they produce a lot of sound, and the sound that they produce is very characteristic of the one species, and so I'm just outlining here how the sound is used, and so many fish produce calls during spawning, but we don't know what those calls mean, and they produce calls before spawning, during spawning, after spawning, and sometimes months before, on their way to spawning. The sound is species-specific, and they may be used by different taxa for individual mate recognition, and they may be agonistic behaviors as well.

Groupers are a sound-producing species that form large spawning aggregations, and those particular sounds have a name, and they are called courtship-associated sounds, and they provide an opportunity to assess the presence of groupers, and, hence, their status of the aggregation by monitoring their sound, and you can make a relationship between fish abundance and sound production, which is not straightforward, but what I want to show you here is how can we do that, and I will show you here what we call a spectrogram, and so, basically, it's the change in frequency over time, and so it's the frequency time images of sound.

What you can see for each of the fish on here is it's very different, and so we have red hind, Nassau, black grouper, and then way to the right, which is not as defined as the others, but that's why I put

it here, to show you that some species may be more difficult to automatically identify than others. What you have seen on the first three that I just talked about, what we see here is what we call a tonal call, and so there is a change in the tone of the sound produced with time, and then the yellowfin -- I showed both the pulses and the tonal, and you can see the pulse is basically a drum beat, but what we have realized is, if you look at the recent literature, this is what you're going to find as an example of spectrograms, but, as we started digging into it, we realized there is a variety of sounds, and there is a variety of sounds that are not produced all together at the same location at the same time.

Basically, they are associated with a particular behavior of the fish that we have yet to understand, but what we have realized is that there is a structure in the way those sounds are produced through the history of the spawning aggregation, from the time that they move to the aggregation and the time the males call the females and to the time they spawn and to the time that they leave. What has been assumed for many years also is that only males call, and then, recently, in recent captive experiments, they realized that females also call, and so now how do you distinguish between male and female, and what is the meaning of those calls?

In order to be able to make sense of all of that, I guess it would take years and years of research, or imagine every one of us being in the room with one computer and looking at each of those spectrograms and listening to every file that the fish that we are seeing is actually a red hind or a Nassau or any other species, and we can't really do that, and so the idea we came up with, probably five years ago, was to build an algorithm, and so a method based on machine learning to detect and classify those calls.

Very simply, you may remember your processing classes, and that's the basics of signal processing, and so that we do here is we take the sound, and just to give you how things work and the idea of the basic architecture of machine learning. You take the sounds, and you analyze them, and you know that you can take any signal and decompose that signal in the sum of sine and cosine function with a wave, and so those waves, basically, we can pull them out, and each wave distribution can become the signature for a sound, and so you can create a library of wave distributions that each correspond to a sound.

Now, when you do your analysis in real time, you calculate those waves, and then you use a machine learning classifier that will basically look at your library and the sum you have detected and tell you whether you have a call or not a call or detection or not a detection, and so that's the basics of it. We have done that, and we have created a little app that is available to anyone who has acoustic data, and it's called the FADAR, Fish Acoustic Detection Algorithm Research.

We published two papers, the first one using a method based on the auditory function of the human ear, which is different from what is the trend right now, which is use to deep neural networks, and so you use big machine learning systems that are built by Google or Amazon and that can be applied to any kind of data, and so we've done that. What is important here to realize is that we don't actually detect -- It's to basically classify sound by different species, but I was telling you earlier that each of the species actually makes different sounds.

Now we have tried to build detectors that can classify sound within species, and that's how we can learn the dialect, and that's what we're doing here, which is the latest of our work, and that was just submitted, and so classification of call types for species.



In summary of what I just presented and what is available to the community now is -- Basically, we built a tool, which is an autonomous system that can be used as a sensor to monitor aggregations. Also, keeping in mind that aggregations are ephemeral, but predictable and site-specific, as far as we know from Eulerian measurements, which means fixed measurements, and so the way we study aggregations is we go to one place and we think that's it, but what is happening a hundred meters or 200 meters or 300 meters away, and what's happening over the course of the week, and where are the fish coming from, and how do they aggregate, and what is the mechanism behind the aggregation?

We have this autonomous system, which is a mobile system, so we can solve those questions, and there are complementary measures to collect data, such as temperature, salinity, current profiles, chlorophyll, DO, pH, and I just told you what earlier what it does, and we can use the signal detectors that can be operated in real time to identify species and the nature of the aggregation, and so you can imagine that one day we'll be able to come up with a detection system, machine learning system, for whales, and we can use the same platform to do the same thing, and it can be for any organism, basically, that produces sound. In addition to the detector, you can use complementary sensors for in-situ validation and abundance estimates, and that's when the echosounder technology comes in.

The outcomes of such tools and such technology applications is -- You can obtain a comprehensive vision of the spatial extent and temporal dynamic of fish spawning aggregations, and you can get a consistent, efficient, low-cost, unmanned assessment of FSA status through time. You can get a real-time alert system of boat traffic and fishing activities, because, if we can classify fish sound, we can also classify noise, which can be classified in which you can find boat noise or any other anthropogenic sound, basically, and it could be a seismic survey or anything, piling activities or anything, basically. The ultimate goal, and ultimately, hopefully, we can get abundance estimates of spawning aggregations.

I am just going to give you some examples. I talked a lot, and I said a lot of things, but, in reality, what did we get from that? Well, we took the glider on a cruise on the Nancy Foster in the summer of 2016, and we went to Riley's Hump. Riley's Hump is a very -- I call it a hotspot for spawning aggregations, and so you have a lot of snappers that spawn there during the summer and the groupers that spawn there during the winter, and so it was in the summer, and so we weren't really looking for grouper spawning aggregations, but more for snappers, and so, if you look at the second graph, you see red and blue dots, and that's where cubera snapper aggregations were observed, but just aggregations and not spawning aggregations, and so we looked at a distribution of fish around, and, in particular, red grouper, and that's what the black dots are showing you.

Basically, we are recording the sound, and so the dots on the first plot show you the transect that we did, and we had to fight the current, and so we were a little bit pushed away from Riley's Hump, but we made our way back, and we got a good idea of how some of the species were distributed. The big black dots on the middle graph show you the red grouper, and the little blue dots on the yellow graph show you the squirrelfish, which has a sound signature which is very close to the yellowfin grouper, and so, anyway, you can get an idea of species distribution, and we also had a VMT transceiver, and so we could also track tagged fish that Fish and Wildlife was tagging at the time, and so we also got a few detections, but detections at the surface are not, for some reason, in certain environments, as good as close to the bottom.

We also used the glider to survey a goliath grouper spawning aggregation, and we made a discovery, but it was a very fortuitous discovery, and so we were working with a group at FIU, with Kevin Boswell, and we were using an echosounder to assess basically the size of the goliath grouper spawning aggregation, and so to get a return based on the echosounder of different fish and an estimate of the biomass.

We said, okay, we're going to go, and so this is off of Jupiter, Florida, and you have a series of the wrecks where people go and dive every year to watch the goliath grouper aggregate, and so everyone thought that that's where they spawn. Well, by serendipity, basically, my engineer at the time made a mistake on the location, and so we went further offshore than actually to the wreck, and what we found is the site where the goliath grouper spawn, which is two kilometers away from where they aggregate during the day, and what was interesting --

First, I wasn't sure, and so that's the little dots that you see there where that big round circle is, and so it's away from the wrecks, and I was like, okay, maybe it's not an aggregation and maybe they just went there and they were transiting somewhere, and so we are there throughout the night, and so we are able to record the sound production through the night and then compare that sound production with the site on the west coast of Florida where they have actually recorded sound production from goliath grouper.

The timing of the sound production and the rate of production, sound production, was exactly the same on the west coast and on the east coast, which is incredible. It started at 9:30 and ended at 11:30 on the west coast and exactly the same on the west coast, and so how do you explain that? I don't have an answer, but it's something interesting that it confirmed that we had found it.

Another thing that we did in the Virgin Islands is they have been studying the recovery of red hind and Nassau grouper aggregations, but, as you notice on these graphs here, this is Abrir la Sierra on the west coast of Puerto Rico, and it's like the fish distribution is not concentrated at one particular site, and it's pretty spread out, and so we confirmed that, and the other thing is, also, in Puerto Rico, Nassau grouper has almost been -- The fishery was over, and so they couldn't fish for Nassau grouper, and, based on the discussion with fishermen, some of them told them, well, there used to be an aggregation in Bajo de Sico, which is the green dots on the right graph that you see here, on the top of the red ones.

We are not sure that they are still there, and so a colleague of mine started putting hydrophones there and baited cameras, and he started seeing a few Nassau, and so, with the wave glider, we took it out there during the week of spawning, and we actually found Nassau in large numbers spawning there, and so what is interesting here is also the segregation of the species between sites. The red hind are at one location and the Nassau are in another location, which tells you about different spawning habitat and spawning constraints that they are after when they spawn.

Then, finally, and that was our biggest survey in the Virgin Islands, which is south of St. Thomas, and what you see is the track through the days, and so it goes first west, and then it goes back east, and then it comes back to the middle, towards Grammanik and the Red Hind Bank. I don't know if you can see it well, but, all along the track, there is little crosses, and all those crosses are a fish call, and so, if we zoom into the square, this is Red Hind Bank and Grammanik Bank, and you see the tracks of the glider, and it's supposed to be little blue dots, but what you see most are little

crosses, black crosses, which are actually fish detections, fish calls, and so, when you think about the aggregation at Red Hind Bank and that you see a density of fish calls at least higher to the side, west of the bank, the spawning bank, you may want to question how many aggregations are out there or how this distribution is related to the aggregation.

The other thing that we found here is Grammanik Bank is -- As I showed you earlier, it's known for yellowfin and Nassau grouper, and people had never thought that red hind would spawn there, because they had never seen them. What we found with the glider is that there was -- We found red hind calls, but 300 meters north of the yellowfin aggregation, which they could have never found unless they had dove there by accident, and so it was a discovery like that, that also red hind spawn at Grammanik Bank, but not at the same site as the yellowfin, and so that's basically -- The research that we're doing right now is understanding how the fish are distributed and their relationship and their behavior and their association with the main spawning aggregation, but also are there other spawning aggregation sites nearby, and what we started to realize is that fishermen are coming out with some stories about how some sites used to be spawning aggregations that are on the west side of the Red Hind Bank.

I am going to stop here, and I just want to summarize what I've been talking about today and give a perspective of how this can be used. Autonomous surface platforms, such as the wave glider, provide low cost, persistent access to FSAs, and so they can be at-sea, and they can go at-sea where we can't go, and real-time information on fish presence and the surrounding habitat, and so we can really understand what the spawning habitat is like, and maybe there is transient habitat that leads to the spawning habitat, and so there's a whole mapping that can be done and the role of those different habitats, and this can be correlated with the sound pollution and different types of sound associated maybe with the different types of habitat.

If you can merge active and passive acoustic data, such as the wave glider, those two types of data are very complementary, and, if we put them together, you can address a number of questions, and this will answer some of the questions that are important to you for fisheries management and habitat conservation, et cetera, and so what I emphasize here is that you can estimate population abundance levels as a function of the number of spawning adults, with environmental or ecological input, which can provide a framework to predict recruitment and define strategies within an ecosystem context.

You can also elucidate mechanistic relationships between fish species and the surrounding ocean habitats to provide a solid understanding of fish behavior, population dynamics, and life history within an ecosystem perspective, because, as we know, this is only one part of the puzzle, but that part of the puzzle is essential to the rest of the life history of those organisms. I want to leave it there, and thank you for your attention.

MS. DEATON: Thank you. That is really interesting work, and we'll take some discussion.

MR. MARTORE: This actually might be a question for Roger, or both of you, but the council just recently designated several spawning special management zones, and I'm just wondering if there has been any consideration of using something like this in those specific areas, to actually document spawning.

MR. PUGLIESE: There is an entire system management plan that's under development right now, literally, and I think the different technologies are being looked at for some of these, and I think this is the first time we've looked at the extent of the work, and we had, I think, a preliminary review of some of this earlier on, and I know that's tracked in there, but the opportunity to -- One of the reasons we're looking at some of these things is to advance this kind of capability for use in a number of different managed areas.

I mean, it's linking very well in the presentation that we had previously with Debra, because some of the things that I want to see is the opportunity to potentially collaborate with SECOORA and other partners to advance this into these different areas and not just those spawning special management zones, but the marine protected areas and deepwater MPAs are also areas that are anticipated or intended to characterize spawning events within those systems, and I think that's one of the reasons that these are on the table for discussion and seeing how far some of the technology has advanced and the advanced review, and, actually, it's already looking at one of the areas, with regard to the goliath grouper areas that were identified previously, and so, yes. That was a long answer to a short question, but that's the whole reason that we're looking at some of these, is opportunities to take this technology and begin to advance it, but it will take resources to build from this kind of a characterization to other areas.

MS. DEATON: Any other questions or comments?

MS. BUSCH: On the active acoustics, is that similar to like a fish finder? Is that the kind of source? Okay.

MS. DEATON: All right. I think everybody is hungry.

DR. LANEY: Laurent, based on your presentation, most of the work that you described for us that took place over in Riley's Hump and the Virgin Islands and the different locations, has all of that been published already?

DR. CHERUBIN: (Dr. Cherubin's response is not audible on the recording.)

DR. LANEY: It would be great, for the stuff that's already been published, if you could get that to Roger and Anne for circulation to everybody. I would love to see all the details, and that's terrific. Thanks for the presentation, and it's really, really cool stuff. I am assuming, even though your focus has obviously been the spawning aggregations, which is really, really key, it seems to me that you could probably use the same technology, for example, for examining the winter foraging behavior of migratory striped bass off of North Carolina and Virginia, perhaps, and I don't know.

Obviously, that's going to be a more mobile activity. The fish are going to be moving around a lot more, but, in this case, at least based on my observations during these cruises, you have humpback whales, and you have northern gannet aggregations, and so you have aerial acoustics from the birds, plus you can see those with SECOORA's radar, I think, Debra, with the high-intensity stuff, and then you have got the fish under the water, and so you've got all these different species that are coming together out there and aggregating on fish prey, for the most part, and I guess it's Atlantic menhaden, but also Atlantic herring, at least during the wintertime.

It would be really interesting for somebody to look into whether or not you might be able to apply the same technology not just for spawning sites, but also for some of these more mobile types of behavior, and I think it would -- Obviously, it would be more of a challenge, because the fish and the prey are both moving in three dimensions, but it's something to think about even.

DR. CHERUBIN: Yes, definitely, and that's what I was trying to bring up. If you use the echosounders, you can really get an idea of the distribution of prey versus predators, and you can go through the entire food chain if you calibrate your echosounders to identify different organisms that have an echo back to the echosounders, and so that basically gives you sort of an ecosystem assessment of what's happening in the water.

MR. PUGLIESE: One of the other aspects that I think is important, while we're focusing on aggregation sites, is the ability to look at having this detailed characterization of maybe along the shelf break edge area, where you have multiple species spawning that also have sound signatures, because, while they may not have specific spawning aggregation locations, it may be along a specific depth contour to kind of capture that broader spawning event thing, and that may be something that would be really useful to understand a number of other species that are sound producing but may not be focused only on specific locations and may be focused on multiple habitats along a depth contour, and so I think that's going to be critical to advance this beyond just maybe those -- Because there are a number of species that I think follow that in the South Atlantic that are just as critical to know that characterization, also.

DR. CHERUBIN: I just want to add that here we used the wave glider, which is located at the surface, but you can imagine one of the images that I showed earlier that you could install the same type of system on a sub-sea glider, and you could basically couple what you see at the surface with what you see underwater and get a finer analysis of those deep-scattering layers, and so it would give us a better understanding of what's happening at depth and measuring -- If you do that, in the long run, it gives you an idea of what the deep habitat is like. We were talking a mooring to survey what happens in those deep habitat regions, where, if we could do deep transects with deep gliders and get the same type of information over time.

MR. PUGLIESE: Just a follow-up. I think that's one of the biggest things that is really exciting, is the technology is changing so fast that some of the -- Some of the abilities of the vessels to be able to do it and of the sensors to be able to collect it and then the processing capability to be able to analyze this has gone so far from where it was before, and some of these things are becoming realistic and understanding the three-dimensional characterization of both the water column, the habitat, and the species, and we're getting into some really amazing things that I think hopefully we can work that into advancing this technology and to collaborating with our partners in SECOORA and with the other efforts as we advance this. This is going to be exciting times to see this actually become realized, and this is a teaser, I think, is what the idea here is.

MS. DEATON: Thank you very much, and, while we eat, we're going to have the webinar in two minutes.

MR. KNOWLTON: My name is Chris Knowlton, and I'm the Assistant Director at the Inner Space Center and part of the DOSITS team. Today, we're going to hear from Dr. Jim Miller about pile driving and the near-field characteristics and considerations and Dr. Kathleen Vigness-Raposa about marine acoustics. She's going to talk to us about variations in the sound field during pile

driving, and Dr. Jakob Tougaard at Aarhus University is going to talk to us about underwater noise from wind turbines. We're going to start with Dr. Miller.

DR. MILLER: Thanks, Chris. My assignment is to give a short, high-level presentation on pile driving offshore, in particular the near-field characteristics and a little bit of what pile driving is, and there is a lot of colleagues that I want to thank, and I'm not going to go through them, but they're all there, and I have probably missed many, but the important thing is that much of this work has been supported by the Bureau of Ocean Energy Management, and I want to apologize ahead to my European colleagues. This is U.S. centric, Block Island Wind Farm centric, and there is decades of work in Europe that pre-dates what we've done here, but, since I worked on the Block Island Wind Farm monitoring, in the RODEO program, that is what I have concentrated on.

Here is an outline of my talk. I will talk about pile driving and the components, the parts of the pile and what happens, and, in particular, how that contributes to the sound field structure, and this is going to be offshore centric, steel pile centric, hollow pipes, and the creation of a mock wave and what happens when the toe of the pile is being driven into the seabed, and it has all sorts of very interesting acoustic effects.

I will talk about some numerical models of pile driving, just very high-level stuff, mainly pretty pictures, and some of the measurements we did in the near-field, 500 meters from the Block Island Wind Farm construction. Wind farm construction in Block Island is a little different than most monopile offshore wind farms that were in Europe, in that these piles are raked, or they're driven in at an angle, and then I will finish off with some very interesting work done on bubble and resonator screens that I just want to mention, and I will finish off with references, if you are interested in learning more about that, and, of course, you can always contact me.

Pile driving is basically forcing a pile into the soil or the sediment, and this slide is not particularly up-to-date. It's basically obsolete, and, in the offshore environment, they're using much more sophisticated, but I like this picture that I found on the web, just because it has some of the parts that we're interested in, including the hammer and the helmet that guide, and so the hammer is basically your -- It's like going out into your backyard and driving a pipe into the ground. You take a big hammer, and you hit it as hard as you can, and hopefully it's going to go down.

It's more complicated than that. Well, it's not that much more complicated. You are basically lifting a hammer somehow, hydraulically with diesel or with a lead, on a crane and driving that pile into, in our case, the sediment. Sometimes there is a template or a jacket that guides the pile in, and we'll see that, and then I just wanted to point out the toe. The toe of the pile is the bottom of the pile, and that's being driven into the -- There's a lot of stuff that happens down at the toe, and so I'm going to go to the next slide.

This is some very nice work on the right done by Per Reinhall and Peter Dahl at the University of Washington some time ago in which they did a finite element and showed a very nice propagation into the water. The wave speed in the steel is very high, 5,900 or so meters per second, and that's greater than the water sound speed, which is about 1,500 meters per second, and, just like a supersonic jet, going through the atmosphere, it creates a Mach wave, or a sonic boom, and that goes into the sediment also, and that Mach wave is at an angle that it's about fifteen degrees, and it depends on the ratio of that, 1,500 to 5,900.

It travels down the pile at very high speed, and it reflects off the pile toe, and then it comes back to the top, and so you get this back-and-forth wave as it vibrates in the vertical, and that wave radiates into the water, and this is shown here. Just to give you an idea, sediment sound speeds, depending upon what you're going into, mud, silt, sand, or coarse sand, they're all pretty much, for the purposes of what we're talking about, around 1,500 to 1,800 meters per second, and so this Mach wave is created also in the sediment.

On the next slide, the Mach wave -- This is actually a very nice piece of work done by Huikwan Kim, who was our PhD student a few years ago, and he did a finite element model of a monopile geometry, and we're actually using the Peter Dahl and Per Reinhall's work, which we're calibrating everything, but we actually took this farther out, and it took -- It was days of computer time to do this, but it shows the various pieces. In the top green, in the top twelve meters or so, is water, and that's pressure, acoustic pressure, and, below, which looks more blue, is sort of velocity, because it's a more appropriate measure, and it just shows the various pieces of the compressional wave and the shear wave and the interface wave.

The interface wave is especially interesting, because it can be very intense and right at the sea bottom, and so, for animals that are living at the sea bottom, they can get -- It's basically like an earthquake wave in the early, and an interface wave is right at the seafloor. For monopiles, you can use symmetry, and it saves. The Block Island Wind Farm, which we're going to talk about in a second, the piles are raked, and that spoils some of the symmetry, and it's much more expensive to simulate.

The Block Island Wind Farm, which is something that we've been working on through the BOEM-funded RODEO project with HDR Incorporated, consisted of -- It consists of five turbines in water depths of about thirty meters, a little less, and the sub-structure of these consists of a jacket, and it's really a template that the piles are driven through, and there's a picture on the top-right that is -- I took that picture of the jackets being barged down to Block Island by the URI Bay Campus, and you can see they are basically like tables with hollow legs, and the piles are driven through those legs, and so to guide them down. On the bottom-right, you can actually see an aerial view of the five turbines south of Block Island, Rhode Island.

These pile driving operations in 2015, and most pile driving operations, generated intense sound that was impulsive in nature, especially at close range that radiated into the surrounding air, water, and sediment, and a team made up of a number of people there on the first slide, and including Kathy Vigness-Raposa, who is going to talk next, deployed a number of instruments to monitor this pile driving noise at several locations with several different types of instruments, and I'm showing some pictures of the -- You can see, on the very right here, the piles are being lowered into the jacket, and one has already been driven in, and that's the hammer right here, and I hope you can see my mouse here.

There is one pile that has been driven, and another pile has been taken in here, and so it's that barge there that goes there, and there's a couple of different methods that they use. One of the most effective was this lift barge, just because of the water depths and everything like that, and the angle with the vertical was thirteen degrees, which is important to the story.

The use these lattice jacket structures, and there is some more pictures closer up of the piles being ready to be driven into the sediment, and then, of course, I showed also one later on when they put

the upper structure on, and this lattice jacket technology is -- Much of the Gulf of Mexico and oil and gas in shallow water is done using this type of construction, and it's very appropriate for this water depth, twenty-seven or thirty meters or so, and, when we go into deeper water, you need newer technology, floating platforms and things like that, and so this is what we're talking about.

Menck is a company in Germany that makes the hammer, and it's just an amazing piece of technology. I encourage you to go to their website, and they have -- This, in particular, was an MHU 800S, and it has to do with the size of the pile they were doing and the amount of energy they have available, and so this is, from outer pile diameter, forty-eight inches to eighty-four inches, and it's very nice of them to put it in English units for us Americans, and it's seventeen meters tall, three meters at the base, 114 tons, and it's quite an amazing piece of technology, and so I just wanted to show that.

We had a tetrahedral array sitting 500 meters sitting from one of the piles being driven, and, on the top-left, you can see a float that is above our location, and so you can picture how far away we were, and then, on the right picture here, it's a set of hydrophones. We did the tetrahedral array half a meter on a side because we can get particle velocity, and the fish community is particularly interested in particle velocity, because that's one of the main ways in which fish hear.

The bottom-left is a spectrogram showing the acoustic signals as a function of frequency and time, and, every one to two seconds, you basically get a broadband signal, and these are very high-pressure signals, high intensity. On the right up here, there is the four channels and the tetrahedral array, and we're getting levels at this distance of 2.5 kilopascals, which is about 188 decibels, re one micropascal, underwater dB. If you just assume spherical spreading, which is probably not appropriate for a distributed source like that, but it's still useful, you get a peak source level of 242 dB, re a micropascal, at one meter. Because of the distributed source, there is probably not 242 at one meter from this, but it's useful for engineering purposes and expository purposes.

This is some very nice work by Daniel Wilkes and Alexander Gavrilov in Australia, where they simulated, and it took them fifty days of a computer to do this particular calculation, and it's a finite element calculation of the raked pile, this tilted pile, and, although there is left-right ambiguity, the cylindrical symmetry that we had in the Kim work, Kim's PhD, we can't use it here, and, actually, we're working closely with Dan and Sasha Gavrilov on this, and they're doing some simulations for our Block Island case in water depths and things like that, and so there are piles and simulations that can help us try to match the data.

There is technology now that people have been using, including bubble curtains and related to things like Helmholtz resonators to try to dampen the intense pressure signals, these intense signals that are radiating from the pile. Freely rising bubble curtains can be effective in shallow water and calm conditions, but, when you get to deeper water, and, in this case, twenty-seven meters is pretty deep, and, also, it's open ocean, and so we have significant currents and tides, and this bubble curtain can be difficult to use and to manage in regimes like ours.

We did not use any -- The developer did not use any bubble curtains or things like that in the Block Island case, but other people I know are looking at this, and so the Helmholtz resonators are sort of the next generation, and it's a very interesting technology. It's actually being demonstrated in Europe, and the company is ADBM Tech, and they're an Austin, Texas company, and these Helmholtz resonators are basically little fixed balls that can absorb the noise from the pile driving,



and, if they can put resonators around this, and you can actually see, in the lower-left, how this one particular European application is done.

It can drop down, and they have shown, demonstrated, significant reductions in levels by the sound going through these Helmholtz resonators in this one particular test in one panel, and so that's my story, and I am happy to give you these references that are here that are related to the things we've shown, and maybe later, or by email, you can ask me questions, through the chat box, and now I will pass it on to Kathy.

MR. KNOWLTON: Great. Thank you, Jim.

DR. VIGNESS-RAPOSA: I am going to pick up where Jim left off. He talked about the source itself and how the pile driving makes noise, and I'm going to talk about the sound field and how the sound propagates away, or moves away, from the pile driving effort. The two questions that we are really interested in is at what range from a pile driving source does a signal transition from being impulsive to non-impulsive, and we'll talk about what those two terms mean, and then we'll also look at some data on what is called time spread of a signal and also the metric of kurtosis and how do those provide some information on that transition zone.

The second question that my talk is going to address is how does sound propagate away and what models exist for us to predict what a sound field might look like, and so we're going to look at some measurements of sound fields and how sounds have spread away in different cases, and, again, I will talk a little bit about the Block Island Wind Farm that Dr. Miller introduced.

Sound sources are divided into both impulsive and non-impulsive, and this is looking at using definitions from the NOAA Fisheries acoustic guidance. Impulsive sounds are typically transient. They don't last continuously, and they are brief, less than one second, and they are broadband, meaning that they have energy at multiple frequencies, and they consist of a high peak sound pressure level, and that rapidly gets very intense and then rapidly decreases.

On the other hand, non-impulsive sounds, they can be both broadband, narrowband, or tonal, and they can be brief or prolonged, and they can be continuous or intermittent, and they typically do not have that high peak sound pressure with that rapid rise and decay time. We also know that exposure to underwater sounds can lead to mechanical damage of the inner ear as well as some more complex patterns of hearing recovery, and so there's definitely an interest in understanding kind of where that transition is happening, and that gets us back to the questions that I outlined at the beginning, is at what range does that transition from impulsive to non-impulsive occur and then how can we predict sound propagating away.

To jump in and look at time spread, this was work that was done by Helen Bailey and colleagues several years ago looking at pile driving in offshore waters off of Scotland, and they did measurements starting at 100 meters and moving offshore to eighty kilometers, and what you can see in this upper-left-hand figure is that sharp signal, and the sharp peak and then the energy dying off. Even at just four-and-a-half kilometers here, you can see the difference in the signal, where you have lost that sharp peak, and the signal has started to stretch out, or the energy is over more time.

What they found was that, at close ranges, within about a kilometer of the pile driving, the peak lasted about ten seconds, with a total signal duration of about 200 milliseconds. However, at about forty kilometers, that peak had increased to a duration of 200 milliseconds, and that the total signal had increased to 600 milliseconds.

Looking at data from our measurements at the Block Island Wind Farm, what we used to look at time spread was called decay time, and that's defined as the time it would where 95 percent of the energy is present, and so, if you're looking at this figure here, and these are some examples of signals, and these circles represent that peak pressure, and so it's how long after that peak pressure do you get 95 percent of the energy and what's the time it takes for it to decrease to that, that decay time. We will talk about kurtosis, and kurtosis is looking at the time it takes from one-tenth of a second before the peak to eight-tenths of a second after the peak, and so this pink region of the signal.

Looking at the results from the Block Island Wind Farm of decay time, as Dr. Miller talked about, we had piles that were raked towards the seafloor and raked towards the surface, and, in both cases, the decay time increased at ranges greater than about four-and-a-half kilometers, and so the decay time was fairly constant for a while, and then that decay time increased, and so the energy was really spread over a longer period of time.

If we're looking at kurtosis, kurtosis is a measure of the amount of variation in a signal, and higher kurtosis means that there is more frequent extreme deviations, as opposed to sort of modestly-sized deviations, and an example of kurtosis is seen in this figure below, where you've got two signals that have the exact same energy spectrum, and so they've got the same amount of energy across all frequencies. However, if you look at the pressure signal, on the left-hand side, we've got constant deviations, and so you have a kurtosis of only three, whereas, on the right-hand side, you've got infrequent extreme deviations, and so you have a kurtosis of 189.

Looking at our results from the Block Island Wind Farm, where we have defined kurtosis, we have found kurtosis decreasing with range, again meaning that the energy was being spread and we were losing that peaky nature. There wasn't as sharp of a transition in the data as we saw with the decay time, but it was around five kilometers.

If we look at sound spreading and predicting sort of how sound levels decrease as the sound wave moves away from a source, there are sort of two basic models that can be used. The first of these is called spherical spreading, and I referenced the DOSITS website here, where you can go to read more about this, and these figures are from DOSITS. You start off with spherical spreading, where you have got a source, and the waves moving away from that are not restrained, and so they move as a sphere, equally in all directions. However, at some point, that sphere will interact with something, whether it's the seafloor or the sea surface or temperature inconsistencies, and then it has that top and bottom, and it is only expanding horizontally as a cylinder.

Peter Madsen pulled together studies that were looking at sound spreading at five locations and with looking at range here on the X-axis and the decrease in decibels on the Y-axis. They found that, at these five locations, for that first kilometer, you're really stuck with spherical spreading, and so spherical spreading was a good predictor within that first kilometer range. Beyond that distance, they found that it was very site specific, and so there is lots of different things that happen, between sediment changes, bathymetry changes, and depth and temperature and salinity profiles

that can happen and current structure that can happen, and so it was much more site specific at those longer ranges.

Looking at our Block Island data, as Jim talked about, this is a cartoon figure showing the radiation, and so, as we mentioned, the piles were raked, and so they had that angle. In the direction with our towed array, where they were raked towards the bottom, you could see that that sound wave was going towards that seafloor, whereas, if they were raked towards the surface, that sound wave was going horizontally, and it had less interactions, and that is exactly what we found when we looked at the sound spreading. In the direction where it was raked towards the surface, there was much higher received levels than in the direction that it was raked towards the seafloor, and so we had a very directional sound source, much more than we were expecting.

In conclusion, in answering that question, at what range from pile driving does it transition from impulsive to non-impulsive, there is starting to be some research, but we definitely need more studies to come up with a generalized transition range. As we saw in the Block Island Wind Farm, it's maybe four to five kilometers, but it definitely will depend on location and source, and so more work needs to be done to kind of generalize what that would be.

Looking at how does sound propagate away from pile driving, again within the range of cylindrical to spherical spreading, it was about that first kilometer, but the propagation for the distance definitely does depend on location and source, and so these are the references that I mentioned, and I would be happy to provide additional comments or questions if anyone needs them. Thanks.

MR. KNOWLTON: Great. Thank you, Kathy. We're going to -- I see people are putting questions in the chat box, and that's awesome, because that's what we want you to do, and we're going to get all the questions at the end. We're going to try to answer as many during the webinar as we can, but we're going to go on to our next presentation at this time, and so we're going to switch gears slightly, and we're going to actually talk about the wind turbines this time.

DR. TOUGAARD: Thanks. What I will talk about is the noise from the operating wind farms once the turbines are in place, and although, of course, you have to install the turbines before they can be in operation, it was actually the other way around, I think, in terms of concern for underwater noise. The concern started with the noise from the operating turbines, because there is a lot of controversy about turbine noise on land, and I don't want to go into that at all in this context, but just to explain that that was the background for the immediate interest in noise from underwater turbines as well.

One thing that I just want to point out is that the source of the noise in air is very much the airflow across the turbine wings, whereas, in the case of underwater noise and offshore turbines, then this airborne noise is almost completely reflected from the air surface, and so that's not an issue in underwater. The noise is radiated out from the foundation, and it comes from the gearbox and the bearings and so on in the top of the turbine.

This figure shows a summary of all the measurements that I have been able to dig up, and most of them are buried in reports, and quite a few of them in either Swedish or German, and so they are not very accessible, but there are quite a few measurements, and these are just the raw measurements plotted for the different wind farms, and you can see that there is some variation,

but they tend to be in the range of a hundred to 130 dB, and these are the raw measurements, and so they are measured at many different distances.

I don't want to go into the details of the discussion about dBs underwater versus dBs in the air, but I would just point out that, if you're not used to underwater acoustics, then 120 dBs sounds very loud, and so the next slide is -- I think there has been some misunderstandings and some linking of whale strandings to underwater noise from turbines, which are really only based on a coincidence, like this whale showing up behind the turbines, but I think it's important to get a perspective on how loud this noise is, and one way of doing that is to compare it to other sources.

This is what I have done here, and so these are again, all of the measurements that I could find, and these are -- It's the measured intensity of the loudest tone in the noise from the turbine, and most of the noise is -- I will show a figure later, but most of the noise is characterized by some individual pronounced tones that comes out of the general noise, and then they are related to the gears of the turbine.

Anyway, if we just plot the measured levels here at various distances, and then I have plotted some measurements also from ships, you can see that the measured levels are lower or comparable to the levels of the ships at distances from fifty to one kilometer, approximately, and so I think that is very helpful, because that sort of gives them a rough idea of what kind of impacts we are talking about once we start talking about impacts, but it's something that is comparable to the effects of ships. There are some pronounced differences, of course, the fact that the turbine is stationary and will remain in place for maybe twenty years, and that's very different from the situation of a ship that is moving through the area.

Anyway, if I again take this set of measurements, then we can see whether there are some factors that can explain the variation in the levels, and, of course, distance to the turbine is an important factor, and it explains quite a bit of the variation, and the slope of the curve here is, I think, around seventeen to the distance, and so that's a pretty -- It's fairly close to the plot.

Wind speed is, obviously, also a factor that is important, and these turbines will typically begin to pick up speed between four or six meters per second, and then, somewhere between ten and fifteen meters per second, they will operate at their maximum. Turbine size is an interesting -- Maybe the most interesting parameter, because turbines have increased tremendously in size over the years, and the first turbines installed were 200 to 500 kilowatts, and, today, the largest one in this plot is more than six megawatts, and I think ten megawatts are what is being installed at the moment.

There seems to be some relationship, especially for the very large turbines, but it's not a very strong relationship, but keep in mind also that a lot of these measurements are fifteen years old, or close to twenty years old, whereas some of the newer ones are made with the different instruments and under conditions that make it possible to get much better measurements than the old ones.

I will go back a slide here, because I have also split the points up in different foundation types, and there is not a strong relationship there either on the different turbines. The concrete foundations in some of the measurements appear to emit slightly less noise than the others, but it's not a strong relationship, but there is something to look at in future studies, for sure, and also because new foundations are coming in, and one type also mentioned is the floating foundations that have no

direct mechanical coupling to the seafloor, and that remains to be shown and what that means for the sound transmission. There is also an experimental system called a suction bucket that is not piled into the seafloor, but it's buried into the seafloor by suction and kept in place.

The frequency content of the noise here -- In all the cases that I have seen, the noise has been at very low frequencies, below one kilohertz, and there are some smaller exceptions, where there are small peaks at high frequencies, but the main energy is always below one kilohertz, and then, in some cases, at very low frequencies, below 100 hertz, and, here, you can see two different presentations of the spectrum of the same turbine, and it's not the same measurement, but it's done on the same turbine, and, in the top, it's third-octave levels, and there is also a comparison between the ambient noise when the turbine was turned off, and the red part of the curve is the contribution of the turbine, and you can see that it's between 100 and 500 hertz that the main contribution is.

In the bottom plot, you can see these sharp peaks that I mentioned before that are generated at what is called the gear mesh frequencies, which is the frequency at which the individual teeth in the gears engage, and that's the main source of these peaks.

The absolute levels of the peaks are, of course, interesting, but what is perhaps the most interesting is the level above ambient, and here are some measurements also made earlier, and they were made fifteen years ago by the consulting company, and they made these measurements at different turbines, and you can see that the measurements to the left have moved, and they are made at two different wind speeds, and they are interesting, because you can see that the absolute level of the turbine noise increases a little bit, maybe ten dB or so, with an increase in the wind speed, but the ambient noise increases as well, and so that means that the level above ambient is more or less constant, or, for the lower frequencies, it is actually masked by the ambient noise, and that has some impact on how we assess the effect of this on the noise.

On these figures are also the audiograms of the harbor seals and harbor porpoises to give an idea about the audibility of this noise, and so the noise is only audible if it's above the red curves, and, in this case, you can see that all the turbines at these distances should be audible to the seals, whereas they are inaudible, or just audible, to harbor porpoises, and so there is a clear difference there caused by the difference in the hearing abilities between porpoises and seals.

There are other sources of noise besides the turbines themselves, and that has actually not really been studied, and it has been downplayed, and not deliberately, I think, but overlooked in the original impact assessments, but that is the service ships. This figure shows AIS data from the northern part of the German Bight, and you can very clearly see the outline of five individual offshore wind farms, and you can see the large shipping group out to the upper-left corner, but they are also the tracks to back and forth to the wind farms and then the service boats that are milling around inside the wind farms. That is perhaps a source that needs some further attention.

I am not going to go into details about effects of this noise, and one reason is lack of time, and the other one is simply that very little is known about it, but I would like to point out these two studies that are interesting. The one to the left is a seal equipped with a GPS tracker, and the seal is swimming around inside a German wind farm, and you can very clearly see that it spends a lot of time around the turbine foundations, and especially the transformer station. It seems to be very interesting to the seal, and so this is only one animal, of course, but, whatever this seal was looking for, it was apparently not deterred by the noise inside the wind farm, not even at very close range.

The data on the right is results from a study in the Dutch North Sea with the acoustic data loggers recording porpoise acoustic activity, and so the figure shows the activity in two control areas to the left and right and the wind farm area in the center. What you can see is that the brown bars is the baseline condition before the wind farm was built, and there is some variation, but it's roughly the same level across all the three areas, the two control areas and the wind farm, but, once the wind farm is in place, there is a general increase in porpoises that has nothing to do with the wind farm, but, in the wind farm area, there is an increase in porpoise activity, and so whatever noise is generated by this wind farm is, again, either not bothering these porpoises or is offset by some benefit from being inside the wind farm.

That brings me to the summary here, and, in summary, the noise in level is comparable to nearby shipping, and there is rarely any energy above one kilohertz, and, from all the measurements, there seems to be an only small effect of size and foundation type on the levels, and we actually have no real long-term studies, and these are all point measurements, where people have deployed a single instrument, and sometimes just the early ones were measurements from a boat, and, later on, they were made by deploying instruments for a shorter or longer period, but the data may actually be there, but there are no real analyses of what is the contribution of the wind turbines to the general soundscape, and that is something worth pursuing, I think. Then there is this contribution from the service boats that I think is something to consider as well.

I did not deliberately go into any discussion about particle motion, but that's an important field, and there are just a couple of measurements of particle motion around offshore wind turbines, but that is, of course, very relevant once we enter a discussion about effects on fish and invertebrates, and so, with that, I have a very long list here where I want to acknowledge all of the studies that contributed to this summary of results. Thank you.

MR. KNOWLTON: Great. Thank you, Jakob. That was very interesting, and now I really -- Well, my personal question is I want to know a lot more about these suction bucket foundations. I have never heard of such a thing, and so people have been tying in questions, and that's great, and so please continue to type in questions. I would like to ask you if you could maybe say who the question is directed at, if you have a particular one of our presenters that the question is for, and then I think we can go ahead and start with the questions here in just a minute.

I do want to cover a couple of things, because several people have asked, and so we will have a recording of the webinar posted on the DOSITS website. In addition, we will have the -- Everybody today had a great list of references, and that will be available. You can get that on the webinar page on the DOSITS website after the webinar. In the next couple of days, we'll have all this information up there, and so I just wanted to get that out of the way, and I wanted to mention that my colleague, Holly Morin, is helping me track and sort of organize these questions.

The first set of questions I think will go to some -- People had a number of questions about the bubble curtains, Jim, if you want to weigh-in on that, and so the first one is do the bubble curtains reduce all frequencies equally well?

DR. MILLER: I am not an expert on bubble curtains, or as they're called -- There's a couple of different kinds. There is the freely-rising bubble curtains, which have pipes down, and they just emit air, which rises, and those are what I had mentioned were sensitive to the currents and tides.

Then there is some thick systems, both in Europe and the U.S., with these Helmholtz resonators, and so the question was frequency content?

MR. KNOWLTON: Yes, do the bubble curtains reduce the frequency equally well?

DR. MILLER: I would expect that -- Well, there is some very interesting demonstrations, actually, on YouTube, where the University of Texas took a sound source, and I think it may have been a CW source, where the bubbles turned on and turned off, and it's incredibly effective. If there's lots of bubbles, the bubble field really does suppress sound, because there's so much air, and so it does suppress sound, and so I would have to say that I would have to look that up, to look at the frequency content of that. Preston Wilson at the University of Texas is an expert in this, and I would refer you to contacting him, and Mark Wochner at ADEM Technology is also the company that spun off of the University of Texas that has this Helmholtz resonator, and they probably have more information about that. Sorry that I couldn't be more helpful.

MR. KNOWLTON: Okay. Jakob, did you have something to add?

DR. TOUGAARD: There are some measurements from especially Germany that -- There are some very good reports, but they are in German, most of them, and we also have some measurements that we have published on this, and it seems that the bubble curtains that are now used in Germany and elsewhere are incredibly effective above a few kilohertz. They essentially remove everything above ambient noise, or down to ambient noise, at these frequencies, and then they become less and less effective at lower frequencies, and I can share the references.

MR. KNOWLTON: That would be great. We could add that to the webpage, and that would be awesome. The other question about the -- Do the Helmholtz resonators, are those effective in greater depths and sea states, or do they face the same issues as the bubble curtains?

MR. WOCHNER: This is Mark Wochner here. If you want, I can answer these questions for you.

MR. KNOWLTON: Excellent. Please do, because I am struggling.

DR. WOCHNER: This is Mark Wochner, and I developed the Helmholtz resonator system, and so the way these Helmholtz resonators are designed is that they kind of are contemplated to work at certain depths, and so what we basically do is we have different size cups, so that, when the air bubble is compressed to a certain depth, it's the shape and size that we need it to be, and so, for example, there is no theoretical limitation to how deep the Helmholtz resonator can work, but, when you start to get down to really deep depths, probably depths way past where you would ever use the system, maybe 400 meters or so, they don't work quite as well, because the air bubble at that point is so compressed, and it's quite a bit stiffer than it would normally be, and so the difference between the compressibility of the water and the air actually isn't quite as large as it is when it's within forty or fifty meters, and so it still works, but you just need to use a lot more resonators to make up for the fact that it's not quite as effective at these really, really large depths.

Then, just to answer the other question about the performance of the system, it's a tailorable system, and so it generally works at its resonance frequency up to about ten-times its resonance frequency, but, of course, we would use different sizes of cups, in order to kind of spread that out as well.

MR. KNOWLTON: That's great. Then do you know if the frequency reduction is similar to what Jakob was talking about?

DR. WOCHNER: Essentially, freely-rising air bubble certainly works in two ways. It works by either blocking the sound, because it's got very different acoustic properties, or through the acoustic resonance of the small bubbles that are produced by this air bubble curtain, and so that's why -- Jakob is right that air bubble curtains work really well at a few kilohertz and up, because that's the resonance frequency of those bubbles. What we do with the Helmholtz resonator is we just make really large bubbles that are contained in a way that we know exactly where they are, and, because we can control them, we know -- We have a pretty good idea of how well the system is going to perform, because we know the size of the bubbles and the location of the bubbles and how many there are.

MR. KNOWLTON: That's great, Mark. Thank you so much. I think those are the questions that we had at the beginning about bubble curtains, and we're going to move on to some questions about the piles, raked piles, and so how -- I don't know, Kathy, if you know this, but how common are the raked piles? Is that a lot of what we're seeing done now, or does it just depend on the type of installation?

DR. VIGNESS-RAPOSA: It definitely depends on the type of installation, and, as Jim showed with the Block Island Wind Farm, there was that jacket structure, and so the raked piles went through that jacket, to pin the jacket to the seafloor, and I think it was designed to withstand hurricanes that we have here on the U.S. east coast and are not common in the North Sea, and so, if it's a monopile structure, obviously you have like the vertical monopile, but, with a jacket structure, you would typically have those raked piles, and they -- I think it was the first time that they had done jacket pile driving for wind turbines, but, as Dr. Miller mentioned, that is a fairly common structure that is used in the Gulf of Mexico for oil and gas projects.

MR. KNOWLTON: Great. Then are the jackets removed, or does it just become part of the structure?

DR. VIGNESS-RAPOSA: Right. The jackets are part of the structure, and so the piles go through the jacket, and the jacket sort of sits there and holds the turbine, and so it all stays there.

MR. KNOWLTON: Okay. Great. I think a lot of us, myself included, we have never really seen it done, and so we're like, well, okay, how does this all come together and what does it look like, before and after, and so I think we need to create like a video. All right. A question about the turbine bases, Jakob, and does a multi-pile base have a different underwater sound characteristic than a single-pile turbine?

DR. TOUGAARD: I would say that's possible, but no one really has the data to say that. I think, as I said in the introduction to my presentation, in the beginning, there was great concern for this underwater noise from the turbines, but, fairly quickly, it became clear that it was not a real issue and the real issue was the pile driving, and so the focus, I would say rightly, shifted to paying attention to the pile driving and mitigation and so on, and so very little work has been done on the sound from the turbines, and there has been some papers recently, and that's because now long-



term monitoring is becoming cheaper and much more abundant, and so people will get these long-term recordings for other reasons, and they can start analyzing more of the turbine noise.

MR. KNOWLTON: Okay. That's great, and then I don't know if it was in your list of references, but do you know of any literature looking at the acoustic properties of the floating turbine sub-structure and the mooring system that goes with that?

DR. TOUGAARD: I think that there are only a couple of experimental moorings of this type, full-scale moorings, but they are still in experimental, in Scotland and Norway, I think.

MR. KNOWLTON: Okay. That's great. It seems like the gear mesh noise is there in the really low frequencies, and has anybody used something like active noise control for the gear mesh noise, or, like you said, are people just not looking at these things?

DR. TOUGAARD: As far as I know, no one has really paid attention to it, which also means that, if it's demonstrated to really be an issue, it could be an otherwise very silent area, with very low levels of ship noise. If it's an issue, I think there's a lot of low-hanging fruit, because there are lots of off-the-shelf solutions to reducing these noise sources in the gear box, I think.

MR. KNOWLTON: Okay. I guess attenuation can also be achieved using a double-walled pile, or a pile driven with an internal mandrel, compared to attenuation achieved by the bubble curtain, and do any of you have any information about that?

DR. MILLER: I don't know much about that technology, and I certainly have not made any measurements of those kinds of systems.

MR. KNOWLTON: Okay. Well, we don't know that one. I am going to take just a moment here, because we are past an hour, and I know some people may have to go, but I just want to really quickly reiterate a couple of things, and then we'll come back to some more questions. I do want to just remind folks that there are two more webinars in the fall, this general topic and commercial vessel traffic and the echosounders combined with sonar. An archive of the webinars will be online, and we do have new content on the DOSITS website and in the DOSITS iBook, and so please check that out, and we should have the recording up in the next couple of days, and, like I said, that will include the Q&A time period, and it will include the references that folks have put forward with the presentations. To return to the questions, is there a temperature increase in the lead of the Mach wave? Jim, do you know?

DR. MILLER: That's a really, really good question, and, because the -- When you get to high-level sound, the acoustics is non-linear, and there are thermodynamic effects that have to do with the temperature increase and things like that. I would not be surprised if there was. It's not something we have measured or modeled, and some of our non-linear acoustics colleagues might be -- I feel terrible that I'm not able to answer that question, nor the couple other questions, but, with very high-level acoustics, there is these thermodynamic effects that you wouldn't see at lower levels, and so it is very possible that there is a temperature increase.

MR. KNOWLTON: Okay.

DR. WOCHNER: Jim, I can answer that if you want me to. Yes, there is definitely going to be a local temperature increase around the increased pressure, but, if the question is, is it going to noticeably warm up the water around it, I think the answer is a pretty comfortable no. It's not going to affect the actual temperature of the water. I mean, there will be a very minor local temperature perturbation, but, with these levels, I wouldn't expect it to be particularly significant, and certainly not warm enough to warm the water around the pile.

DR. MILLER: Mark, you should have given this talk.

DR. WOCHNER: No, I don't want the responsibility.

MR. KNOWLTON: Thank you, Mark. That's good information, and so I think we have time for one more question here. I think, Kathy, this is talking about what you were presenting on, and is there also a change in the frequency spectrum over distance along with the pressure falling off that you showed in one of the figures?

DR. VIGNESS-RAPOSA: Correct. The initial pulse is very broadband, and so there is energy across a wider range of frequencies. As the signal moves out, the higher frequencies do attenuate sooner, and so it's the lower frequencies that propagate to further distances.

MR. KNOWLTON: Okay. Great. I think that answers the question really well, and so I think that will be our last question, just for time today, and I want to thank everyone for watching the webinar and for joining us and for asking all the great questions. The webinar will be archived on the DOSITS site, in the webinar section, and, if you joined us today and registered for the webinar, you will get additional emails and notifications about the future webinars on the anthropogenic sound sources for the fall, and we look forward to seeing everyone in a webinar again. I want you to give a big thanks to our speakers today, and thank you, Mark Wochner, for chiming in there with some excellent information as well, and I hope that everyone has a good day, and we will look forward to reconvening again in the fall. Thank you very much.

MS. DEATON: I guess the one thing that I learned from that is it's better to put the pilings in at a slight angle, because it reduces the noise. Any other take-home messages that anybody has?

DR. CHERUBIN: One thing that didn't come out of that presentation is the fact that the sound coming out of the wind turbine is constant, and the sound coming out of the ships cruising and the service ships is just transient, and then the other thing that I noticed is that you notice that the amount of -- The echolocation clicks from dolphins near the wind turbines and other locations where you don't have them, and so I wonder if there is some interference with the sound produced by the turbines that make them have to search more than they would otherwise, because this could be interpreted many ways. You could say, oh, look, there is more food around, and so they hunt more, but maybe they can't see as well, and so they have to search more. I don't know which way it is. Also, that constant buzzing in an animal's head, it's not all addressed here.

AP MEMBER: The standout was to see all the tracking of the seal around the farm area, especially the transformer, and, again, I just don't think there's enough information, or maybe people don't want to ask the question yet, but is it a positive attraction or is it a negative attraction? Does it cause the seal to stay there when it shouldn't be there?

Laurent and I were talking, and the constant noise of the wind turbines created by the transmission gears changes dependent on the velocity of the wind at the time, and probably it's unique to whoever the manufacturer is, Seamans or somebody else, what kind of gear ratio they believe is optimum. Do those frequencies -- Would it be advantageous to look at -- Do those frequencies, can they interfere with the normal conduct of communication between either mammals or fish and disrupt it, and so I think there's a lot that we don't know, and maybe it would justify some level of research before it gets too much farther along.

MS. BUSCH: Kind of going back to that seal, some of the behavioral response research that the Navy has done, we're finding that the animals will respond differently depending on what behavior they are exhibiting at the time, and so, if they're foraging in a really high forage area, and the sound or the presence of a ship doesn't bother them that much, they will continue foraging.

If something is too loud, or annoys them too much, and they're not doing anything important, they may swim away, and so I get the sense that that seal realizes that those pilings attract fish, and it's a buffet. It's just going from pile to pile, and so it appears that possibly the sound isn't enough, because the benefit outweighs the negative. The fish are plentiful and easy to get to, but, yes, I think some of the behavioral response studies that the Navy is doing will help with some of this information as well, just kind of feed into the bigger science background.

MR. PUGLIESE: I think that's one of the big points, is that they are doing some of those behavioral, which is I think pretty critical to understand the real adjustments, and even what you've already identified is a pretty significant telling, and you can kind of see some of those things coming out, what they're already seeing up in that area.

MS. BUSCH: If I could, I will just give a little bit of background, because I recognize that people may not know the behavioral response studies that we're doing, and a lot of them are occurring off of Hatteras. Hatteras has a large number of easy to tag pilot whales and beaked whales, and we think that beaked whales are one of the most susceptible species to underwater noise, and so we're tagging the whales, and then we have an actual Navy ship that will set on a course and turn on sonar at different points along that line that it's traveling.

We are not chasing the whales, but, those tags, we can record if they stop vocalizing, which means they have stopped feeding, and at what depth they dive to, when they dive, if they break off a dive, if they change course, all these different things, and so it's getting at how are they responding behaviorally to either the presence of a ship or the presence of a sonar, and that's the other thing too, is trying to tease that out and what is it. Is it the sonar, or is it the ship, but we're trying to get to all of those answers, and so we're doing a large-scale study. We have done it off the west coast, and now we've moved on to the east coast, because we're finding that you can get beaked whales easier out off of Hatteras.

MR. PUGLIESE: I think it's just really important that they're taking this on across the board, the Navy, BOEM, et cetera, and really understanding sound, and I know the Renewables group had jumped in on sound and fish. Before, nobody had even considered most of that, and it's always been on the mammals and everything, and so I think the fact that there's that much of a thing, everything from understanding baselines to behavioral changes, et cetera, it's really an important part of the system that we really need to understand, and this is just one piece of the change that's occurring or has occurred over time.

MS. DEATON: Okay. Let's move on and look at the new wording for the two recommendations, and Roger is going to pull that up on the screen. Steve Ross worked on the one about the deepwater habitat, and David worked on the mackerel.

I will read this through, read it out loud, and you guys think about it. It will now say the AP recommends that the council strongly encourages all relevant agencies and partners to establish sentinel sites for monitoring and sampling to assess long-term status and change in deepwater habitat condition. Base site selection (covering several habitat, depth, and latitudinal ranges) and protocols adopted should be conducted by experts with experience in the deepwater habitats and assisted by council and other agency staff, as required. Examination of existing shallow-water coral or other sentinel monitoring sites may assist this process, in terms of strategies to include or avoid. Does everybody seem comfortable with that language? Okay.

For the next one, which is about the bullet and frigate mackerel, we have a paragraph about what we discussed and recommended in the fall, which said, in keeping with renewed efforts by fisheries management entities to proactively address potential threats to currently unmanaged species, in addition to the growing emphasis on developing ecosystem management approaches, the AP recommended that the SAFMC begin monitoring the bullet and frigate mackerel species.

At that time, we thought more information was needed, and that's why it was worded like that, and now we're going to say -- The recommended wording is this issue was revisited by the Habitat and Ecosystem AP at the spring 2019 meeting, and the AP strongly recommends that the council take proactive actions for bullet and frigate mackerel, due to sound existing science regarding their importance as prey for wahoo and dolphin.

I think the discussion was that there is better diet information about these species than almost any other, and so, even though we do need more information, we've got a pretty good foundation here that action could be taken of some kind, but that the AP didn't want to say specifically what action, deferring to the expertise of the council.

DR. LANEY: There is two areas of concern, maybe, that we identified. One was the reliability of the MRIP estimates for the recreational catch, and then the other was the identification problem in the commercial catches, and so does the panel want to just mention those two things and indicate that we think additional work needs to be done to resolve any identification issues or any recreational catch estimation issues?

Maybe that's the way to say it, just identify the fact that we acknowledge those two areas of problem and that we encourage NMFS, NOAA, because -- Well, ACCSP, I guess, or the states now actually run the MRIP program, in collaboration with ASMFC, and so maybe just say something along the lines of encouraging -- We encourage the responsible parties to continue to work to address the identification issues in the commercial catches and generate better estimates of recreational catch, something like that, and just leave it at that.

MR. PUGLIESE: Do you want to include that in the actual recommendation?

DR. LANEY: Just to put it on the record that, yes, those are two areas of uncertainty that could possibly be reduced with some additional work.

MS. DEATON: Okay. While Roger is typing that change in, go ahead, David.

MR. WEBB: Just as a comment, that's not unique to the bullet and frigate mackerel. I mean, the MRIP -- The deficiencies of MRIP are across-the-board, and so just -- I don't object to it being included here, but I don't know that it's additive to what we're trying to address though.

MS. DEATON: Roger had suggested that it could go in the discussion when he gives the summary, instead of the actual recommendation, and that's another thought.

MR. PUGLIESE: What is the preference of the panel? I mean, you're going to be carrying the recommendation back to the council.

DR. LANEY: You who? Me?

MR. PUGLIESE: You, the liaison.

DR. LANEY: Either way is fine with me. David is exactly correct. I guess the only reason that I thought it might be a little bit more important in this case, David, is because of the fact that we have the diet quantified, and we've got solid information that says, man, these two species are really important in the diet of wahoo, in particular, and, to a certain extent, in terms of dolphin, and, to the extent that the council may ultimately decide that, okay, we want to set some sort of limits, then you really need really good, tight estimates of what your landings are for both sectors, maybe to help you inform whatever sort of limits you want to place on it, and I don't know. What do you guys think about that? I'm good with it either way. We can either stick it in here or we can just -- Roger and I can make sure we cover it in the discussion with the council.

MR. PUGLIESE: Let me jump before you go on that, because I think one of the considerations is that this issue is a bigger issue, and, right now, the SSC is recommending not using those for management, and so those numbers are not necessarily going to be on the table for even that kind of consideration, because they're going to have a workshop to review these, and there's a lot that is going to happen on the bigger picture, and so I think maybe -- The high ground may be to keep it in the discussion and highlight those, because those are high levels relative to what you see, but the reality is that the number itself probably would not be something that would be grabbed, because it would be based on recommendations that the SSC has already said not to necessarily use at this time.

MR. WEBB: My concern is it could cut both ways, and, if we think the MRIP is unreliable, then maybe not many fish are being taken anyway, and I got the sense, and I don't want to speak for the AP, but I got the sense that we felt pretty strongly that this needs to be looked at and that, long-term, all these forage prey fish should be included in some manner, in some way, for a comprehensive fisheries management plan, and so I don't -- I would rather keep it clean. Personally, I would rather keep it clean and strictly to that, but I'm not going to oppose it.

DR. LANEY: I am fine with that. We can address it verbally, and we'll just note that, hey, we discussed this, and these are concerns as well.

MR. WEBB: I did notice there was an edit in the last part. Did we not want to talk about comprehensive fishery management plans, from the draft I sent out, or -- There was a couple of sentences at the end, and I'm fine with it, but I just didn't know if there was a reason that it was chopped.

MS. DEATON: I think we just used the part about strongly recommending to the council, and so that kind of was -- Instead of the sentence you had in there, and it got lost in the process, but I have the new one, and the original --

MR. WEBB: I was trying to tie in the concept of a comprehensive fisheries management plan instead of species-by-species, but I'm good either way.

MS. DEATON: The AP feels the dedicated scientific study should target bullet and frigate mackerel in conjunction with other identified forage prey to enable the future development of comprehensive fishery management plans.

MR. WEBB: It's a recommendation addressing those two prey species, but in the context of a comprehensive -- Which is where Jamie was going with it, an overall comprehensive.

DR. LANEY: I think that's in the two-year roadmap too, I believe, David, wasn't it, and we talked about that yesterday.

MS. DEATON: The next thing on the agenda -- Is Todd Kellison calling in?

MR. PUGLIESE: Yes. He's online.

MS. DEATON: Thank you. Now the agenda item is NOAA Fisheries EBFM Activities for the South Atlantic Region: Status and Timelines for Completion of Deliverables Supporting FEP II. In your materials, that was Attachments 9 and 10 provided by Todd Kellison with NOAA Fisheries, out of the Beaufort Lab.

DR. KELLISON: Good afternoon, everyone. Also, Kevin Craig is here, and we're sort of going to tag-team this presentation, and Mike Burton is listed on the title slide as well, and so Mike is the lead on the climate vulnerability assessment process, but he is unable to be here this afternoon, and so I will cover that part during the presentation.

First of all, we're going to talk about three different sort of ecosystem or ecosystem and climate-related activities that are being led right now by our Southeast Fisheries Science Center, and those are development of a South Atlantic ecosystem status report, a South Atlantic climate vulnerability assessment, and then a multispecies or aggregate production modeling effort that is focused on the South Atlantic, although that has also taken on a Gulf component as well, looking forward.

As we go through each of those, I think we'll cover each of those in sequence, but, after we sort of get to the end of each story, we'll just speak a little bit to the relevance of those efforts to the Fishery Ecosystem Plan and the roadmap and also the just-finalized NMFS South Atlantic Ecosystem-Based Fishery Management Implementation Plan. Maybe, in getting started, Roger or Anne, we could spend a lot of time talking about these, but can you give us an idea of a target time

for us to cover all of these? What should we be looking at, like thirty minutes or something like that, just so we can sort of track our time and not get lost in the details?

MR. PUGLIESE: You have the amount of time -- This is the main thing to discuss this afternoon. We shifted all the other presentations to the morning, and so we'll be discussing the EBFM activities, and so I would say thirty. If you need a little bit more, that's not a problem, I think.

DR. KELLISON: Okay. We'll keep an eye on things.

MR. PUGLIESE: With the connection to the FEP II, those are some of the things that I was literally going to be highlighting and just touching on the roadmap of how some of these are going to be addressing those, with the intent of going into more detail at the October AP meeting.

DR. KELLISON: That sounds great. Okay. Thanks for that. Briefly, the just made public this week, I think, NMFS South Atlantic EBFM Regional Implementation Plan, and that's a mouthful, identified a lot of activities that were part of that plan, both short-term and long-term, but it also identifies five priority activities that are either ongoing or in the future, but, actually, I think maybe all of them are ongoing right now, and those are listed here.

It's the development of an ecosystem status report for the South Atlantic, the aggregation multispecies production modeling, developing community vulnerability analyses, and so that's focused on the socioeconomic component, and our Regional Office is leading that effort, the climate vulnerability analysis, and the last one is coordinating with the council on ecosystem and climate-related efforts, in particular FEP II and the associated roadmap and ecosystem modeling efforts. I just wanted to note that the three that are now underlined are ones that we're covering today, and the coordination is ongoing, and thanks for that, Roger, and I guess I would count this discussion as part of that as well. Moving forward, unless there are any questions, Kevin will get started talking about the development of a South Atlantic ecosystem status report.

MR. CRAIG: Thanks, Todd, and hello, everyone. My name is Kevin Craig, and Todd and I and a number of people at the Beaufort Lab, here and beyond, have been working, for the last couple of years, to develop an ecosystem status report for the South Atlantic region. If you're not familiar with these, they are prescribed under the EBFM policy and roadmap that was developed by NMFS as a whole, and these ecosystem status reports have been developed for a number of other systems, particularly the Bering Sea, the California Current, the New England shelf, and then, most recently, the Gulf of Mexico, but we don't have one for the South Atlantic.

The intent of these is that they be useful for management, particularly fishery management councils, but also other management bodies, and the idea is that they are periodically updated. That varies among regions. Some regions update their ecosystem status reports annually, and other regions, based on resources and other considerations, it might be on a three to five-year timescale, but what I'm going to show today is our stab at the first iteration of this, and so the intent is that it be iterative and that there's a feedback loop between the Center and the stakeholders and the other partners in developing these indicators that will serve the management interests in the region.

At the bottom right, this is a delineation of the South Atlantic, which most of you are familiar with. It's basically from the North Carolina/Virginia border to the Keys, and it's the jurisdictional boundaries for the South Atlantic Council, and we've had a number of contributors to the report,

and so it's being led here in Beaufort, but we've also had input from other labs within the Southeast Center, as well as NOS, AOML, USGS, and a number of other state university partners. I think I did the tally a few weeks ago, and I think we had thirty-three people and seventeen organizations that were contributing something. In some cases, that was just data, and, in some cases, it was actually developing an indicator, and others it was writing up text and actually contributing to the report itself.

The intent of these is to provide trends over time in multiple components of the ecosystem, and so it's very much a -- It tends to focus on time series, and we're looking for datasets that can reflect long-term patterns and different aspects of the ecosystem, and we're also looking for indicators that are focused at a regional spatial scale, and so we tend to try to find things that capture the South Atlantic as a whole, as opposed to maybe particular habitats within that region, and most of them are on an annual to a monthly timescale, and this is an example here for the Atlantic multidecadal oscillation, and so I'm just going to walk through this graph, because there is a pretty standard indicator format that's being developed and that's being used nationwide, and so you're likely to see this if you look at other region's ecosystem status reports or the forthcoming one for the South Atlantic.

This is an indicator for the Atlantic multidecadal oscillation, and so the time series is a monthly time series that extends back to the 1940s, and the long-term mean is this dashed line, and then the two solid lines are plus or minus one standard deviation, and this indicator extends beyond that. Above, it's shaded in green, and below that one standard deviation threshold is shaded in red, and then we also look at what is happening in the most recent time period, and so over the last five years, and you can see, in this case, there is some upward trend overall in the AMO, as indicated by this arrow here, but it's not significant. It's not actually, on average, beyond that one standard deviation threshold, and that's what this filled-in circle represents. This is the standard sort of format that we're using for most of these indicators.

In terms of the categories, we have seven categories, and these are pretty standard among the different ones in the U.S. We have climate drivers, physical and chemical pressures, indicators related to habitat, lower trophic level, upper trophic levels, fishery indicators, and something that is getting a lot more attention recently is human dimensions, and so things like the tomography and economic indicators and reliance of different communities on marine ocean ecosystems.

Those are the categories, but, within each one of those, there is a number of different indicators, and so, in the case of physical and chemical pressures, we have indicators related to temperature and various aspects of the Gulf Stream and river flow and nutrient loading, precipitation, sea level rise, ocean acidification, and so on and so forth. Similarly, for human dimensions, we are tracking population growth and population density within Crystal County in the South Atlantic, but also coastal urban land use, dependence on ocean economy or whether the ocean economic sector is increasing or decreasing, as well as various measures that are being developed primarily by SERO on reliance on commercial fishing or engagement in commercial and recreational fishing activities. Within each one of these categories, there is a number of specific indicators.

I am not going to go through all of those, and many of these are still in the process of being developed, but I did want to give you just a few examples, so you could get a sense of what's included. This is a very common one, sea surface temperature, and the map at the upper-left is the



long-term average sea surface temperature in the South Atlantic, based on integration of various satellite products, and then the graph shows the time series.

This is at a monthly scale, and so you can see summer temperatures are warmer, and winter temperatures are cooler, and there is the long-term trend going back to the 1980s, and one of the things that is interesting about this, as we see in some suggestions, rising sea surface temperatures in the South Atlantic -- There is some indication that summer temperatures may be getting a little bit warmer, but, also, these winter temperatures seem to be warmer as well, and so we're not really seeing these low winter temperatures that were present in the early and mid-2000s.

We don't know if that's annual variability or if it's a classic trend or a secular change in temperature. There have been periods of warm winter temperatures in the past, but it is suggestive that something may be going on in terms of the temperature dynamics in the South Atlantic that we're hoping to track over time.

DR. KELLISON: If I could just jump in, just another note from this is that -- Kevin noted that, over the most recent years, it appears there might have been some warming, perhaps, through the warmer winter temperatures, but another take-home message from this is that, over the last couple of decades, the temperature across the shelf in the South Atlantic has been pretty stable, which is a lot different than we see in the Mid-Atlantic, where temperatures have, from a purely oceanography standpoint, relatively increased a considerable amount, and there is some very clear expansions of species, like northern distributional ranges and things like that, and so, from a -- It's just an aside, but that's the kind of thing that we -- That's the kind of reasons that these ecosystem status reports are put together, to be able to make inferences about what's been happening over the longer period, but it looks like, over the last couple of decades, the temperatures have been pretty stable, but we might be seeing an upward tick over the last few years.

MR. CRAIG: I think the next few years will be telling, to see if that returns to some value similar to the 1990s or early 2000s, or if it's a continual increase. Thanks, Todd. The next example is this sea level rise, and so there are a number of gauges used to monitor sea level along the South Atlantic, and they're shown here in the map, and there is quite a bit of variability in sea level rise among these locations.

The green are areas where rates of less than three millimeters per year have been documented, and the yellow are three to six millimeters per year, and this is a graph that shows the long-term trend in mean sea level rise since the 1920s. On average, in the South Atlantic region, sea levels have been rising, on average, about 2.6 millimeters per year, but, again, with quite a bit of variability. Some areas are experiencing on the low end of about two millimeters up to about four or almost five millimeters per year.

That is, obviously, another aspect, particularly related to habitat and marsh inundation and things like that. That's not an insignificant amount of sea level rise. It's certainly not at the scale that some other places are seeing, for example in the Gulf, where sea level rise seems to be occurring much more rapidly, but this is another one of the indicators that we plan on tracking, because it has implications both in terms of fish habitat, SAV, marsh habitat, those sorts of things, but, also, coastal communities that occupy those areas right along the coastline.

This is another example, and this is from the human dimensions section, and this is showing coastal urbanization within a coastal county in the South Atlantic, and this is data from the NOAA Coastal Change Analysis Program, and I show this because we tend to focus on the time series, but, often, we don't have an annual or a monthly time series over a long period of time, but we might have a change between two points in time, and that is what is depicted here, and so, on the left, this is showing the developed areas in 2010, where the darker colors indicate higher levels of development, and the lighter colors indicate lower levels, and that is based on the amount of impervious surface in those locations.

Then the bright is showing the change, and so it's square miles of land converted to developed areas between 1996 and 2010, and so you can see, pretty obviously, just visually, that there is some hotspots where conversion of land has been higher than others, particularly several places along both the south, central, and northern coast of Florida, but, also, indications that other areas along the coast, particularly off the Carolinas, Myrtle Beach and the Charleston area, are experiencing higher rates of coastal development compared to other counties in the watershed.

A lot of the focus has been on indicators related to fisheries, because that's part of our mandate, is to provide information and advice for managing fisheries, and I'm just going to show three of those. This is from the SEFIS survey that is run by Nate Bachelor out of Todd's branch, and that's a coordinated effort between MARMAP and the Southeast Fisheries Science Center, and that's a trap video survey, and this is showing the total abundance and then the species richness from that survey, the trap portion of that survey, since the early 1990s, and so we've seen a lot of variability in both total abundance, overall species, and also species richness, but there has been a general decline over time, and we're not sure exactly what the drivers of that are, but potential direct or indirect effects of fishing, as well as potential environmental drivers, are possibilities.

Another metric that we've been tracking is the proportion of the landings, total landings, in the South Atlantic that are recreational versus commercial. This is a misprint here, and it's not actually a ratio. What this is showing is the proportion of the total landings that are coming from the recreational sector, integrated overall recreational gears and for the entire region, and so you can see, historically, the recreational sector has always dominated the landings, and it's been about 65 to 70 percent from the 1980s to the 1990s, but there was a jump-up in the 2000s, where it approached 75 or 77 percent, and then, particularly more recently, there's been an uptick in the recreational proportion, to where it's accounting for roughly 85 percent of the total landings in the region. This is work that Kyle Shertzer has done and is a forthcoming publication that further describes these patterns.

We have also been looking at metrics that can be used to help track management performance, and so this is a very common one, the number of stocks that are overfished or overfishing, or where overfishing is occurring, and so this is as of the end of 2018, and so, in the late 1990s and early 2000s, we had a relatively high number, twelve to fourteen stocks, that were considered overfished or overfishing, and that has gone down over time, to the point where now we have somewhere on the order of four to six stocks that are in one of those categories, and so this is based on information from S&T, which tracks, based on the stock assessments, what species are considered overfished or are experiencing overfishing.

There are some caveats to these sort of things, and it does depend on when species are assessed, because, once they're in a category, they stay in that category until another assessment is done,

but, in general, it looks like somewhere around a third of the stocks are in this overfished and overfishing category, but it's down quite a bit from what was the case in the early 2000s.

I just put this in here because we'll come back to this at the end, but one thing that we'll be looking for, as we start to distribute this report, is feedback, perhaps from the APs or the council, about what indicators might be most useful from a management perspective, and so, as I mentioned earlier, the intent is that this be iterative, and so, if there's indicators that we're developing that may not be useful, we can drop those. If there's other ones that might be more useful, then we would like to add those, but, particularly with respect to fisheries, there will be an opportunity, and we would welcome the feedback, on what sorts of indicators would be of most interest and most use.

DR. KELLISON: Sorry to jump in, but just a quick clarification, particularly because Roger is there and would catch this as well, but the last column there, the declines in hardbottom fishes, those data are from the regional scale trap and video survey, which is a collaboration between MARMAP and SEAMAP South Atlantic and SEFIS, and so I just wanted to clarify that, that that was not just a -- It's a cooperative, regional-scale survey, and this data reflect the data from that overall time series.

MR. CRAIG: Thanks, Todd.

MR. PUGLIESE: Thanks, Todd. I was going to ask that question. You jumped ahead of that one.

MR. CRAIG: We're also looking at indicators related to protected species, and so that's another function of the Center, and this is an indicator for loggerhead sea turtles, and I think I was pretty struck by -- These are data that are coming from each one of the states, and so North Carolina, South Carolina, Georgia, and Florida, which each have their own standardized surveys and monitoring and nest counts of loggerhead sea turtles, and so they started at different points in time, depending on the state, but what you see is a really similar increase in nest counts across the board, and it's strikingly similar that all of these states are experiencing the same rate of increase in loggerhead nest counts since roughly the mid-2000s.

Those were the examples that I had to show, and I think, just to outline what our next steps are, we're planning to complete this in 2019, and we are dependent on external collaborators to help us in developing some of these indicators, and we do have other sort of job responsibilities, and so this is a little bit of a moving target, but I think we're pretty confident that we'll have a draft report available this calendar year.

Then I think what is still to be determined is what the review and feedback process is going to be, and it will certainly go through the Center and to the council in some form, as well as to other partners, and we have recently become part of a national ecosystem status report working group, and so we'll be able to draw on some of the expertise in other regions that have been developing these things and working with their respective councils over a lot longer timeframe than we have.

I think that's the last of it, but this is the relevant slide, and so just to highlight the ecosystem status report, I think, is relevant to both Action 3 and 5 in the FEP II plan, if you're familiar with those, and that refers to the development of ecosystem indicators for key species and drivers, as well as time series and spatial maps, things like temperature, chlorophyll, fresh water, and salinity, and so

we have a number of those that we're including in the report, and then it's also related, a little bit more tangentially, but to Action 2 under the South Atlantic Climate Variability and Fisheries, to develop or use these indicators to define triggers for when management action is needed, and so I think part of the intent is to develop these indicators and keep them updated in a way that they can be useful for management.

As Todd mentioned earlier, this is one of the five priority activities that is included in the Center's EBFM implementation plan. I think we'll pause there for a few minutes, and we could try to take questions now, or, if people want to think about it for a while, we can come back and do questions at the end.

MS. DEATON: Are there any questions now? I don't see anybody. You can keep going.

MR. CRAIG: Okay. I think Todd is going to move on to the climate vulnerability analysis.

DR. KELLISON: I'm also looking at my watch and seeing that we're about twenty or twenty-five minutes in, and so I won't spend a lot of time on the climate vulnerability assessment, which is a young effort for us, and so it's really just gotten up and running this calendar year, and so a matter of months, but so what is a climate vulnerability assessment? Well, it's a tool to identify stocks or species that we anticipate are going to respond to a change in climate with some type of shift, like in their distribution or abundance or stock productivity.

Completing a climate vulnerability assessment for a specific region is a priority under the NMFS National Climate Science Strategy and the South Atlantic Climate Science Regional Action Plan. There's a lot of these national-level and regional-level plans, but it's a priority across NMFS regions, and these climate vulnerability assessments, or CVAs, have been completed or are underway for all NMFS regions, and they follow a very specific methodology, and I just put a copy of the sort of title page from a NOAA tech memo which details that methodology, and it was published in 2015, and so all the CVAs that have been completed or are going on within National Marine Fisheries Service are following that specific methodology. I mentioned at the beginning of this presentation that Mike Burton is the lead on this, and, unfortunately, he's tied up this afternoon.

That is the sort of what of a CVA, and the why is that we anticipate that this process, or the results of this process, can be used to guide research and monitoring and management decisions that can be used to identify key data gaps or information needs, and they also have potential implications for fishers and fishing communities, particularly if there are considerable changes, anticipated changes, in distribution of targeted species, and so that's the why.

This is the how, and so it's just some major steps in the CVA process. The first step is to identify what species are covered, and so it's typically a balance between desire to get information on as many species as possible and the knowledge that each additional species is going to take extra effort and less time, and so it's sort of finding the appropriate middle ground between including a sufficient number of species, but not stretching the process out too far, and so identify the species to be included and compile detailed information on each of those species, and so developing what are called species profiles across a suite of characteristics called sensitivity attributes, which are consistent across -- They are documented and are set in that Morrison et al. methodology, and I will come back to those in another slide.

They are also compiling predicted time series of potential physical and biological drivers, and so I think this is not unlike, in many ways, the ecosystem status report approach that Kevin was just summarizing, but it's looking forward, and so it's trying to think about factors that may affect the distribution or the abundance of different species and how those factors might change under different climate scenarios.

Then another step in the process is compiling all of that information and using that to quantify species-specific vulnerabilities, and that is done with the input of people that are very familiar with these species and their life history characteristics and their distribution, and so incorporate participation from experts within the region to make those quantifications, and the result is a ranked or a grouped list of species based on their vulnerability to the effects of, or anticipated effects, of changing climate.

Here is just a list, a broad list, of the types of species that are currently planned for inclusion in the South Atlantic CVAs, and they including multiple snapper and grouper species and species from other reef fish families, and black sea bass is one, and gray triggerfish, both golden and blueline tilefish, and I know white grunt was included, and I think several parrotfish species. I know parrotfish are included, and I'm not sure how many species. There were multiple species of sharks, coastal nearshore species, coastal pelagics, invertebrates, which include, but are not limited to, blue crab, multiple shrimp species, and spiny lobster. Then several biomass or forage species.

I will come back to it in another slide, but, right now, the tentative list is sixty-six species, and so it wasn't particularly informative to try to put those on a slide, but it would be helpful to provide that list, and, Roger, I think you have it. If not, I can resend it, if the panel is interested in seeing that list.

MR. PUGLIESE: I was just going to jump in. I think what I would like to do is be able to provide some input on potential expansion of that list, and I think we had some comments from Steve Poland relative to that.

MR. POLAND: Thanks, Todd and Kevin. CVA analysis, and I am speaking more from the council perspective on this, but, personally, I would really like to see all our managed species included in that analysis. I mean, I know it will be a little bit more daunting, and, for complexes like the snapper grouper complex, I know that's fifty-five or so species, and I know that's a lot, but, from helping us inform management decisions, I really feel like we need to at least consider all the managed species in that list.

DR. KELLISON: Thanks, Steve. That's good input, and I will -- I don't really know what to say right now, except for point taken and I will pass that along. The continuing of reaching out to partners, and so certainly ASMFC -- There are spots where we would like to know as much as possible, and so all of our species we would like to include. Again, we're just going to have to figure out if there's a balance there or if the best approach is just to make this a longer-term process and put essentially everything in there, and so thanks, Steve, and I can keep in touch with you, and certainly Roger and Anne, as this process develops.

DR. LANEY: Todd, a quick question is whether or not -- I know that GARFO, I guess John Hare and his group, have already done a bunch of these for like I think eighty-six or eighty-eight species

or something like that, and I realize they -- I guess they start from at least a different temperature baseline up there, but I was wondering if there was any efficiency to be gained -- Whether or not any of the vulnerability assessments they already did for the species they looked at could be applicable here in the Southeast or, if because of the different habitat conditions and different temperature regimes, you just have to do them over again for the South Atlantic.

DR. KELLISON: That's a great question, Wilson, and I think where the gain is with that is that the information that is compiled for species is often consistent across regions, and so we're certainly coordinating with the Northeast, and so there's a separate CVA process that is ongoing for the Gulf of Mexico as well, and there are a lot of shared species between the South Atlantic and Gulf, and those species profiles -- Actually, while I'm speaking about species profiles, the slide that's currently on the screen, a species profile is just a collection of information that is generated for each species, and it's information that is under what are termed sensitivity attributes, those bullets on the left there, and so all of that information is generated of what's in the literature for each species.

We have a lot to work with already for shared species between the South Atlantic and Mid-Atlantic and between the South Atlantic and Gulf, because a lot of the development for those species profiles has already been completed, and we can just update them for our region, and so there is a lot of gain to be had there, and we are utilizing that. Does that make sense, Wilson?

DR. LANEY: Yes, it does. Thank you.

MR. PUGLIESE: Todd, I think whatever we need to do to advance some of those recommendations is probably worth it, and I'm not sure if we just make sure we get additional representatives to cover all the other species or whatever, and we can reach out to our state partners and the independent research, et cetera, to be able to make sure at least that it's addressed, and, if there's data, there is data. If there isn't, well, at least it sets a stage for future research that does provide that into the future.

I think it's really critical, because a lot of these discussions, especially with the species moving in different directions, we need to at least get things on the table, so that we can know what's coming, and, also, and I think I made it clear to you, is this AP, when we first discussed some of this, offered the fact that the state leads could provide -- They could identify species experts for some of these different things, and so just talking a little closer, to make sure that we've got our ducks in a row on that, I think you can get more accomplished and address management priorities for the states and for the council in a pretty rapid fashion, to make sure we get at least all the right people there and looking at the broadest complex that we know and what we have and then what we need into the future.

DR. KELLISON: Yes, that sounds great, Roger, and so maybe -- I think there's not many more slides with this, but let me jump through the rest of this. Perhaps that will be helpful, and then we'll come back to questions, because I do have a slide for participants, from an agency standpoint, and so you will see that we have broadly been soliciting input from this, and we'll continue to do so.

The current slide, we talked about the column on the left. The column on the right are what are called exposure factors, but they are basically just environmental or maybe climatological factors

that could reasonably affect the distribution or abundance or productivity of a stock, and the critical need for including them in the CVA is that their value, preferably quantitatively, but possibly qualitatively, is sort of predicted under different climate scenarios, and so we have to be able to sort of look forward and say, well, under these different climate scenarios, this is how a particular exposure factor might vary, and so this is maybe the current list of factors that are being considered for inclusion, or are anticipated to be included, but I would certainly welcome input on any of this.

Who is participating in this? This just shows a list, and so it's NMFS, and this says our laboratory, but it would be representation from within our Science Center, which is Gulf and Atlantic, and Roger is the official point of contact for the council, and we have been coordinating with ASMFC and then all of the management entities for the states. Steve, I'm not sure, because I'm not -- I'm involved in this, but not on a day-to-day basis, whether you are aware of this, and I know multiple people have been looped in, including, I think, Steve Murphy and Katie West and others, but were you aware of this before, Steve?

MR. POLAND: Yes, I was, and I actually think I'm on the workgroup, or at least I got the doodle poll.

DR. KELLISON: Great. Okay. Thanks for that, and so I'm glad to hear that, and thanks for that. Then academic partners and at least two retired scientists who are going to be participating, or have indicated their willingness to participate, and one of those is George Sedberry, who many of you know, and so it's a broad list, and we have representation from all of that, and I will jump to what that representation will be in a moment.

Timeline, and so I mentioned that this is quite young, just a matter of months old, and this is just a list of some things that need to happen and whether or not they are in progress or plan, and so species list, and that's tentatively identified, but it's still a work in progress, and I definitely welcome the feedback that has been provided today. Then we're in the process of completing the species profiles, basically collecting information on the species. Then selecting the exposure factors, after which we need to compile data on species distributions and the climate projections for those exposure factors.

Then there's an expert participation process, and so that will involve some work on the participants' end. They will be ranking vulnerabilities, or scoring vulnerabilities, for a subset of all the species that are included, and then a multiday workshop, which, right now, we're targeting for the last week of September to complete the scoring, and so everybody comes together and brings their scores. It will be to process and bring in all those scores together to get some initial vulnerability rankings. Then, after that, there's a lot of data processing and compilation, which I will admit that I am not completely familiar, to go into the finalization of the process, and so we anticipate that happening, I would hope, relatively early in 2020. Again, potentially, depending on if we expand the scope of species covered, that's going to push that farther.

Then, lastly, just the relevance that we mentioned before, and that's one of the five priority activities for the NMFS Regional EBFM Implementation Plan, and it's relevant to the Action 2 under the South Atlantic Climate Variability and Fisheries component of the FEP II roadmap. Maybe we'll stop there. That wasn't as brief as I had hoped, and I'm sorry for not getting through that more quickly, but thanks for the questions and comments, and I can take any other questions now, or we can wait until the end and see if there are any more.

MS. DEATON: I think you're good.

DR. KELLISON: Okay. Thanks, everyone.

MR. CRAIG: This last part will be pretty quick. We haven't made a lot of progress on this since the last update that I believe Todd gave at the fall meeting. We do have a person coming in in about a month who is funded off of some of the new EBFM funds that the Center has got and has received to work on this, but I'll just give a brief overview of what the approach is and what it does and kind of a proof of concept example.

Aggregate surplus production models are designed to provide some estimate of the maximum yield that can be taken from a complex of species and so, typically, with single-species stock assessments, we're concerned with the ups and downs in biomass and landings and so forth of the individual species, but, presumably, there is some total level of yield that can be harvested sustainably that is driven by underlying characteristics of the ecosystem, like the nutrients, the productivity, the trophic transfer to higher trophic levels, and surplus production models are designed to try to get an estimate of what that yield might be, and, in some cases, they can serve as another management benchmark to see if the productivity of the system changed or are we fishing in a way that's above or below what we think the long-term sustainable yield might be.

In terms of the model complexity, they're on the very simple end of the spectrum, and they provide a bridge between single-species stock assessments to more ecosystem-level metrics, and so they only require biomass and catch to fit, and they do provide a complement to some of the more complex models, the food web models, where interactions among species, or among functional groups, are being modeled explicitly in a food web, like just to the right, and those interactions are inputs to these models in a production model, where we're assuming that a lot of those interactions that are explicitly modeled here are already occurring to influence what the yield from the system might be, and so I view these two things as very complementary to each other, and, if we can move them forward in concert, then I think we could draw some interesting insights about what's going on, because they each have their particular strengths and weaknesses and sets of assumptions.

Just the types of data that we have, these are the twelve stock assessments that we have for a lot of the snapper grouper species and also for deepwater species, like golden tilefish, some of the coastal pelagics, like mackerel and cobia. Just to give you a sense of what the catches have been over time, since the 1970s, aggregate catches have been around 10,000 metric tons, and that has declined by about 20 percent, to about 8,000 metric tons. Then the biomasses have declined as well from the 1970s and 1980s through the mid-1990s, and then they have started to increase since the early 2000s, potentially as a result of the implementation of the management regulations, which tended to increase during this time period.

This is just an example, and this is for the snapper grouper complex, where we fit these production models to the individual species and get an estimate of what the individual species maximum sustainable yield might be, but then also the aggregate species, where you get an estimate of what the aggregate yield might be, and we can compare those two numbers, and so, if you sum across all of the different species that from the individual model fits, where they're not really accounting for potential interactions or losses to the system, you get an estimate of about 3.91 times ten to



third metric tons as an estimate of what the long-term sustainable yield of the snapper grouper complex might be.

At an aggregate level, it's a little bit lower. It's about 15 percent less than the sum of those individual MSYs, because, with these individual fits, we're not really accounting for potential species interactions or potential technological interactions between fisheries, and so this was interesting, because it's in line with what people have seen for other systems, where the ecosystem-level MSY is less than the sum of the individual species, but it's not nearly as -- The magnitude is not nearly the same as some of these more temperate and boreal ecosystems, where the ecosystem yield is 20 to 40, or in some cases 50, percent less than what you would get from the single-species stock assessments.

I don't want to make too much of this at this point. This is just sort of to give you an idea. There is quite a bit of additional work to be done here, but I think what it is suggesting, as least as a working hypothesis, is that we might have relatively weak trophic linkages among the snapper grouper species, and perhaps that's a reason why we don't see these large differences between the ecosystem-level yield and the sum of the single-species yield, similar to what you do in some of these more northern boreal systems that seem to have much stronger trophic linkages among the harvested species complex.

As I mentioned, we do have a person coming in who is going to pick this up, and there's a number of things to do, updating this with data from recent assessments, and there's a number of alternative model structures. A big issue is defining what constitutes a complex, and so assume that snapper grouper operate as a complex, and we're going to be doing some community analyses with some of the trap video data to get a better idea of how species are organized into assemblages and whether those are consistent in time and space that can help to inform the production modeling effort, and then we're looking for correlations with environmental factors, some of the things in the ecosystem status report, to see if we're seeing trends that might suggest changes in what the ecosystem can likely support, in terms of fisheries production.

Then, ultimately, comparing this with some of the more process-oriented outputs that will be coming out of the Ecopath and Ecosim approach, where a lot of those processes are modeled explicitly, and so I think, again, just relating this back to FEP II, I think it's certainly complementary to some of the ongoing food web modeling that has been and is continuing to be done by the council and others, and it fits under the South Atlantic food webs and connectivity and EFH, and also the climate variability and fisheries aspects, of FEP II, and it has been identified as one of those five priorities within the Center's EBFM implementation plan.

In terms of a timeline, I think this one is a little longer than some of the others. We're probably one to two years out, at least, I think, to getting some hard numbers or reliable results from this, but hopefully that will be starting soon, as soon as we get the new personnel onboard, and, Todd, did you have anything else? I think that was all that I had, and I don't know if Todd has anything else, but, if not, we can just stand by and open it up for questions or comments.

DR. KELLISON: I don't have anything else. Thanks.

MS. DEATON: I have one question. If you have these different components, but they're all going to be completed at different times, is this going to be reported out together or by these separate categories?

MR. CRAIG: I think Todd can probably speak to that, but I think they're going to be reported out as they're completed, and so I think the ESR will be in some distributed form within the calendar year, and that's what we're shooting for. The CVA will be probably in 2020, and then, the production modeling, possibly some initial preliminary results in 2020, but more likely 2021, and so unless you have some comments on that.

DR. KELLISON: No, and your question was whether the results of these three major efforts that we described would sort of be compiled together, and is that correct?

MS. DEATON: Yes, correct.

DR. KELLISON: I concur with Kevin. They are really independent efforts, mostly unrelated efforts, and they are just summarized here. We just compiled them here because they are sort of ecosystem related, and they relate, in one way or another, to the FEP II roadmap. One of the challenges that I guess I would note to completing these is that all these efforts are ongoing, but they're not really anyone's day job.

The little bit of an exception to that is Mike Burton's lead on the CVA, and just that we've cut out time for him so that he can work on it, but we don't -- Unlike a lot of the other Science Centers within NMFS, and so under the science operations in NMFS' other regions, which have dedicated ecosystem and climate teams, we don't have that within our Southeast Fisheries Science Center. We do have an ecosystem lead, who is Mandy Karnauskas, and she's based in Miami, but Kevin's primary hat is on stock assessments, and my primary hat is working with fishery-independent and fishery-dependent surveys, and so one reason the ecosystem status report process has been sort of rolling along for a while is that we're fitting it in when we can, and it's the same with the multispecies production modeling that Kevin described, and we've been successful in getting some funds and bringing in a post-doc for that, and so that will help speed up some of these processes, but, yes, inherently, there are connections between these processes, but they will be completed and reported on as they are wrapped up.

MS. DEATON: Okay. That clears it up. I do think there's connections between them, and it would be nice to look at sort of the conclusions of all three and see how they are affecting each other.

DR. KELLISON: That's a great recommendation. Thanks, Anne.

MS. DEATON: Anybody else?

MR. PUGLIESE: I appreciate it, Todd. I think it's really pretty critical that we keep things on track to get these accomplished. I know that, in the council's statements up the chain on collaboration on EBFM and advancing these, that these are foundational activities that need to be done to kind of go beyond this. There's a lot of things, I think, that will inform the modeling efforts and inform the way the SSC looks at how you integrate ecosystem and environmental and other types of components, climate issues, et cetera, into the process and into the assessment and

into management strategy evaluation discussions, et cetera, and so it's going to be really critical to stay on line.

I think, in the recently approved South Atlantic NOAA's implementation plan for EBFM, it specifically states that these are the foundational components of advancing some of the first steps for this, and so the council, wherever we need to re-emphasize the commitment from NOAA, from on high, down through the regions, making sure that you have the capabilities and that you have the resources and the directive to accomplish these things I think is really important, and so you're not saying that it is an add-on, because, from the way the implementation plans have been provided, those should be identified, and those specifically talk about ramping up some of the capabilities, and I'm glad to hear that you were able to get some resources for specific support for some of these activities.

Again, I think it's really critical that we move forward with these. The discussions we're having on species moving north, in collaboration with our partners to the north, it's pretty critical that we have some of this information to inform those activities and discussions. It's important to inform the research and monitoring that's going to be connected between the systems, and so it's just these are -- It's good to see things moving, and I take to heart some of the opportunities that you have to expand the activity and to integrate some of the state as well as some of the other partners, to make sure that they get further.

I'm going to do everything I can to see some of the direct coordination that you're already getting with some of the partners, like SECOORA and others, to enhance that, because I think, while you have a foundation for the ecosystem status report components and indicators, et cetera, I think we can refine that, and I'm hoping your coordination with the national level will also provide some guidance and the fact that your Senior Scientist at the national level is very closely familiar with all of this.

With Cisco understanding that, hopefully the directives can come down to our region and allow us and allow you to have the resources and allow our region to have the capability and the understanding and these activities be accomplished, so that they meet our long-term directives under the Fishery Ecosystem Plan and the roadmap, and it supports also the South Atlantic EBFM plan for NOAA.

DR. KELLISON: Thanks for that, Roger. I guess I would just say that we're committed, and we look forward to working with you to get these wrapped up, but, definitely with the ecosystem status report, to make it an iterative process, as Kevin mentioned.

MS. DEATON: Great. Thank you. I know it's hard to compile all of that information, and I guess the implementation plan, the roadmap, was 2018, and so it's a two-year plan, and that would be like 2020, and so we're close.

MR. PUGLIESE: Yes, and I think that's key, that we are somewhat initiated. There are some timing lags on some of these different things that have happened, but I think we really have the opportunity, especially with some of these management actions moving forward and discussions moving forward, to make sure that we meet some of those timeframes and address the FEP, and I do appreciate you being in charge of identifying where it did address some of these specifics under the ecosystem plan, and those directives and actions are under the implementation plan, and

specifically under the two-year roadmap, where these have highlighted the indicators and things that are going to form that. Those are kind of where I was going to go with that next step and discussions about how some of these are going to be addressing that, reiterating the need to keep things on track.

DR. KELLISON: Roger, we'll look forward to continuing our regular discussions with you, just to make sure that we're keeping things well communicated and pursuing what we need to pursue.

MS. DEATON: Good. Thank you very much for calling in.

DR. KELLISON: Thanks, Anne, and thanks, Roger, and thanks, everyone.

MS. DEATON: All right. We're going to move on to our next item. We are getting close to the end, and we've got Roger to just go over the implementation plan two-year roadmap, some of which we've just been talking about.

MR. PUGLIESE: Namely, what I wanted to do was set the stage for additional review and discussion and status that's going to happen between now and the October AP meeting. We want to really move this forward and identify where we've made some progress and where things still need to be initiated and set things in motion, so that, especially within the two-year roadmap, that we accomplish as much as we can to initiate those and then, to a great degree, complete some of these.

I appreciate Todd and Kevin really kind of getting ahead of what they highlighted, which really were the areas that I was going to focus on, because I think that needs to be continually reiterated up the chain on this, is that, under both our council's implementation plan and now the implementation plan through NOAA Fisheries, these are major areas that have to be accomplished and feed a lot of the different actions that have been highlighted that need to be accomplished to advance ecosystem-based management in our region.

I just want to touch quickly on a couple of the ones, probably within just the first three chapters of this that I think have already been highlighted, but I think it's important to just reiterate those, because I can talk about what's going on. One of the first ones was under Action 1 under the food webs, and this really gets to the issues of forage and prey and predator, and I think the important aspect under this action is the issues of identifying species and data, and I think I highlighted the fact that we are formally advancing the discussions under Ecopath and Ecosim modeling and diet complexes, not only building it for the existing, but really setting the stage for understanding the information across all the other species and moving that in, so that that can be collected through our existing fishery-independent and dependent surveys, and so that's an ongoing and initiated process.

Prioritizing maps of forage, and I think the other aspect of this is we're also connecting it directly with some of our ongoing collaboration with FWRI and building of the Ecospecies species information system, and so the ability to not only identify those species and identify diets, but then begin to identify what information we have on distribution is going to be important to understand how those species are distributed throughout our region as well as how they contribute into the diet.

While this focus is on forage, I think the big aspect too is the fact that we're looking at the entire prey complex, and that is lost sometimes in the discussion, and there's been so much focus on that. The great thing about Ecopath and Ecosim is that it also provides that ability to really understand those interactions between species, like say black sea bass and red snapper, and some of the analysis that's been done, even up to this date, are beginning to show some of those connections may be even more significant than we understand, and so that's really important to understand the bigger aspect. I think the key here is that, under these actions, we have initiated those through multiple levels, and we'll hopefully actually really see a lot of this done in advance of the completion timeline here.

The indicators, as Todd and Kevin identified, is that, as part of the ecosystem status report, the opportunity to provide some of those. The other aspect that I see is, as part of the food web development that we're doing under the Ecopath and Ecosim activities, we're understanding the really detailed, complex connections between all of these different species, far beyond, I think, what is even being done in the other areas, and so, between these different efforts, the complement, I think, is really going to address some of these significant actions.

Again, the ecosystem indicators for -- Under that direction for the status report, and that's, obviously, going to move forward. I think the key that I had with that one is that I want to see more coordination directly with multiple partners under the Ocean Observing Association that are contributing, and they're focusing on some aspects, and there's a lot more beyond that that I think we can get into, because I think we need to get things -- Maybe even having issues of how we understand the annual flood activities, and those episodic events can be integrated into some of these discussions of indicators and food webs and implications relative to those.

Patterns on managed species and species distributions, I think we are already initiating activities for that with our developing online web services, and our collaboration with FWRI has been expanding, the distributions of essential habitat and the species distribution mapping that we're trying to initiate, and, again, the activities we're working on on Ecopath and Ecosim and really moving into a spatial aspect, Ecospace, is going to hopefully provide even more motivation to get those types of key things, and they have a lot of value beyond just understanding this, our contributions and connections with our partners as they're looking at siting locations.

If we can get that at the species level distribution maps, the multiple layers of these, as well as habitats, the formation that you're beginning to glean for that is going to be far greater, and then, as it gets into the modeling efforts, it's going to very interesting to see how much we can actually work with that to understand how they are and then how some of it's changing too, because some of that is already being initiated through our partners in the fishery-independent surveys.

As Todd indicated, they're already looking at combining or collecting some of this baseline information, and, again, those are going to be some key inputs for some of these broader model outputs, and so their coordination with Ruoying He's group and others to be able to compile this information is going to be key.

Under the climate variability, again, there is the actions that are ongoing right now that are pretty critical. The first one really is talking about coordination, and I guess I would just touch on a little bit more about the council is coordinating directly with -- The South Atlantic Council, Mid-

Atlantic, and New England Councils are coordinating, in cooperation with the Atlantic States Marine Fisheries Commission, on this issue of species moving north and species moving.

The directive from the Council Coordination Committee was that this will be attacked in two aspects, one on a governance aspect and then another on a science aspect and research, so we understand the supporting information that's providing us -- Be able to anticipate what may be changing or with species changing or environmental conditions that are affecting it, but then also the science that we can connect the different programs to be able to capture that and be able to monitor, both in the fishery-independent, but also on the dependent surveys, so that they can begin to capture it. I know, in the Mid-Atlantic and New England areas, they added I think twenty-five species to their collections, to be able to capture some of these species that are starting to show up in some of their different surveys.

That whole process is ongoing, and I think we may have more of that kind of discussion about how that is advancing hopefully also in the time to come, especially at the October meeting, where we'll probably get further into the fishery-independent activity and how that's going to be advanced further.

The climate indicators, as were identified, some of those are going to be teased out of the beginnings of the vulnerability analysis as well as in combination with the ecosystem status report, and I think them reaching at a national level is going to help refine that, and that's going to be pretty critical, because there are a lot of people that are far ahead of us, in terms of having the information that they can build that and then also inform management. I mean, a lot of them are already using those types of things directly in the management process.

In addition, this one is going to be key, and they have to do this foundational work to ever get to a point where you can begin to talk about how it may impact and address setting ABCs or constraints you may have, and, actually, the allowable catches ultimately that will come out of there, and so those foundational works that are going on now are critical.

The last one I was just going to touch on was on marine aquaculture, and the council actually had voted to develop a marine aquaculture plan. We stopped short of advancing a lot further, because of litigation that has happened in the Gulf of Mexico. However, the bottom line is marine aquaculture is coming, in a big way, and that was something that was very highlighted at the CCC meeting, with some of the facilities that are beyond anything I think I have ever seen, in terms of production, some of those probably a quarter of a million fish could be used in some of these different ones that are used internationally at this point, and the U.S. is determined to step forward and advance these types of efforts more significantly.

I think I mentioned this before, but we can -- From an AP level, we were the ones that developed -- The AP developed the policy statements that have supported the move on informing aquaculture and probably catching up on where the states are and what's going on and building foundational information is some of the steps, I think, that this group can help inform the process, because there's a potential that, once it gets a step further, that we may see a move toward developing a plan or developing actions relative to the plan quicker than not, and so we might as well be ahead of the curve to know how everything is going at the state levels and then how things may adjust and advance and some of the science behind what's being done and then also how it connects to the national directives.

Those are really the main things that I wanted to touch on and where the status is under the FEP II and the roadmap and reiterate what Todd and others have said, that some of those key areas are already being addressed, and we just need to stay on task and get those accomplished, so that that can inform the entire process and meet those implementation goals that the council has been setting. Any comments on where we are and where we're going? I think the bottom line is there's a lot that is going to be done between now and the October meeting, but I think it's going to be excellent, because a lot of things are going to be kind of coming together all at one time at that point, which is going to be really, really key.

MS. DEATON: Roger, I have one question about the other policies, like the SAV, beach nourishment, the dredging, and will we -- I would like to suggest that we get an update on those, even if it's from the state level maybe, at the next meeting, if possible, to just see -- For example, we were talking about the ports in the past, and I'm kind of interested in what the status is of all the different states doing port expansion, and I know we, in North Carolina, are about to do some SAV mapping, and so, anyway, I thought it would be good to hear from the different states as it relates to the roadmap on where we're at with that.

MR. PUGLIESE: Yes, and, truthfully, that was -- I was going to originally initiate some of this in advance of this meeting, but it's just, timing-wise, to get that, and that's what I'm saying, is I think what we're going to do is have a full review of all the different actions at the next meeting and set the stage maybe in advance of that, and so I think we can coordinate with the sub-panel chairs and identify where some of those are and where we stand with the states that may be addressing some of this and where other people may be addressing this and things that still need to be done, and so we kind of get all the ducks in a row, so that, when we go to the October meeting, we'll have kind of a compendium of where everything stands and know where we go, or maybe where we need to reach out beyond that or other things that may be connected to it at that point.

Yes, that's definitely in the -- It was intended, and I didn't mean to kind of cut it off as not being -- That's definitely going to happen, because I think the key is that there's a lot of those that are happening at the state levels, and then some of the partners have highlighted things that are already ongoing that are feeding those, and it will be really good to be able to step back from here and see some of the things that we have discussed here, because I think there were a number of things that were discussed at this meeting that are addressing those that we can immediately begin to connect, and definitely it will give us a real good foundation to know where we are at that meeting, and so, yes, a long answer again to a short question.

MS. DEATON: So, for that to happen, I guess the state leads would need to have a conference call to discuss it.

MR. PUGLIESE: Yes, and I was going to talk -- Because I'm going to work on -- There's going to be a number of things that we want to go with the state leads on some of these things, and so we may follow-up with the discussion we had the other day about those bigger-picture activities, and I will be working with Wilson, I think, to maybe touch bases with the state sub-panel chairs, and then there's going to be a number of tasks that we can accomplish within that one context and hit them all at one time, or multiple meetings, or however we need to do it, but I think we've got a couple of things set in motion, and I was planning on taking advantage of the fact that we do have

Wilson back onboard, and that's going to be a perfect time to enhance some of this direct sub-panel coordination.

DR. LANEY: One of the things too is coordination with ASMFC, which normally happens by virtue of the fact that Lisa Havel sits on this AP, but they are, unfortunately, meeting at the same time we are, but, on their agenda, they had -- They are still working on that habitat management series document for aquaculture as well as one on acoustics also, and so, once they get those finalized, those are things that we can certainly share with this AP as well, and they were also doing a number of other things that I think are going to be of interest to this AP, and so, once those proceedings are out, we can certainly share those with everybody.

MR. PUGLIESE: Most definitely, and I've been kind of keeping a tab on those, because I think they need to get to another state before Lisa was going to advance much on some of those different measures, and so I think some of them are moving faster, and so hopefully, maybe at the next meeting, the next meeting or so, we can get further updates on those pretty important components that they're working on.

MS. DEATON: Any other comments or questions on the status or the roadmap and where we're going? Okay. The last agenda item for the day is the South Atlantic Ecopath with Ecosim model, and Roger is going to handle that, also.

MR. PUGLIESE: Okay, and I'm going to be actually fairly brief. What I want to do is I have provided you to the detailed presentations that were given at the SSC, at our last SSC meeting, from both Tom Okey as the completion and finalization of this iteration for moving forward to review, and then Luke McCracken was providing some foundational about, once you get to a certain stage, how do you actually utilize this, and it sets the stage for identifying how Ecopath models can be actually utilized to inform assessments, management, et cetera, and also how Ecospace -- Because he had done the Ecospace model, the spatially-explicit model, for the Florida Keys, and they are partners -- Directly, we are partnering with FWRI.

What I was going to do is I included a very brief document, and it's called the "Ecopath/Ecosim Model of the South Atlantic Region: The Path Forward", and what it just does is it lays out what we're anticipating is kind of the next steps on where we go with the Ecopath model. The model has been developed at this stage and finalized and balanced and provided as a first iteration and review at the SSC meeting.

What we've done is we've created -- We have taken a team approach to go beyond this, in terms of modeling, and what we do is we have actually engaged FWRI, with Luke McCracken and Lauren Gentry at FWRI, collaborating with Tom Okey, who was the original collaborator we worked with, through the funding through the LCC, and so that modeling team is going to be advancing continued refinement as it goes into a review by the SSC, and so that group is kind of providing the foundational efforts.

As it turns out, that also is going to provide the long-term sustainability of this model. The model is actually going to be housed at FWRI, and we're going to put the processed inputs and the processed outputs actually integrated directly into our Ecospecies system, and so we're looking at that and providing a long-term connection, and it was really very timely and very opportunistic, because it provides a lot of the input parameters for diet and all of those things, and those are the



types of things that we really want to inform by species level in that system, and so it's a great crosswalk, plus the expertise of having a modeler like Luke McCracken, who was trained at the Ecopath Consortium in Spain to be able to advance that model capability, and actually has done Ecospace, and it really sets the stage for us to understand how you translate this into management, because he has actually been using that to evaluate the management scenarios in the Keys and different managed areas, and so there's a real benefit of expanding our collaboration with FWRI to advance this and also to continue work with it.

What has happened now though is this has been advanced to the SSC and understanding the opportunity for how this can inform management, and there was an acknowledgment of that, and it was interesting, because some of the individuals that were maybe more apprehensive got to the point where it was not only acknowledged as an important part of the effort that the SSC should be looking at, but it's like a part -- You should be looking at single-species assessments in combination with ecosystem models, so you can inform those and what some of those changes you may be seeing here are really from these types of activities.

I think it was a really significant step forward to advance that, and so what has happened is we've created an Ecopath model review workgroup. It's a very specific task that these members of the SSC, in cooperation with some appointed members from the modeling team and some additional individuals that are contributing significant parts, will provide a review of the model. What's going to happen though is that we actually are going to advance that.

The first steps are going to have a meeting with the modeling workgroup, but other invited participants, and have very two specific tasks to address of refining diet information, looking at -- The great thing is that, the way it was compiled for this latest model iteration is that, not only was it pulled together on how we built the matrix that feeds the model, but it also provides the understanding of how the different species -- How important they are in within driving the model, so that there could be a sensitivity analysis done that we can highlight which species -- If you get the information on diet, that will affect the model in even a greater way, and so the intent of this very focused meeting is, one, to look at that type of diet information and look at the analysis and begin to provide prioritized species lists to SEAMAP and MARMAP and SEFIS to collect that information and other partners in the states and other programs, and that can be kind of long term, and this is being done in advance of a review. This is really actually looking way into the future, and so it's great to do that, plus build on our partnership that we already have.

The other aspect is going to be building the information from our habitat mapping and mapping capabilities that we are working with FWRI and using that information as a foundation to understand what types of spatial information do we need to drive the development of a fully regional Ecospace model, a spatially-explicit model that has habitat information and environmental information, and so how you pull model outputs from the environmental models and how you pull what forms that distributional habitat information, because this model spatial side has evolved so far.

There is very few that actually have taken advantage of this real high-end capability that we are literally going down some very new roads to be able to really look at all of this in combination, and so that focus is going to be how do we use everything we have to begin to expand that capability, because, ultimately, you can actually look at the connection between the different systems and the connection between protected areas and transporting capabilities and everything

within those types of things, and it's really going to be an investigation. That is going to be some very tasked efforts, even before we do the review, and so that's going to happen.

Another aspect of it is then, at that point, the model is going to be -- We are tweaking any last things and rebalancing and collecting any core pieces that need to be done, so that, when it goes to -- There is going to be an initiation of this review group, a webinar, to kick off the review, and, at that stage, the model will be at the state where they can actually go in and do all of the review and the recommendations, and so we're going to be building that into the future, and so we have an SSC meeting in October, and there will be an update on this July meeting.

The idea is that then we'll advance the model, and it will be in a condition for review, and it will initiate that and multiple webinars in advance of -- The idea is that we would have a full review completed in advance of the April 2020 SSC meeting, so that it would be advanced and really looked at then in how it gets integrated into the system and opportunities to advance this further and to even things such as management strategy evaluation, et cetera.

That is kind of a long-term projection of where we go and how we're moving forward, and so the great thing is that we're building on existing partnerships and advancing it, and there is cross-sectional directions, because we are having all the inputs from the existing stock assessments and everything, and that was provided through our coordination with Kevin Craig at the Beaufort Lab, and so what we want to be able to do is be able to have comparability between the Ecopath model and some of the production modeling that they're talking about doing and how they can inform each other and what advances.

That is where we are going with the bigger picture on Ecopath and Ecosim in our region, and it's an exciting time, because I think the SSC really did see the opportunity to not only inform the existing models, but even pieces and parts and be able to really begin to bring in some of those considerations that everybody has been talking about, environmental components, et cetera, into this discussion, to understand some of this variability that we see in different assessments or connections or really things that may be influencing inner-species interactions that have been discussed, but really not highlighted.

One of the interesting things is the things that were supposed to happen at the meeting were to have it finalized, so we could see where to go and understand how you use it, and then the other thing was do some beginnings of what-if capabilities, and one of the things was to put every single species that we could do in maximum sustainable yield and put that into the model, and the bottom line is the model exploded all over the place, which I think everybody says this all the time, that you can't manage prey and predators and higher trophic and lower trophic at MSY, which is the way we manage.

That was a very visible way of showing the system totally collapses, and you cannot do that, and so it was something that I think opens up that discussion, and I think, to the degree where that is actually being considered nationally on the directives for MSY and what some of the consideration changes may be under Magnuson to allow flexibility and the ability to look at different types of avenues to address these things.

The other one was discussions, and I think I alluded to it before, was the interaction between species, not just what we consider traditional prey and predator, but interactions -- In this case,

there had been discussions about the considerations of red snapper and black sea bass, because there is a very interesting timing, where you have the red snapper population expanding exponentially, and black sea bass was doing very well, and then the black sea bass numbers are continually dropping down, and some of the informed side of the predation that was integrated into the Ecopath model was pointing to the fact that there may be more significant interactions than we had considered in the past, but that's something that is a teaser to begin to investigate, but it was interesting to open those doors.

The other ones had to do with the occurrence of sharks and the population of sharks in different areas and how that may be influencing, and so what I think it did is it did exactly what it was supposed to do. It was to provide that ability to begin to look at these different types of what-if scenarios and inform what we may not be able to see from individual assessments, or even environmental information that we have, and putting it into a bigger context as well as we can, and that at least can give you an understanding of what dynamics may be driving some of these stocks, and so that was a lot said.

MR. WEBB: A couple of questions and observations. Is the participation from all the outside people, the largeness of the group to develop this thing, kind of counting as the peer review, or is there going to be a separate peer review from people that didn't have any input to the development of it?

MR. PUGLIESE: The review is essentially going to be -- This is what this Ecopath model review workgroup is going to be accomplishing. It's going to be -- We have members of the SSC that are really going to be doing the critical review of the model and providing guidance on where it goes and how it can be used, and so that, I think, is going to be the core review of the activity.

MR. WEBB: With the obvious dependence on resources to actually get the processed data, with the single-species management plan we have now, you're looking at three years -- If you're going to do a stock assessment, a full-blown stock assessment, it's three years, or maybe even a little bit longer, and how do you guys envision -- How is this model going to be updated? If you have one species that's lagging out ten years on a stock assessment or something, have you seen anything that shows how that will interact?

MR. PUGLIESE: I mean, that's the evolving thing. What we've done is we have established that we're going to have a core where this is maintained over time. The key though is the way the model operates is that, as the information we've built and the connections directly with ACCSP and directions with MRIP, and it has the most updated information in the system as it is, and the queries and everything are set up, and so the opportunity to inform it as new information comes up is almost instantaneous as you go along, but it just depends on the iteration, if you want to pull everything in that may update it, and so it is very conducive to updating it, and then, as new assessments refine that information for biomasses, those can be adjusted within the system, and I think some of it is going to evolve on how we can do it.

The other thing is this issue of creating the longer-term repositories, and so the individual items that are identified that are input parameters for this may be already in the Ecospecies system, and so, as the assessment is being accomplished, the longer-term thing, a lot of those are updated immediately. If they are already in the system, while we're working on this, you could actually go back and reach to those and even before other activities -- Some of those already could be

updated in the ongoing model effort, and so I think this is one of the most dynamic model capabilities that we have even envisioned, and so we'll see.

MR. WEBB: One more, and then I will shut up. One of the earliest discussions, when I first got on this panel, we were talking about this, and that was the subject of jurisdiction and authority. As we include -- You were talking about the spatial models for habitat and all that stuff, and what kind of conversations are you having internally, and maybe from external sources, about when things start to be identified that are outside the jurisdiction of the South Atlantic Fishery Management Council, but have a critically important impact on what is happening, where are we on that road?

MR. PUGLIESE: I think one of the key things that you see is that discussion we're having already on the species moving north, because the potential that we may have many of our snapper grouper species starting to show up in the Mid-Atlantic region has gone to the point -- Before, where there was a lot of desire to keep management separate and do it, I think there's been a reality check in our partners to the north on, if this is going to become something that becomes broader, the more rapid way may be an expansion of the existing FMP in the South Atlantic to coordinate with them in the area, and so I think that whole issue of jurisdiction -- Now, there is a different aspect that I look at too, and it's kind of inherent in where we started this process.

When we started it, it really was originally founded through our Landscape Conservation Cooperative connections with -- Their connections with SECAS and everything, and so I think that desire to understand the true connection of offshore models with inshore models is there, and we do have kind of the people lined up. The interesting aspect is that the individual they are bringing onboard at Beaufort is the one that did the Pamlico Ecopath model, and so what I'm hoping, and this reaches all the way to the beginning, when we started the process, is we talked about creating a regional spatially-explicit model with connections to sub-models and everything, and that's exactly where I think we're going to get.

Now, the model capability is such that they actually, I think, are getting to the point where they can begin to inform, and so the third group that I mentioned is this ecosystem modeling workgroup, and it actually included individuals like Peter Shang to look at estuarine model systems and how that information could inform the oceanographic models and beyond, and so I think it's multiple ways. It is state jurisdictions and effects on essential fish habitat within -- It's outside the council's jurisdiction, but maybe the state and local affecting that. It's the expansion of ranges, and then I would even say, in the longer term, we may be seeing some of the international activities on some of these.

The way this type of model -- It has the ability to -- You have to put it so that you can compensate for some of those parameters. If X percentage is outside the bounds, you can do it, and so there's ways to make them informed that it's not only just here, but it's from other areas, but it's an evolving process, because this new technology and new advancement is beyond -- I don't think anybody has done it at this scale and has the level of information that we've got already, and that is still just a step to go further, and so, yes, we've been thinking about it a lot.

Any other thoughts or comments on the activities? Laurent has actually been pulled into the group that's going to be meeting in that July -- I think it's really important, because of some of the aspects that he brings to the connections of these systems. I think, as we get into Ecospace, that's really

going to be critical to have the information that we can actually do some of that and understand what some of those connections are and how that influences the overall understanding of the populations. Any other thoughts or comments on that? More to come.

AP MEMBER: I am just hoping from the other end, as far as better scientific data from the fishermen, that it's really going to be enhanced from this electronic reporting that we're starting up and that things will get there more accurate and they will get there a lot faster. Therefore, I think it will be more effective, because MRIP data, through the years, has been -- It doesn't exactly inspire confidence, let's put it that way.

MR. PUGLIESE: I think that's a key, is these different systems are coming online to kind of have more refined information and collection information, and it's going to affect the way the information is compiled for identification of not only the collection of the catch information on that, but also the population, as it gets put into the estimates for biomass, et cetera, and so it's going to be those evolutions, and hopefully we can continue to see that and the support from -- At least I'm seeing the national support to advance that even further, in terms of embracing electronic monitoring, and it's still moving forward fairly significantly, and so I think we're hopefully going to just be the beneficiaries of better information as this goes online.

AP MEMBER: I think that's what all this modeling and so forth is all about. We're managing the fishermen, and we're managing the fish, and it all boils down to that, from a habitat and ecosystem-based view, and I hope, as far as what you mentioned a while ago about the Gulf of Mexico and talking about fish farming, basically, aquaculture -- You go to the supermarket now, and you see bags and bags and bags of frozen tilapia fillets from southeast Asia and China, and the same thing with shrimp. I believe 90 percent of our shrimp are imported now.

Our resource is still out there, and we just have about 40 percent less shrimpers than we did forty years ago, or maybe more than that, but the resource is still there, and you can see that this year, and they're crushing them, but it would be nice to see some American-grown tilapia, and I might even try it then.

MR. MEDDERS: I was thinking about the ecosystem status report, and I'm new to this committee, and so I may be kind of in left field with a hockey stock waiting on the kickoff kind of thing, and so you can stop me if that's where I am, but we have done -- Actually, we're in our fifth year of an ecosystem report card that we did for Georgia, kind of after the Chesapeake model, and we learned, after a couple of years, that there was some interpretation of the data, specifically relating to fish consumption guidelines.

If you go back and look at ours, we dropped fish consumption guidelines, because some assumptions were made about the data that weren't there, and it has made me think about something that David said about the stock assessments taking three to five years. I mean, we usually keep on that kind of rotation, so you can see if what you're doing is working, and Todd and Kevin said that that tracking management process is going to be an indicator, and that one sends up a red flag, like our fish consumption guidelines wasn't a good indicator, because it's not on an annual basis. If they're going to update the ecosystem report annually, like we get a grade every year, and that one might not be a good choice, or they just need to be -- Maybe they're thinking about it, but I just don't know if anyone said that, that they're thinking about the idea that you're reporting all this other data on an annual basis, but that really won't track annually, and

then, of course, they're going to all be at a different -- The process, and it's just something that's been playing around in my mind since it was said.

MS. DEATON: In North Carolina, we do the stock status report annually, based on what information they have plus the latest stock assessment and FMP, but it's not a good indicator, because people have criticized it a lot, because sometimes the status is because of limited data, and there are just so many variables, and it's a gauge. It's just a rough gauge, and that's it.

MR. PUGLIESE: I think the more we can relay these things, and what I'm hoping is that maybe we can get more details of that, so that we can have more input directly to that process, because, while it's foundational, I think there's still opportunity to highlight what may be good and what should be added and all that sooner than later.

I know some of them are set, but there may be things that they can learn from the states on where to go and where not to go with some of these things or things that you should add now, because that's an opportunity, and so I would hope that I could get more from that group, so that we can provide more input from this group to help guide and advance and learn from different activities at different levels.

MS. DEATON: All right. I think everybody's brains are tired, and there's been a lot of information over the last two days, and so is there any other business?

MR. PUGLIESE: The only other business was the October meeting, and the dates have been set for October 22 through 24, and we're going to be meeting at FWRI. We're going to be staying at the Hilton right down the road from them, and so we can walk to there, and then we can go to all the local establishments. It's an easy run from there. It's the 22<sup>nd</sup> through 24<sup>th</sup>, and so we'll be starting first thing in the morning, and so the travel time will be covered from the 21<sup>st</sup> through the 25<sup>th</sup>.

We're going to need that time, as much as we've set the stage for at this meeting on follow-up for that, and I think it's going to be an excellent meeting, and I would definitely encourage the rest of the participants who have been sent off in different directions to be able to make sure they make this, because this is going to be really, I think, a pretty critical one, from everything from the discussions we had on broader coordination to the activities that we have set in motion to coordinate with the state sub-panels and inputs and the advancement of the FEP roadmap, and we'll get updates on the modeling activities and survey connections, and there's a lot. There's a lot to do, but it's all good.

This is going to be a real good meeting, but I will send out the preliminary notices as soon as I get a chance, because we already have the hotel, and you all can start making your reservations whenever you can, and so you can lock it in and probably get the cheapest flights you can this far ahead.

We wanted to make sure we did that early, and that's why we stayed outside from there, because we couldn't even get in there, and they get locked up pretty quick in St. Pete. Any other thoughts or comments? Steve, do you have any, as our chair of our Habitat Committee? We really appreciate him being able to be here for the whole time and be able to hear a lot of, I think, a lot of excellent discussion and advancements that this group -- Any thoughts?

MS. DEATON: Okay. Then meeting adjourned.

(Whereupon, the meeting adjourned on May 22, 2019.)

- - -

Certified By: \_\_\_\_\_ Date: \_\_\_\_\_

Transcribed By:  
Amanda Thomas  
June 12, 2019

5/21/2019

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