SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

HABITAT PROTECTION AND ECOSYSTEM-BASED MANAGEMENT ADVISORY PANEL

Webinar

October 21-22, 2020

Transcript

Habitat & EP AP Members

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Additional observers and participants attached.

The Habitat Protection and Ecosystem-Based Management Advisory Panel of the South Atlantic Fishery Management Council convened via webinar on October 21, 2020 and was called to order by Anne Deaton.

MS. DEATON: I will just start by saying welcome to everybody. Thank you for joining our October meeting, and it's unfortunate that we're meeting like this, and we're missing the fun part of being on these advisory panels, and we could be in Florida right now, but here we are, and so that's okay, because we have a lot of good information to share and to discuss.

AP MEMBER: It's raining and lousy in Florida anyway.

MS. DEATON: There you go. Before we start the agenda, I wanted to welcome Steve Poland, who is here with us today, and, as you know, he's on the council, and he's now the Vice Chair, and so welcome, Steve. Would you like to say something before we get started?

MR. POLAND: Thanks, Anne. Welcome, everybody. The council has decided, for all of our future AP meetings, that the committee chairs should address the APs and just provide a little bit of comment on recent discussions around the council table. Unfortunately, the Habitat Committee has not met in some time, and so I really don't have a lot to update everybody on, but I did just want to pass along my appreciation to all of you all.

I know that serving on an AP is -- It's a volunteer endeavor, and I know that everyone takes time out of their busy work lives, unless you're retired, and then you take time out of your busy retired lives to come and provide the council with good and much needed input, and we really do appreciate that. I am looking forward to the discussions over the next couple of days, and there are quite a few items on the agenda to discuss, and quite a few that are really timely, and so I look forward to everyone's robust discussion, and please don't hold anything back.

MS. DEATON: Okay. Thank you, Steve. If you've looked at the agenda, you can see we have a lot of presentations, and that many of them related back to implementation of the Fishery Ecosystem Plan. With that, I think we should first approve the agenda. Do we have consensus on that? Are any changes needed?

MS. KEENER: I have some minor edits. There are fifteen minor edits, and they do not change the content of the material, and so we can either take a minute and go through those now on the agenda, or we can save time, and I can just send those in as notes later, and so what would you prefer?

MR. PUGLIESE: However you would like to do it, and you can send them on in, unless they change the content or they're things we need to address.

MS. KEENER: No, they don't. They don't change the context of the minutes, and so I will just send them in later, just to save time.

MR. PUGLIESE: Yes, and minutes is the best to do that. That's fine.

MS. KEENER: Okay. Perfect. Thank you.

MS. DEATON: So we'll just assume that we have consensus on the agenda, and the agenda is approved. Paula just pointed out some edits she would like to see with the April 2020 minutes. Does anybody else have any comments or edits they want to mention now about the minutes? If not, you can send those in, as Roger mentioned. Assuming that those edits that have been mentioned will be incorporated, do we have consensus to approve the minutes? Just shout out if you don't. Otherwise, we'll assume that they are approved. All right. The agenda is approved, and the minutes are approved. Before we start the first session, do you want to do a roll call, Roger?

MR. PUGLIESE: Yes, and I was just going to walk through who I have. Then, if I do not call you as an AP member, just let me know. Anne. I guess just identify your affiliation. Anne Deaton.

MS. DEATON: Here, and I'm with the North Carolina Division of Marine Fisheries Habitat Enhancement Section.

MR. PUGLIESE: Cindy Cooksey.

MS. COOKSEY: I am here, and I am with NOAA Fisheries Habitat Conservation Division.

MR. PUGLIESE: Rene Baumstark.

DR. BAUMSTARK: Good morning. Florida Fish and Wildlife Conservation Commission, the Fish and Wildlife Research Institute.

MR. PUGLIESE: John Galvez.

DR. GALVEZ: Here, and I'm with the U.S. Fish and Wildlife Service, the Aquatic Conservation Program, in Florida.

MR. PUGLIESE: Steve Miller.

MR. MILLER: I'm here, and I'm with the state Conservation and Water Management District in northeast Florida.

MR. PUGLIESE: Paul Medders.

MR. MEDDERS: I'm here, and I'm with the Coastal Resources Division of the Georgia Department of Natural Resources.

MR. PUGLIESE: Tom Jones.

MR. JONES: Here, and I'm a Georgia recreational fisherman.

MR. PUGLIESE: David Glenn.

MR. GLENN: David is here, with NOAA National Weather Service and recreational fishing, from North Carolina.

MR. PUGLIESE: Trish Murphey.

MS. MURPHEY: I'm here, and I'm with the Albemarle-Pamlico National Estuary Partnership.

MR. PUGLIESE: Paula Keener.

MS. KEENER: Good morning, everyone. Paula Keener, retired NOAA, and Global Ocean Visions.

MR. PUGLIESE: Bob Martore.

MR. MARTORE: Good morning. I'm with South Carolina DNR, the Marine Resources Division.

MR. PUGLIESE: Lisa Havel.

MS. HAVEL: Hi. I'm here, and I'll be in and out today and tomorrow, bouncing between meetings. I'm with the Atlantic States Marine Fisheries Commission and the Atlantic Coastal Fish Habitat Partnership.

MR. PUGLIESE: Brian Hooker.

MR. HOOKER: Brian Hooker, biologist with the Bureau of Ocean Energy Management's Office of Renewable Energy Programs.

MR. PUGLIESE: Wilson Laney.

DR. LANEY: Thank you, Roger. Good morning, everyone. I guess my immediate affiliation is the Department of Applied Ecology at North Carolina State University, but I am also heavily involved in APNEP as well, and also an ardent recreational fishermen.

MR. PUGLIESE: Steve Ross.

DR. ROSS: I'm here, and I'm with the University of North Carolina in Wilmington.

MR. PUGLIESE: Okay. That's who I have on the list, and I'm not sure if others -- We have a number of different presenters and participants, and those we'll just identify as we get into the different sessions. Are there any other members that I have not called? If not, I think that's our roll for today. There are a number of members that have identified that have a couple of things that are either going on first thing this morning, or later, and so they will be joining as they are able.

MS. DEATON: That's right. All right, and so, with that, I think we'll just move on into the first presentation.

MR. PUGLIESE: Quickly, one thing we do need to do is we are required to take public comment at the beginning and end of the webinars, and we're in the webinar mode now, and so that's become standard for all of our APs. It's not on there, but I noted that's what we need to do, and so that will be first, I think, before we go into the actual session. As indicated earlier on, when any

individual, whether it's a member or presenter or individual at this time, raise your hand, and we'll unmute you to be able to speak.

MS. DEATON: Okay, and so do you want to see if there's any public comment at this point?

MR. PUGLIESE: Yes.

MS. DEATON: Okay, and so, if you do want to give some comment, I guess raise your hand with the little hand button.

MR. PUGLIESE: I don't see anything right now.

MS. DEATON: Okay, and we're going to do that again when?

MR. PUGLIESE: At the end of the session.

MS. DEATON: Okay, and so we do it for each session?

MR. PUGLIESE: No, no. At the end of the day.

MS. DEATON: Okay. All right. That makes more sense. All right, and so this first session has three items, which will take up our morning, and the first presentation has to do with climate, which is one of the FEP -- There are several actions about addressing climate change in the FEP, and then we will talk a little bit about implementation and progress, in the next topic, and then we'll move on to some information and updates on food web and connectivity work that's been done with the Ecopath and Ecosim models, and so first up is Michael Burton from NOAA Fisheries, and he's going to speak to us about ecosystem-based fishery management activities for the South Atlantic region and what they have been working on to deliver for the implementation plan. With that, I will turn it over to you, Michael.

DR. BURTON: Thank you. I'm Michael Burton, and I'm a fishery biologist at the Beaufort Lab of the National Marine Fisheries Service, and the topic today, as you were just told, is the fish climate vulnerability assessment for the South Atlantic region. I will just say, upfront, that my name is on this slide, but this is largely a group effort, and there's probably a cast of a couple dozen people that have been involved in this so far, and so I'll leave it at that.

Moving on, a little background information, and there is fairly widespread agreement in the scientific community, I think, that marine fish and invertebrates are being impacted by climate change. A classic example from the literature, that goes back decades, if not centuries, is the relationship between Pacific sardine and northern anchovy, and it's well studied, and there are large population fluctuations, alternating between the two, and, in large part, they have found that that's been due to climate forcing of at least a couple of different variables, temperature and upwelling. They have done some studies that hindcast this relationship as far back as the 1600s, and so it's not a recent phenomenon.

Recent studies that have been done, more in our backyard, link fish population models to climate models, and a couple of these are studies done by John Hare up in the Northeast, involving population outbursts, if you would, large fluctuations in croaker populations in the Northeast.

Another one, done by Anne Hollowed at the Alaska Fisheries Science Center on northern rock sole in the Bering Sea, and these single species efforts are intensive, and they require extensive resources, and they require the development of mechanistic models that will link the population and climate models together.

One of the drawbacks, if you would, of this is your strategy to assess climate impacts on fisheries, and I'm not saying they shouldn't do these, but they do take a lot of resources, and there is an awfully large number of managed species, and so something that's been developed in recent years has been an alternative method that we'll just call trait-based climate vulnerability assessments. In this methodology, you identify environmental variables that are expected to change, due to changing climate, that could impact the species, and you also identify life history characteristics of those species that could affect their intrinsic resilience to change. Then you put these things together, and you assess the vulnerability.

CVAs were adopted by the agency as a priority in their Fisheries Climate Science Strategy, and here's a picture of that document, and it was done Jason Link et al. back in 2015, and their goal was to conduct CVAs in every major region under their management jurisdiction. They're also a priority under the South Atlantic Climate Science Regional Action Plan, as well as the South Atlantic Ecosystem-Based Fishery Management Implementation Plan.

A methodology for conducting CVAs was created back in 2015, and here's a picture of the cover of that document, and it's a NOAA tech memo by Morrison et al., and CVAs have been completed, or are underway, for all NMFS regions, except for the Caribbean, and I suspect that, when we finish with the South Atlantic and the Gulf of Mexico, which are both currently underway, that they'll get around to the Caribbean.

In essence, a climate vulnerability assessment, by definition, is a tool to determine the likelihood that a species' productivity, abundance, or distribution will be affected by a changing climate. Some of the steps in the CVA process, and I know you all have gotten some of this in a previous presentation, and so I'll just try to go through this fairly quickly, but you have to identify your study area, and clearly that's the southeast U.S. shelf ecosystem.

Then you identify which species to include, and this was done largely by myself, with some input from some partners, and I wanted to make sure that a wide range of functional groups were represented, commercially and recreationally-important species, sharks, things like that, and so, originally, we had sixty-seven species, and that was expanded to seventy-one, with a little bit of input, which I will get more into later.

Then we have to complete a synthesis of life history information on each of those species, and that's called the species profile, and those species profiles were used by the expert scorers that we recruited to score the vulnerability to climate change. Those life history characteristics, or sensitivity attributes, as we call them, we didn't really have to identify those, and there is twelve of them, and they have been used in all of the CVAs in all of the different regions so far, and so that was an easy one. We didn't have to identify those.

We did have to identify which environmental variables to include in the assessment, and those are what we term exposure factors, the things that changing climate will affect the species. Changes in those environmental variables will affect the species, and so those were arrived at by internal

discussions among some of the staff here at Beaufort. Then we had to identify expert scorers to participate in the scoring workshop and compile current species distribution maps, and we used data from the IUCN red list database for that.

The species, we have seventy-one, and they broke out into these sort of nine functional groups that we identified, and we wanted to cover reef fishes, deepwater reef fishes, coastal fishes and coastal pelagics, diadromous species are important, pelagics, the sharks, invertebrates, et cetera.

There is a list of the twelve life history characteristics, or what we call the sensitivity attributes. As I said, these are constant across all the regional CVAs, and they assess a wide -- They describe a wide swath of the life history of the different species, reproduction and spawning, early life history issues, habitat, prey, mobility, their sensitivity to environmental variables, such as temperature and ocean acidification, and then population growth rate and stock size and status. These have an effect on how, could have an effect on how, they respond to changing climate. Then other stressors would include things like habitat alteration for your inshore species, harmful algal blooms, invasive species, are they preyed upon by invasive species, pollution, et cetera.

This is the format of what a species profile looks like. We had a blank template, and, on this one, you will see four of the sensitivity attributes, habitat and prey specificity, sensitivity to ocean acidification, reproductive strategies, and so we filled these in for all twelve of the sensitivity attributes for all seventy-one species. The data column would include a descriptive narrative that described the questions answered in the cells on the left, and the source column would include citations, and then we gave each of those items a data quality score that sort of assessed whether there was an abundance of data in the literature to write these descriptions from or whatever, and so this was quite an undertaking, and it took a bit of time.

The next steps, as I mentioned previously, was to identify the potential physical and biological drivers that affected, that might have affected, the vulnerability of these species, and these were called the exposure factors, and so there were seven that we identified: sea surface temperature, air temperature, salinity, ocean acidification as measured by pH, precipitation, and then currents and upwelling.

The exposures to the first five, which were quantitative exposure factors, were estimated from the ESRL data portal, which is the Earth Systems Research Lab, and I believe maybe it's in Boulder, Colorado, but it gives you all the high-powered global climate modeling and stuff, and it was assessed from an ensemble of twenty-five to thirty-five global climate models for those four, and ocean acidification was estimated from an ensemble of eleven earth systems models.

The bottom two, currents and sea level rise, those were what we called qualitative exposure factors, and we didn't download data for those from a data portal, and what we did was examined the literature and consulted with other experts, such as oceanographers, and then we wrote up a qualitative description that the expert scorers used in assessing a species vulnerability to those two particular exposure factors.

Here is another way to look at what I just said. There is five quantitative, as well as the variance of each of those factors, the mean and the variance, and those were downloaded from, as I said, the ESRL data portal, and then the two qualitative factors on the bottom were created, or assessed, based on literature and expert consultation. This is an example of one of our species distribution

maps, and the red circles on this map are all of the available data nodes from which data could be downloaded from the ESRL portal, and the crosses are the data nodes that we actually used, based on what we understood the distribution of these species to be.

Next, we had to identify a panel of expert volunteers, and this basically consisted of me putting together a list of names, and I consulted with various people around who might know who had expertise in various fields, and, as I remember, I think I talked to Trish Murphey about who over at DMF could be tapped to help out with this effort, and things like that, and so we put together a panel.

These are the names of all the people, and the ones who have an asterisk by their name did not act as an expert scorer, but they were instrumental in providing input, whether it was on species to include or who could be used as an expert scorer, and, as a matter of a fact, I think Roger suggested a couple of people, and we took those people, and they turned out to be a great help to the effort. The name at the very bottom is Mark Nelson, and he's the NOAA affiliate, or contractor, who has been helping me, and he's kind of been my mentor on this effort. He's been involved in all of the agency CVAs to-date, and so he's a great fount of knowledge.

From that list of names you just saw, sixteen of those were expert scorers, and they were all assigned somewhere between twenty and twenty-five species, and their task was to review the species profiles and then assign a rating for each of those twelve sensitivity attributes into a low, moderate, high, or very high vulnerability category for that given species for that given sensitivity attribute.

When we did the scores, they were given for both exposure and sensitivity, and they scored the twelve sensitivity attributes and the two qualitative exposure factors. The quantitative exposure factors were done automatically by the models, when the data was downloaded, and so the human scorers scored the twelve and the two, and they were given five tallies to spread across the four bins, if you would, the low, moderate, high, or very high vulnerability bins. This was a method that forced the scorer to choose one bin as the most likely, because five doesn't go into four evenly, and so they had to have at least two in one of those bins, and this was a way to allow the scorer to incorporate uncertainty into the scores, and there was a fair amount of uncertainty to be spread about.

An example of this would be like, if you knew a species was not exposed to a particular exposure factor, then you would place all of your tallies in the low category, and an example would be blueline tilefish and precipitation. Blueline tilefish are likely not going to be affected by precipitation, or probably by sea level rise either, and so you would put all your categories in the low effect category, or all your scores in the low effect category, for that.

This was done remotely, and the scorers were given access to the species profiles, and they were given their species assignments, and then they were given access to the database to enter their scores, and, when all of the scores had been done, then we had an in-person workshop, where results were passed around and discussions were held, and arguments were allowed to be made as to why I scored this way and whatnot, and all experts were given the opportunity to change their scores based on those discussions. This was a good part of the whole process, because we had a good group of people, and there was a lot of good discussion, and, in the end, we got a final set of scores.

Within Morrison et al., the document that I referenced, the methodology document that I referenced back in the beginning, for each sensitivity attribute, there was a rubric, if you would, to assist the scorers in how to go about scoring, and this is just an example for one of them, and I think it's for prey specificity, and it gives you the goal, the relationship of that sensitivity attribute to climate change, and then it more or less, at the bottom, tells you these are some characteristics of a species that would have a low vulnerability to prey specificity. If eats a large variety of prey, it's able to adapt. If it's a specialist, and it's unable to switch to alternative prey for one of its food items, then it would have very high vulnerability, and so this was just an aid, and this was available and used quite a bit, certainly by myself.

Here is an example of some preliminary results for one of the species, and this was prior -- These were the results distributed prior to the in-person discussion, and this is just quickly to show you kind of the way this breaks out, and so we had five scorers, and you can see them across the top, with the different color assigned to each scorer. There is the graphs for the twelve sensitivity attributes, the four bins across the X-axis, and this happens to be eastern oyster.

The upper-right panel, let's say, as an example, that makes it clear-cut, is adult mobility on eastern oyster. Well, they don't really have much mobility, and so they have a very high vulnerability to environmental factors, because of that lack of adult mobility, and so almost everybody scored those in the very high category.

If you go down to the bottom of that column and look at other stressors, which would include things like habitat alteration and pollution and environmental degradation, clearly most people thought that oysters were very subject to those types of things, and so they were scored as a very high vulnerability, and so this was done for all seventy-one species, and these are what we discussed at the meeting.

People would argue back and forth as to why did I score -- Or this is why I scored my scores this way, and, I mean, just as an example, if I had been on this graph, and I had put all of my scores for adult mobility in the low category, some of the discussion might have been something like what were you thinking, Mike? I mean, do oysters have fins? Why did you give them all a low vulnerability for adult mobility? These were the kinds of discussions that we had, and sometimes things were changed, and sometimes they weren't. We made it clear that we were not trying to achieve consensus on a final score, and that's part of the reason why we have this uncertainty built in, but, due to arguments made by people and stuff, we found that a lot of people did end up changing some of their scores, and so this was a good process.

After the rescoring was done and we got everybody's second round of final scores in, then weighted means were calculated for all of the attributes and exposure factors, and the weighted means simply consisted of assigning a numeric value to each of the bins, one for low, two for moderate, et cetera. Then summing those and then dividing by twenty-five, which was the total number of tallies, and so this weighted mean would give you a value that would indicate what the overall either exposure or sensitivity was.

This was caveated though with a logic rule that was in the methodology, and it said that if any -- Well, you can see it there. If any three or more mean sensitivity attributes or mean exposure factor scores were greater than or equal to a numeric value of 3.5, that automatically got a very high

classification, and it goes down the line, and so I'm not exactly sure of the rationale for this. They have used it in all the other CVAs, but I just haven't studied up on it enough, but we'll see later that this had an effect.

Component scores, which component means either sensitivity or exposure, were all assigned a numeric rank, and then the overall vulnerability was calculated by multiplying the sensitivity times the exposure, and then where the overall vulnerability, in the end, turned out to be depended on where the product of that last equation fit into this matrix, and so you can see that, if you had a sensitivity of two and an exposure of four, then you would be -- A total product of eight would put you in the high category. This was done, and overall vulnerability ranks were calculated for all species.

I will get to some of these results in just a minute, but a couple of other things were done. We asked the experts to assess each species for the potential to change their species distribution in response to a change in climate, and this potential was based on a subset of four of the twelve sensitivity attributes: adult mobility, larval dispersal, habitat specificity, and sensitivity to temperature.

If you think about it, these four attributes are things that make perfect sense in the ability of a species to change its distribution. If it's high mobile, if it has widespread dispersal of larvae, if it's low habitat specificity, and so it can adapt to different habitats, and it has a high tolerance for temperature change, then it should be a likely candidate for expanding their distributional range.

The last thing that we assessed was the directional effects to climate change, or next-to-the-last thing. Excuse me. Scorers were asked to score the directional effects of climate change on each species, to determinate, basically, overall, whether climate would have a negative, neutral, or positive impact on the species. This was just a slightly different scoring methodology. Again, these were assessed by five experts for each species, and they spread four tallies among the three categories. Again, this forced them to put a preponderance of their tallies into one category or another, and it allowed them to spread that uncertainty out.

Then, finally, the last thing that was done was to assess the uncertainty in the final vulnerability rankings by using a bootstrap analysis, a random sampling with replacement with 5,000 iterations, and this was basically just done to assess the species that were borderline between two vulnerability ranks. You might have something that straddled the border between high and very high, and so this was done, and there were a few results from that, which you'll see in a minute.

Results, and I hope you all can see this. I tried to make the print a little bit bigger, but, if not, I apologize, but this is the final vulnerability rank matrix, and what this shows is we have the exposure rankings, or the exposure on the X-axis and the sensitivity attribute axis on the Y, and, depending on what that final product was, the exposure times sensitivity component, it fit into one of these boxes, and I will just say that this was not the result that we expected, because, if you had read, as we all did, the previous study in the Northeast by John Hare et al., it had a lot of these species spread across the far two-right columns. In other words, high and very high exposure columns.

Pretty much all of ours were in the very high exposure, and then they were spread throughout the different levels of sensitivity, and, when we first looked at this, it kind of look us aback a little bit,

but I will get into more about why this was in just a second, but just some take-aways from this is, in the very highest overall vulnerability categories, if you look at those species names, you can see that there is a fair number of diadromous species, and a lot of the deepwater reef fish species and invertebrates. Some of the least vulnerable species include the pelagics and the coastal pelagics, and the reef fish are scattered throughout, and so we'll take another look at some of this data in a bit.

Then the bootstrap -- I will just mention quickly that the bootstrap -- There are some species that are italicized, and that indicates that the bootstrap analysis found that there was a probability that those actually might be in one rank lower, and so that's hogfish, blueline, and golden tilefish. They might -- The bootstrap found that they could actually be ranked as high, instead of very high. Enough about that for now.

Why was everything ranked as an extremely -- You know, very high exposure? Well, this turned out to be why, and this is some output from the ESRL data run on salinity, and, if you look at the upper-right panel, that's a plot of the salinity anomaly, which plots the projected salinity profile against the historical, and so it's the years 2006 to 2055 as the projected, or future, climate, minus the past, which is 1956 to 2005.

If you look at that, you will see that, off of the southeast U.S. coast, we have a projected increase in salinity from two to two-and-a-half to three parts per thousand, and that wasn't seen in any of the other regions, and it's not -- There is some speculation in the scientific literature as to why this might be, and I haven't gotten into reading all the papers yet, but what could be causing this projected increase in salinity? Is it warmer climate and more evaporation, et cetera? I just don't know, but clearly it found that there was a projected increase in salinity, and so that pushed the exposure scores for salinity up above 3.5 for almost all the species, and that triggered that logic rule that said that, if you have three or more attributes, or factors, greater than 3.5, then that is -- By definition, that's a very high classification, and that's what happened, and so this is interesting, and I think this is going to require some more thought, and I haven't got there yet.

Here is a chart that shows one of the other things that we wanted to look at, which was the potential for species distribution change, and this kind of is straightforward. I mean, what we did was plot the scores and assessed what they thought the potential for each of these species to change their distribution was, in response to a changing climate, and you will see that those things that have the lowest potential for changing their distributions include some of the diadromous species and a fair number of the invertebrates. The things that have the highest potential include the open ocean free-swimming things, such as the pelagics and the coastal pelagics, and the reef fish are scattered throughout, and so enough about that.

The next thing that we looked at was the directional effects of climate change, and so, overall, do you think that climate change is going to have a negative, positive, or neutral impact on a given species? First of all, the things, again, and this is kind of in keeping with what we saw in the vulnerability ranks, but the things that shook out as the most negative included diadromous species and invertebrates, and so the things that turned out to be most positive, that climate change will have a positive effect, were the pelagic, or semi-pelagic-type species, coastal pelagics, if you would, and there's a fair number of coastal fish in there, and then quite a large number of species that were in the neutral, or no effect, category.

Just a brief couple of slides about the scores, and this is just a plot of the mean scores, and this is across all species, and so the mean scores by sensitivity attributes, and the top graph shows that the mean scores are in a fairly narrow range, from like one-and-a-half to two-and-a-half or so, and there's not a whole lot to say about that. If you look at the bottom graph, this is what we call the leave-one-out analysis, or sensitivity analysis, of the effect of each of the sensitivity attributes on the rankings.

What this has done is the analyses were -- The means were recalculated by leaving out that particular attribute that is in that column, and so, if you leave out, for example, population growth rate as a stressor, then that had a large impact on the overall rankings. You had the largest number of changes in climate vulnerability. There, it's only about twelve or so, and so this is just another way to kind of look at this.

Actually, I guess I wanted to say that I didn't think about this before we started the assessment, but it makes sense afterwards. In looking at some of the results, that the two sensitivity attributes that seem to have the most effect on the analysis were population growth rate, which included some things such as life history parameters, age at maturity, overall maximum size, maximum age, life history characteristics, and the stock size status. Is B over BMSY good or bad, and, I mean, these two things seemed to have the most effect on the overall vulnerability, from a sensitivity standpoint.

Mean scores and the leave-one-out analysis for the exposure factors tells a little different story, and there's a wide range of scores, from one all the up to four, and so the whole range is covered, but the things that seem to have the most effect are sea surface temperature, and there is that surface salinity that was mentioned before, and then ocean acidification.

I guess a way to think about this, and I had a hard time grasping this, but, if you leave ocean acidification out, let's say, or let's say salinity, because we're talking about salinity, but, if you leave salinity out as an exposure factor and redo the scores, then you get forty-five or so changes in ranking, forty-five species changed in ranking, and so I guess a way to think about this is -- I was having a hard time with the direction of this, but probably what happens is, if you leave salinity out, forty-five of those species change their vulnerability ranking down one, and so they become less vulnerable, but, if you include salinity, clearly they become more vulnerable, and so a lot of the exposure is being driven by these three factors.

Then here's just another way to look at these data, and this is from a functional groups standpoint, and we have those nine functional groups, and you will see that, first, in the left panel, we look at overall climate vulnerability, and we see that the most vulnerable things, or functional groups, seem to be things like invertebrates and the diadromous species and deepwater reef fish. Regular reef fish are scattered throughout, and there is nothing that's really in the low category, because remember we didn't have anything in the low category in overall climate vulnerability. Coastal fish, and coastal pelagics, are spread in the moderate and high, and so, anyway, it's something to digest.

Potential for distribution change, we'll see that the lowest potential for distribution change clearly is invertebrates and diadromous, and so that's kind of the inverse of the overall vulnerability, if you would, and pelagics and coastal pelagics have a high, or very high, potential for distribution change. The directional effects, which functional groups probably have positive, negative, or

neutral effects, and sorry for my axis there. I forgot to change that, but we see that invertebrates and diadromous fishes, again, in keeping with the other panels, have the most negative, or are projected to have the most negative, reaction to climate change, if you would, and everything else is kind of scattered between positive and neutral.

Here's a little bit about the data, and we're just now getting into this. I mean, there's a lot to be dug into with this data, and you can pick a particular species, and I know, when I first looked at the vulnerability matrix, I looked at that and said, huh, I wonder why things like deepwater reef fish, like snowy grouper and speckled hind, et cetera, are very high, and I could certainly understand some of the environmental factors and things like that, but it just didn't seem like they should be there, but, if you dig into the data, the raw scores, and look at all of the different attributes and factors, you will see that some of those species scored high, or extremely high, in those two attributes that I talked about previously, population growth rate and stock size status.

They have life history characteristics that make them vulnerable from the outset, and they're slow to reach maturity, and they're long-lived, and they're fished heavily, at times, which affects their stock size status, and so there's a lot to be dug into here and stuff, but there's still some remaining things to be done. We have to complete the species narratives, which is kind of a snapshot of the results and the life history aspects of these fishes, and do final interpretation and a final report, which I hope will be done by the end of this year.

This is just an example of what a species narrative looks like, and we're going to have to do one of these for all seventy-one of the species, and you'll see it's got the stock status, and it's got the attributes and the exposure factors, with the mean scores. There's a little bar chart showing where those scores chart out at, or what the overall vulnerability rank is, as well as a brief description of which exposure factors and attributes were influential in coming to that score. While we've done a lot, there is still a fair amount yet to be done. That's all I have, and I will be glad to try to take any questions.

MS. DEATON: Thank you, Mike. That was very interesting, and I'm glad that was done, and, like you said, there's a lot to dig into to really digest it.

DR. BURTON: When we get closer to having this done, I will be glad to send the actual raw data out, if you all want it, so anybody can dig through the individual sensitivity and exposure scores, and it's quite interesting.

MS. DEATON: So your plan is that there will be a report that's compiled, and I think it showed that it would be done by the end of this year?

DR. BURTON: Well, I hope. At least on the report side of things. There has to be a report that's given to the S&T Office at Headquarters, and then the eventual plan is to have a peer-reviewed publication come out of this. I don't know, at this, time, if those two will be the same thing or not, and I think the report will come first.

MS. DEATON: Gotcha.

MR. PUGLIESE: Thanks, Mike. We do appreciate it, and we were trying to hopefully have a draft, and I think we appreciate getting into more detail at this session, because that was one

concern last time, not getting further into it, so that the AP could have more response, and I think also from the council level and for states and for our discussions on how to address climate, et cetera, and I think it's going to be really critical that a draft be provided, and we can distribute it, and hopefully that can happen sooner than later. I think Cindy actually had a question.

MS. COOKSEY: One, I wanted to say how excited I was to see all the progress that has been made on this since our last update, and you guys have -- Your team has, obviously, done a tremendous amount of work, and it's looking really good. I'm very interested in seeing what the final report is going to hold, and I just kind of have one question of interest.

Has there been any attempt to kind of groundtruth say any of your results by looking at any species that you had -- That came out of the analysis as being highly sensitive and kind of looking at current literature, where we're seeing more and more reports come out of range shifts, where you're actually kind of seeing any of that happening in real-time?

DR. BURTON: Well, we haven't done any, or initiated any, attempt to groundtruth anything yet. I would just caveat that by saying that I think it was funny, in the beginning of this, when we were getting this underway, that we were careful to try to always frame this in terms of an assessment and not an analysis, because it's largely driven by judgment, expert scorer judgment and input, and not so much by hard statistical analysis or whatever, but, I mean, that's an interesting question, and that's something that we're going to have to look at, I guess, as we get into this and look at some of the more consternating results, I guess, if you would. I don't know if that helps at all or not. I mean, part of it is just manpower.

MR. PUGLIESE: Laurent has a question.

DR. CHERUBIN: Thanks, Mike. This is really, really interesting, and just to follow-up on Cindy's question, actually, I wanted to ask you if you have any idea of what would be the sort of like best research project or idea that you would see would be helpful to somehow substantiate some of the findings that you have, and so you would go out there and have all the technology in the world, and the access to some of the species that you're talking about, and what would be the best way to evaluate, or confirm, some of the findings that you have in your report, in your analysis?

DR. BURTON: That's a good question. I don't really have a good answer for that. I think, if I had an unlimited budget, like you said, there are probably some of the exposure factors that I would like to hone-in on and better define, and, by that, things like salinity and sea surface temperature. I mean, those are fine for things on the top of the water, but, if we could get bottom salinity and bottom temperature for some of these things, would that have a difference on the analysis? It might, and I'm not really sure, but that's living in a perfect world with unlimited resources and the ability to conduct field operations again and things like that.

MR. PUGLIESE: I had a question from Paula and then Cindy and then Steve.

MS. KEENER: This is just an amazing amount of really great information, and thank you so much for the efforts to pull it all together from everybody. You mentioned life history characteristics, and I'm wondering if reproductive strategies were considered at all in this, particularly hermaphrodism?

DR. BURTON: Well, certainly reproductive strategies were considered, because, if you -- I should send you all the document, I guess, the Morrison et al. document, with the descriptions of the various attributes, because all of those questions that are asked within each of the twelve attributes -- Under the reproductive complexity, I think the term was given to the attribute, it was mentioned, and I just can't remember, at this point, how much of that particular life history strategy entered into the discussion, but it was definitely in the description, at least reproductive complexity, as well as spawning cycle and things like that.

MS. KEENER: Thank you.

MR. PUGLIESE: Steve had a question.

MR. POLAND: Thanks, Michael, for going over this. It's really the first time that I've had the opportunity to actually go back and review my notes and think about this since we did the workshop back a little over a year ago now.

DR. BURTON: Two years ago.

MR. POLAND: That long?

DR. BURTON: Yes, and it's been years in the making. Well, was it a year ago?

MR. POLAND: I think September maybe. Anyway, I raised my hand to comment, and to provide comment, based off of Cindy's and Laurent's questions, as far as what are some potential research questions to be addressed, and one thing that I kind of gleaned out of participating in this was kind of the paucity of information out there on kind of like basic life history for a lot of these species, and so the species profiles that Mike put together -- There was a ranking in there of one, two, or three, and that ranking was based off of the information available, either if it's peer-reviewed, updated information, old information, or just kind of the selected experts best guess, and so I would think, if you're interested in looking at research questions, to really help kind of elucidate some of these trends that are coming out, going to those species profiles and just kind of getting a general sense of what's the state of the research.

I think that's a good place to start, because it was interesting to see, Michael, how much of the results were really based off a couple of those kind of factors, one being kind of population demographics, life history and that kind of stuff, and that kind of gets back to the question about kind of reproductive complexity.

I remember that did come up, and I think it was specific to one of the factors, but it did come up quite a bit, and, if I recall, a lot of our discussions on reproductive strategies of the different species were more based on how changes in the environment could affect the success of a reproductive event, given a reproductive strategy, and so how would warming waters, or just changing habitat characteristics, affect that, at all stages of life history and not just the act of reproduction, but through larval and juvenile stages, and so I feel like species with complex reproductive strategies were accounted for under multiple factors there, and so I think that information -- It might not be explicit, but it was certainly considered by the scoring.

DR. BURTON: An example of that, from a reproductive strategies standpoint, is I know we had some substantial discussions about species with aggregation strategies in their life history, and that made them probably more vulnerable, from a reproductive complexity standpoint, if you would, but it also probably made them more vulnerable from a stock size status standpoint, at least for a subset of the species, and so anyway.

MR. PUGLIESE: Wilson had a question.

DR. LANEY: Not a question, but a comment, but Michael and Steve already covered part of what I was going to say, in that, in response to Paula, yes, we did spend a good bit of time talking about reproductive strategies, and complexity in particular, and, of course, the diadromous species are highly and extremely complex, but, also, as Michael noted, those that aggregate, that have aggregate spawning, and those that undergo some sort of a sex reversal during their life history, we did definitely consider all of that.

With respect to Cindy's question about trying to groundtruth some of the things, I will toss this out there. At least for the distribution aspect, my hope would be, and, of course, it's been adversely impacted this year by the pandemic, but my hope would be that the long time series that we have, and I will toss it to Marcel, because he may want to chime in, but, to the extent that we can keep on maintaining our fishery-independent surveys, and keep those time series intact, that should definitely help out with looking at distributional changes.

One that I believe we discussed, Steve and Michael, was the fact that white shrimp appear to be definitely moving north, because there is a viable white shrimp fishery in the Chesapeake Bay now, with landings occurring in the Chesapeake Bay, and so, again, that may be an example. The extent that NEMAP is picking those up, and the ChesMMAP survey picks those up, and so hopefully, Cindy, from fishery-independent surveys, we might at least get sort of a groundtruth check of our assessment of the potential for distribution shifts.

MR. PUGLIESE: A question from Paula and then Cindy.

MR. KEENER: Thank you, and it's just a comment. I think, building on what was just said, using this kind of information and integrating it, a port sample with protogynous hermaphrodites, and using this kind of information with information from commercial fisheries and others in the recreational fisheries, and looking at the sensitivities for those type of species, and not only that, but those that use -- For the larvae, the post-larvae, that use the estuarine areas for nursery grounds and the potential impact that changes in salinity, et cetera, will have on those potential habitats, and so yes, and thank you.

MR. PUGLIESE: Cindy.

MS. COOKSEY: I just -- Kind of carrying along this discussion, in the end, this climate vulnerability assessment is designed to help improve our ability to manage, and I think we will often get more buy-in on the need to include climate vulnerability in our future management actions by being able to highlight cases where we already see alterations occurring in distributions or life history strategies right now and by mining data that we currently have that can help buttress this argument.

MR. PUGLIESE: Anne.

MS. DEATON: I think that's a really good point, is how do we use this information to manage, except that we can take it into account in our heads? Another question that I just had for Mike is, is there a plan to do a habitat vulnerability assessment for the South Atlantic region?

DR. BURTON: I think there is eventually a plan, and I tried to get one going in this next year, and I submitted an idea that we could do it, since they're doing one in the Northeast right now, and I'm not sure whether they have done them in other regions or not, but the NOAA contractor that I was working with on this, Mark Nelson, was all gung-ho about it, and I said, yes, that would be -- This would be the perfect time, to just roll straight from this into habitat, since the methodology is very similar.

Just, as you might expect, you're using habitat types instead of species, and your attributes are different and stuff, but there was no funding for it in this next fiscal year, but, yes, I think, eventually, there is a plan. I think, currently, there is an ongoing communities vulnerability study out of the Southeast, and they're looking at the socioeconomic side of things, in that socioeconomics shop out of Miami, and so hopefully the habitat will come.

MS. DEATON: Yes, because, I mean, really, they are intricately connected, just like you're looking at, for the fish, how the salinity change and temperature change and habitat change will greatly impact the fish distributions and their vulnerability, and so I would encourage that.

DR. BURTON: Okay.

MR. PUGLIESE: Mike, again, I appreciate the comments on that, and that's -- I think the question I have for you is are these being identified as key activities for the Center to accomplish and update and move on into the future? I would look at the habitat one also as one, because, as we move into looking at advancements of the ecosystem modeling, which we'll talk about later on, and Ecospace and some of these types of activities, it would be really nice to have been directed.

I guess what I go back to is the issue of is it identified as a primary function that the Center would be accomplishing and providing to the council to support not just building the information, but also be able to figure out how it can be used and look at other areas where it has been or will be used and advance that, because that's a pretty critical messaging, if that's still not -- Because that was some of the issue in the past, that it had been identified as just added onto other activities, and hopefully we've gone past that, but that's kind of the question I have for you.

DR. BURTON: As far as I know, all of the vulnerability assessment types are identified in a document that I have just been involved in helping to put together, our Southeast Regional Action Plan, if you would, I guess, which is some overarching ecosystem and climate science plan that we're putting together for Headquarters, and habitat CVAs were definitely line-item identified as something -- As a future, near-future, task, as were CVAs, which is ongoing, clearly, and the community vulnerability assessment, which is ongoing, and so it's on the radar screen, I guess is the short answer.

MR. PUGLIESE: Thank you.

MS. DEATON: Are we ready to move on?

MR. PUGLIESE: I think, given the timing, we may have to do some adjustments on other aspects, and I've given you some recommendations, and we'll go from there, but let's move on. This is the critical, these areas here, in terms of the longer-term information that's going to be needed by the council to advance efforts on an ecosystem and climate impacts. Getting the more comprehensive review at this meeting was really anticipated and appreciated, and so, yes, let's move on.

MS. DEATON: Also, I should have mentioned, for just logistics, there is not a break scheduled until noon, and so just hop off when you need to take a break, really fast.

MR. PUGLIESE: I'm going to make Kevin Craig the presenter.

MS. DEATON: All right, and so we've got Kevin Craig and Todd Kellison here to give us an update on the South Atlantic Ecosystem Report. Take it away.

DR. CRAIG: Hello, everybody. This is an overview of the South Atlantic Ecosystem Status Report that myself and Todd Kellison at the Southeast Center have been leading. We have done a number of short briefings on this report, and so perhaps you have heard of this, or seen some of this before, but Roger had asked us to do a little bit of a deeper dive into the report and what it includes, particularly as we're getting to the final stages, and so we do have a draft of the report that's undergoing some internal review and editing and so forth, and so we expect it to be completed hopefully by the end of this year.

What I wanted to do is talk about what ecosystem status reports are in general, and these are in existence in various regions around the country, but they're fairly new to the Southeast Region, and then I will give an overview of the South Atlantic report and what it includes and show you some of the indicators and a little bit about how they fit together, or not, and then I want to broaden back out, at the end, and talk a little bit about how ecosystem status reports can be used in management, by giving some examples of how these are used in other regions, and hopefully that will lead to some discussion and feedback about how we can use ecosystem status reports to address whatever objectives related to ecosystem issues that the council, or other management bodies, might have, and, also, just provide a framework for increased communication between scientists and managers.

What is an ecosystem status report? This is basically a synthesis of scientific information on a wide range of ecosystem components that includes information on physical characteristics of the ecosystem, climate drivers, all the way up to sort of macroeconomic indicators related to employment and gross domestic product arising from association with the oceans, as well as a number of human dimensions. We looked at measures of engagement and reliance on recreational and commercial fishing, and so this is a very shallow dive into a broad range of topics.

ESRs are a core component of the EBFM Roadmap, as well as the implementation plans for that roadmap for the different regions. They're a priority in the climate science strategy, as well as in the IEA, or integrated ecosystem assessment, regional plans, and so they're a component of a lot of these larger national issues related to ecosystem-based management.

The objectives of ESRs are to provide a broad overview of the current state of the ecosystem with respect to recent and historical trends, using a suite of indicators, and the intent is also to transfer that knowledge to managers, to provide context for information for making a range of decisions that affect marine ecosystems, and, as I mentioned before, they are intended to be iterative and updated and improved over time, and it's not intended as a one-and-done sort of process, and so we're really interested in increasing communication and information exchange and engaging in some sort of feedback, where we can improve the report and make it as relevant as we can to a lot of the objectives of the council with respect to ecosystem issues, and so those are the general objectives.

MS. DEATON: Can I interrupt for just a second, Kevin? I noticed that we do see your presentation, but we're seeing the slides and the notes page, too. Do you have two screens?

DR. CRAIG: I do, but I don't have a notes page up. Let's see.

MS. DEATON: Sometimes, if you selected the wrong screen to share, that's what happens. I don't know -- I mean, it's fine if you want to leave it like that, but I was just letting you know.

DR. CRAIG: It should be in presentation view. Let's see.

MS. MURPHEY: I think, if you go back to where you were and hit -- I think there's something called Display Settings, at the top left, and you hit "duplicate" or something, and that should fix it.

DR. CRAIG: What do you see now? Do you still see the notes screen?

MS. DEATON: Yes. Try that trick that Trish mentioned. See at the top.

MS. MURPHEY: See the Display Settings at the top left.

DR. CRAIG: What are you seeing now? Are you seeing the presentation view, or are you seeing the next slides?

DR. LANEY: That fixed it.

DR. CRAIG: Okay.

MS. DEATON: Sorry about that.

DR. CRAIG: That's okay. No, thank you. I didn't realize that that was happening.

MS. DEATON: It's bigger too, this slide.

DR. CRAIG: Okay. So where are ecosystem status reports being done? These are being done across the country, and these are the different regions that have ecosystem status reports, as well as when they were first initiated and then the frequency with which they're updated. You can see there's quite a bit of variations among the regions. In the North Pacific, in particular, there has been ESRs ongoing since the late 1980s and early 1990s, in the Eastern Bering Sea and the Gulf

of Alaska. They also had a more recent report for the Aleutian Islands, and then there's one for the Arctic Ocean, and that's an international effort that's in progress now.

The New England does one, or the Northeast does one for New England, which includes the Gulf of Maine and Georges Bank, as well as the Mid-Atlantic, and those were initiated in 2009, and they are updated annually. The California Current started in 2012, and this is updated annually. I should say that most of these efforts are geared towards federal waters, and particularly federally-managed species. West Hawaii is the one exception, and they started in 2016, and they are very much geared towards state-level management issues.

The Gulf of Mexico, the first report was done in 2013 and was recently updated in 2017, and then this is the first ESR for the South Atlantic, and there is one for the Caribbean that's in progress, and so there's a lot of sort of collective knowledge and wisdom about how to structure these reports and how to use them from these other regions that we're trying to draw on and apply in the South Atlantic.

There is also a national ESR workshop that was done in 2017 that reviewed ecosystem status reports, and it summarized the regional plans for their development, and so each region had a five-year plan for the development of their ESR, and it also provided some general guidelines about how to improve ESR content and how to streamline and make the production more efficient, and then a big focus has been on how to engage managers and get this information used in a management process, and so, if anybody is interested, that report is available at this website, and then all of the regional ecosystem status reports are also available, so you can kind of see what different regions are doing.

In terms of the South Atlantic ESR, this has been going on for about three years, although, in earnest, probably for the last year or year-and-a-half. This list shows the contributors to the report, and so we've had twenty-three different organizations, and about sixty individuals or so, that have contributed data, time series, or interpretation to the report, and that includes a number of the labs within the Southeast Center, and NOS has contributed, and the AOML.

The U.S. Geological Survey has been important, particularly with some of the more land or land-based indicators, and we've had contributions from virtually all of the state agencies in the region, as well as a number of the universities, and you can see here, in the upper-left, what the domain of the reports -- This is basically the South Atlantic Council's jurisdictional area, and so this is what we're considering the U.S. South Atlantic, and so most of the indicators are limited to this region.

We used an indicator-based approach, and the intent is that these track, or are proxies, for trends over time that reflect biological, chemical, physical, social, and economic conditions of the ecosystem. There is an emphasis on quantitative, and so we're focused on trying to quantify these changes. We're also focused at a regional spatial scale, and so we want indicators that kind of reflect conditions in the U.S. South Atlantic as a whole.

Sometimes that's not always possible, and so we do have indicators at much smaller spatial scales, if the regional scale information isn't available, and we also do track information on key kind of ecosystem components, for example coral reefs that are limited in geographic extent, but are important ecosystems for the region.

In the South Atlantic, we have seven categories of indicators, and forty-eight indicators in total, and 182 time series, and so it's a lot of information to collect and try to quantify and make sense of, and one of the things we use as a standard reporting format, and this is in use in all of the ESRs throughout the country, for the most part, and this is an example of using the Atlantic Multidecadal Oscillation, but the point that I wanted to make is that the indicator is shown in black, and the long-term average for that indicator is shown in the dashed line, and plus or minus one standard deviation from that mean is shown in the solid lines, and so you can easily see periods where the indicator extends above that one standard deviation threshold in green or below that one standard deviation threshold in red.

Then we do some simple statistics on the last five years of the time series, to try to determine whether, in the most recent years as the indicator, is it declining, is it increasing, or is it stable, and so you'll see this sort of format a number of times, and it kind of facilitates the comparison among the indicators and sort of standardizes the visual presentation a bit.

These are the seven categories, and these are pretty common in most ESRs. There is climate drivers, large scale processes like the AMO, as I showed in the last slide, and physical and chemical pressures, and we include information on habitat state, things like seagrass and salt marshes and oyster reef, where it's available.

Then lower trophic levels and upper trophic levels and ecosystem services, which includes a lot of indicators related to fisheries, if you think of the South Atlantic as support for fisheries as one of the services that the South Atlantic ecosystem provides, and so we include information on fisheries indicators as well as a number of protected species or species of concern, like marine birds, cetacean strandings, sea turtle nest counts and so on. Then an increasing emphasis, in recent years, has been on this human dimensions and trying to quantify the condition of coastal communities, fishing-dependent communities, employment levels and ocean-related activities and so on, and so those are the seven categories.

I am not going to go through all of the indicators, but I did just want to give you a list, basically, of what is in the report and then show some highlights from these afterwards, but, in the climate drivers section, we have all of the major large-scale climate drivers that have direct, or in some cases interactive, effects in the U.S. South Atlantic, and these include things like the AMO and the North Atlantic Oscillation, and you have probably heard of El Nino, or ENSO, and the North Atlantic Tripole, and the Atlantic Warm Pool, and so these are large-scale climate drivers that extend well beyond the U.S. South Atlantic, but they have important influences there.

Physical and chemical pressures include a number of things, like various measures of temperature, sea surface temperature, bottom temperature, decadal changes in temperature. Then a number of indicators related to the Gulf Stream, which has a large influence on the underlying productivity in the South Atlantic, and so position of the Gulf Stream, and we have some indicators related to upwelling.

Then the Florida Current transport, or the amount of flow that's coming through the Florida Straits and feeding into the Gulf Stream, and we also have a number of more land-based indicators, or indicators that are influenced by processes that occur at the land-sea interface, and so coastal salinity, and we synthesized a lot of the stream flow information, nutrient loading from the major watersheds that empty into the South Atlantic. Then regional precipitation and drought patterns,

as well as sea level rise, and then we also track things like storms and hurricanes and ocean acidification.

Habitat and lower trophic levels, these are two where we're probably the most limited, in terms of indicators, and I think that's one of the values of these reports, is they do tend to highlight where information gaps exist, and so we do have some information on forested wetland cover, SAV, oyster reefs, some information on coral demographics, and then, for lower trophic levels, chlorophyll-A from satellite imagery, and we collected a lot of zooplankton information that exists in the region, which is fairly limited, as well as some measures of ichthyoplankton and forage fish abundance.

For trophic levels, they're mostly coming from the surveys that occur in the region, and so there's a SEAMAP trawl survey and an offshore hardbottom trap video survey, and longline survey, and so we developed similar indicators across those different surveys to track patterns and abundance and diversity, and we also do some higher-level indicators, for example mean trophic level, which is used as an indicator of ecosystem health, and it's basically an indicator of the effect of fishing on a community.

Then, for ecosystem services, we pulled a lot of information from the stock assessments, and so the biomass and recruitment of the assessed species, and then we have information on aggregate commercial landings and revenue, recreational landings and effort. Again, most of this is focused on federally-managed species, but we do include some of the key state fisheries, particularly shrimp, crab, and oyster landings, as well as a number of the megafauna or apex predators, marine mammals, sea turtles, and marine birds.

Then, for human dimensions, we have the measures of population density, coastal urban land use, and then some economic indicators, as well as engagement and reliance on commercial and recreational fishing, and so that's basically a catalog of what's on the report.

What I want to do is just kind of go through each one of these categories and show you some of the indicators. This is from the climate drivers section, and so this is -- I showed earlier that AMO is a multi-decadal mode of climate variability, where there is both warm and cool phases, and so you see there is a warm phase that existed up through the 1950s and 1960s.

The 1970s and 1980s shifted to more of a cool phase, and then, in the mid-1990s, there is a shift back to the warm phase, which has extended to the current time, and so we're in a warm phase of the AMO, and that tends to be associated with increases in precipitation in the watershed, and it affects Atlantic hurricane activity, mainly through its effects on the transport of moisture, atmospheric moisture, content. We're in a period where we would expect increased hurricane frequency now, more so than in the 1980s and early 1990s.

One of the other large-scale climate drivers is the Atlantic Warm Pool, and so this is the area of water that's above 25 degrees C, and so you can see here, on the right, these extends much beyond the South Atlantic, and it includes most of the Caribbean and the Gulf, as well as the hurricane development area for our region. The AWP has increased over the last thirty years, and so we've had an increase in the area of warm water that has extended up along the eastern coast of Florida and through the South Atlantic.

This increase has occurred over the last thirty years, and it's consistent both with the shift in the AMO to a warmer phase and also with trends in increasing sea surface temperature associated with global climate change. Again, that also leads to higher precipitation and changes in moisture content in the atmosphere and increased hurricane activity.

Some of the physical pressures, we have a number of measures of temperature, and so this is sea surface temperature from satellite imagery on the South Atlantic Shelf, and so what you're seeing is temperature in degrees C, and this is in a monthly time scale from the early 1980s up through 2018, and we have seen some indication of an increase in sea surface temperature in the most years, particularly since 2013, and that's most evident in warming winter temperatures, but also, to some extent, increasing summer temperatures.

That pattern seems to be corroborated by some of our survey data, and so this is average bottom temperature from the SERFS, and this is the trap video survey that's conducted annually in the South Atlantic, and so you see a lot of variability in average bottom summertime temperatures through the 1990s and early 2000s, but we've had the warmest years on record that have occurred at the end of the time series, particularly, again, since 2013, and we've had above-average bottom temperatures.

Those changes are occurring against the backdrop of longer-term increases in temperature, and so this is another indicator that we include in the report, and this is the -- These are mean surface and mean bottom temperatures by decade from the 1960s to the 2010, and so this is coming from the world ocean database, and so you can see, since the 1970s and 1980s, we've had a pretty consistent increase, and not a large increase, but a pretty consistent increase in both the surface temperature and the bottom temperature that amounts to about a degree, or a degree-and-a-half, over that forty-year timeframe, and so we have multiple indicators that there is some changes in ocean conditions that are leading to increases in both sea surface temperatures and bottom temperatures in the South Atlantic.

We have looked at this in relation to some other indicators that we've developed, and I think this illustrates one of the values of these ecosystem status reports, because they pull together different sources of information that, in some cases, lead to new questions, or new hypotheses, and so I showed the suggestion of rising temperatures in the last slide, and that seems to be associated with a decrease in upwelling intensity, and there is a mechanism that suggests that warmer surface temperatures, in particular, might impede the transport of nutrients from deeper waters up into the photic zone, and we also looked at chlorophyll-A concentration as an indicator of primary productivity, and we've seen what looks like a decline in primary productivity over time.

You can kind of see what that looks like on the shelf in these maps to the left and the right, and so, in high-productivity years, you tend to have high surface chlorophyll-A that extends pretty much across the continental shelf, to the shelf-slope break, and then, in low-productivity years, you see these patches of large areas in the mid-shelf region of low productivity, particularly in these regions from southern North Carolina down through Georgia.

This has led to the question of how do these changes in productivity -- One, can we validate those, and so we're looking at some other satellites and other information sources, to see if we can corroborate these patterns, and then looking at how they may be linked to recruitment dynamics of shelf-spawning fishes, particularly hardbottom reef fish species, and so this is -- We have a

research project, or a couple of research projects, that have been funded to look at this issue, and so I think this is one example where pulling together information in an ecosystem status report would help to develop these hypotheses that can then fuel additional research to answer some of these broader questions about how the ecosystem may be changing and what the implications may be for managed species.

A lot of that work is related to the sort of open ocean dynamics, and we've also looked at more land-based indicators as well that may be more relevant to nearshore estuarine ecosystems, and so this is an example of precipitation since 2000 and drought severity since 2000, and so you can see there's a lot of variability in precipitation, but precipitation has been increasing. In fact, 2018 was the wettest year on record, I think since precipitation measurements have been taken in the United States. I should say this is for the South Atlantic states and not for the U.S. as a whole.

This is drought severity, and so there seems to be an inverse correlation, as you would expect, where you have periods of relatively high precipitation, but low incidence of drought, and, in general, the Southeast precipitation has been characterized by these really frequent high-intensity rain events that are interspersed with fairly long duration dry periods. Sort of projecting that out, if you look at the general climate models about what the expectation is in the future, it's that the Southeast is going to become wetter, but there's going to be some regional variation in precipitation, with most of the Southeast experiencing increase precipitation, but peninsular Florida, in particular, is expected to become drier into the future.

That's relevant because precipitation is one factor that influences stream flows, and stream flows are one factor that influences nutrient loading into coastal ecosystems, and so nutrient loading is going to lead to a number of issues, like increases in hypoxia, harmful algal blooms, and so on, and this is work that was contributed by the USGS. They do water quality models where they synthesize all of the flow and nutrient-loading data for all of the major watersheds in the South Atlantic region, and so this is showing total nitrogen inputs in the solid line and total phosphorous inputs in the dashed line for these various watersheds that drain into the South Atlantic.

On average, and this is between 2002 and 2012, there's been about a 20 percent increase in nutrient loading to the coast, although that varies quite a bit among the different watersheds. Some have changed from as much as up to 40 to 50 percent increases in nitrogen and phosphorous over that ten-year timeframe, but the broader point is that most of these watersheds are showing increases in nitrogen loading and increases in phosphorous levels.

This is another indicator that reflects issues going on in the nearshore and coastal zone for sea level rise, and so this is one of our longest indicators, and it goes back to the early 1920s, in some cases, and we have a number of stations along the Atlantic seaboard that are measuring sea level rise. Sea level rise, obviously, has some negative effects on coastal infrastructure, and it can have a number of impacts on marsh and beach-dependent species.

If you look in the Southeast, the average rate of sea level rise has been pretty comparable to the long-term global average of 1.7 millimeters per year, with particular hotspots in south Florida and then in sort of the Cape Hatteras region, although this looks like there's been some kind of acceleration in sea level rise since the early to mid-2000s. We had a relatively stable period from the 1990s to early 2000s, but, in the last five to ten years, there has been some acceleration in sea level rise.

I mentioned habitat earlier, and there were some questions about habitat in Mike's talk, and I think this is one of the indicators that we have the least amount of information, particularly at the regional scale. Most of the habitat work that's being done is being done at the state level, and so sometimes it gets difficult to integrate that, due to differences in sampling design and time and sampling errors and so on, but this is one example where -- This is wetland coverage, and this from the Coastal Change Analysis Program, and this is showing a change in wetland coverage from 1996 to 2010 on the right, and then the change in forest cover over that time period on the left.

Over this about fifteen-year period, wetland coverage has declined by about 1.5 percent, and so not huge declines in wetland coverage, although there have been big changes in some of the underlying types of wetlands, for example continuous versus emergent marsh, but, overall, not a big change in wetland coverage, and it seems to be concentrated in particular areas, like the Orlando metro area, as well as the Myrtle Beach area, but there's been about a 17 percent decline in forest cover, and you can see that here on the left, and so that has occurred mostly in these areas with these lighter colors around Charleston and around Myrtle Beach and then in the Albemarle-Pamlico region.

When we don't have good information to develop time series, sometimes we try to just collect the information and report it as it exists, and that's the case for a lot of the structured habitat, and so this is showing the seagrass areal coverage and percent change for multiple nearshore ecosystems, several in North Carolina and Florida. These are difficult to integrate, because the sampling has occurred at different times, or is using different methods, but we just report this as-is and then allow people to dig into the original reports or interpret as they see fit.

In some cases, it looks like there's been some increases in seagrass coverage, for example in the Indian River Lagoon system between 2011 and 2013, although that preceded some declines that had occurred earlier, and then, throughout North Carolina, we have fairly small, but notable, declines in seagrass coverage between the early to mid-2000s and the 2010s, and so this is another example where, when we have sort of limited information, we just try to report what's known, so that that can be used as a basis for other people to interpret or to expand on or to develop research programs or monitoring programs to address it.

This is an example of sort of a key ecosystem, and so Florida, for the coral reefs, and they aren't particularly abundant throughout the South Atlantic as a whole, but they are very important in the Florida Keys and south Florida, and so this is information from the Coral Reef Watch Program that shows time series of thermal stress, which is related to bleaching, where corals expel their symbiotic algae, and that potentially leads to mortality, and so degree heating week is an indicator of thermal stress, and you can see that thermal stress on corals that might lead to mortality, above eight degree heating weeks, has increased pretty consistently since the mid-1980s, both in the Florida Keys and in south Florida, and that's mirrored by degree heating days above four, which is an indicator of stress, but not necessarily mortality.

If you look at when those are occurring, and so the period of thermal stress is beginning earlier in the year, and so warmer temperatures are occurring earlier in the year now than they did in the 1980s, and it's persisting later in the year, and so we're getting both an increase in temperature, but an expanded duration over which those stress temperatures are occurring, and that's consistent with some of the other information that we're seeing on rise in sea surface temperatures.

Upper trophic levels, this is mostly coming from, as I mentioned, surveys in the region, and so we do have an opportunity to track multiple components of the food web, because we have surveys that sample very different components of the food web, and so the longline survey samples apex predators, and particularly sharks. The SERFS, or SEFIS, trap video survey samples mostly reef fishes on hardbottom, and then the SEAMAP trawl survey samples in the nearshore, and it primarily captures juveniles and demersal fishes, and so we've developed indicators that are standardized, so we can track different components of the food web over time from these different surveys.

This is one example, and this is some work that was published a few years ago that shows, for hardbottom reef fishes, species richness has declined over time, from the 1990s to present, and total abundance has declined over time, but what's interesting is that seems to have occurred both for targeted species, and so species that are targeted by the fishery, as well as these non-targeted species, and so this suggests that some other sort of ecosystem factor may be acting, and that's one of the lines of evidence that led to this work that we're doing looking at sort of changes in the underlying productivity of the system and how it may be related to recruitment dynamics of these species.

This is mean trophic level, and so this a measure of changes in the component of the food web that is harvested by fisheries, and so you may have heard of we're fishing down the food web, where fisheries will initially target the larger, higher-trophic-level species, and then we'll kind of fish down and target lower-trophic-level species, or, perhaps, as fisheries develop, they add lower-trophic-level species to the harvest, which is called fishing through the food web, but, either way, it's used as a common indicator of ecosystem health, and particularly as a way of assessing effects that fishing might be having on the larger ecosystem.

If you look at mean trophic level, and this is for all commercial landings, we exclude menhaden, because the biomass of menhaden, historically, was -- The harvest was so high that it kind of dominated the pattern, but you do see this period of high mean trophic level in the late 1970s or the early 1980s that seems to correspond with development of a lot of the major domestic fisheries in the region that came up after Magnuson in the mid-1970s.

A lot of those fisheries were kind of fished down and are in rebuilding phases now, and so we've seen a decline in mean trophic level and then some indication that those are sort of coming back, perhaps as the management regulations start to take effect and you start to see some recovery.

Recreational patterns look a little different, and so this is from MRIP data, and it's all of the marine recreationally-harvested species, and you see a pretty consistent decline from the early 1980s. That seems to be driven, in part, by some of these declines in reef fishes, but also increases in harvest of small sort of estuarine species, things like croaker and spot and mullet and things like that. They're becoming more and more common in the recreational catch, and we have some ideas about why that may be. It looks like it might be related to just general increases in recreational fishing pressure and access that the public has to nearshore estuarine waters.

We also tracked a lot of the information, or tried to collect a lot of the information, from the assessments, and this is the biomass of assessed species in the South Atlantic, and you can see the common pattern that I alluded to earlier, that there's been a decline in biomass, primarily in the

1970s and 1980s, and then, beyond that, it kind of depends on the species, and you get increasing biomass in the early to mid-2000s for several species, for red snapper and Spanish mackerel, but some have shown persistently low biomass, despite increasing fishing regulations. Things like gag and snowy grouper and red porgy have been low, but slow to recover, despite increasing management. Then, for some, you can see these recruitment-driven events, like red grouper and blueline tilefish and black sea bass, where there are these periods of sort of high recruitment at certain points in the time series.

This is getting into more of some of the fishing indicators, and so this is showing total commercial landings on the left and total commercial revenues, and so commercial landings have been fairly variable, but stable, from the 1950s to the 1980s, but they have kind of declined since the 1980s, and that's been mirrored by a decline in commercial revenues, and it has lagged somewhat the decline in landings, but we've seen increases in recreational landings and increases in recreational effort.

Then this is from some work that was recently just published, and I don't have the citation on here, but this is for federally-managed species, and this shows the proportion of the landings that are coming from the recreational sector, and so, in the South Atlantic, it looks like the landings have always been recreationally dominated, about 65 to 70 percent, even back in the 1980s and 1990s, but that's become more extreme recently, and so about 75 percent of the landings come from the recreational since the 2000s. Then, in the last few years, it's been approaching 80 to 85 percent, and so it does seem like a lot of the federally-managed species are becoming increasingly recreationally dominated, and we have these kinds of indicators that we can use to track that pattern over time.

We do look at protected species, the sort of megafauna, or species of concern, and so this is showing sea turtle nest counts, and so these are from various state sampling programs in Florida and South Carolina and Georgia and North Carolina. They all show a very similar pattern, that there is highly variable nest counts from the 1980s and 1990s, but, since around 2005, there's been a consistent pattern in the region of increases in loggerhead nest counts, and we're not exactly sure what the cause of that is, but it is a fairly consistent pattern across these state sampling programs that are conducted independent of each other.

Then this shows -- We look at cetacean strandings, and so this shows the number of bottlenose dolphin strandings since the early 2000s, and you can see major events, and like there was a Morbillivirus event that occurred in 2013 that resulted in high levels of strandings, and so we try to track those sort of indicators of the sort of status of protected species, species of concern.

The last section of the report has to do with more human dimensions, and so this is showing long-term population trends in the South Atlantic region, and so this is by coastal county. The darker areas are areas of higher population density, and so this is going from the 1800s all the way through 2010, and so, in the 1800s and early 1900s, the region was mostly agricultural-based, and it was really a plantation-based economy that was centered around Savannah and Charleston, primarily, but there has been increasing urbanization, and that's been particularly evident in Florida, starting in the 1950s.

There was some legislation that implemented a number of water-control structures and infrastructure and road development that facilitated the population boom that Florida has

experienced, and that has kind of continued to this day, with a lot of those regions now also having economic ties to Central and South America, and so there has been a pretty dramatic increase in population density that's been most extreme off the Florida east coast.

We're in a census year this year, and so we don't have the 2020 census data, but, just looking at the 2010 census data, the Southeast is an area of very rapid population growth. The four states that make up the region are within the top twelve nationally, in terms of population growth, and so there is increasing populations, and I think, associated with that, we might expect increasing pressures on the coastal resources.

One of those pressures is increasing urbanization, and so this is something -- These are maps that show areas of high-intensity development in the South Atlantic, and this is in 2010, which was the most recent year that data were available, and those tend to occur in Miami, Florida, the Orlando metro area, Jacksonville, and the Myrtle Beach area.

Then this shows the change, or the square miles of land converted from undeveloped to developed, by county, between 1996 and 2010, and so a lot of that urbanization has occurred all along the Florida coast, as well as in particular regions, the Myrtle Beach region and the Charleston area, along the Atlantic seaboard. On average, there's been an increase of about 18 to 23 percent of the land area that has been converted to developed areas per decade over this twenty-year time period.

Some of the other indicators are -- This is getting into some of the higher-level kind of macroeconomic indicators, and this is employment in the ocean economy, where the ocean economy is defined as jobs related to living marine resources, which sort of include fishing, but not exclusively fishing, but also marine construction and transportation and mineral extraction and ship and boat building and tourism and recreation.

Then the bottom graph shows ocean-related gross domestic product, and so how much does this represent, in terms of dollars, indexed to 2014 dollars, and so the region accounts for a lot of jobs, about 600,000 jobs, in the ocean economy, and about $35 billion is contributed to the U.S. GDP, and that's dominated by tourism and marine transportation, and you can kind of see this decline. This was the crash in 2008, the economic downturn, that resulted in a decline in both employment and ocean-related GDP. Employment has come back, and it well exceeds what it was in that 2007-2008 period, although ocean-related GDP is just coming back to about that level, and so this is another indicator related to how economic conditions along those coastal regions are changing over time, in terms of employment and sort of economic contribution.

Then this last one -- These are some fairly new indicators, and these have been developed by Mike Jepson at SERO, where he has tried to quantify both the engagement of coastal communities and commercial and recreational fishing, as well as their reliance on fishing, and so engagement is basically an indicator of participation in fishing activities. Reliance is similar, although it is referenced to the -- It's indexed to the proportion of the community that's involved in those activities, and so this is an example, and this is for recreational fishing engagement on the left, and then reliance on the right, by county, and this is from 2017.

You can see the recreational engagement is high all along the coast, and you can see particular areas where engagement is high, like south Florida, the Cape Canaveral region, the Charleston region, and the Albemarle-Pamlico region, but the reliance -- This actually shows the extent to

which these communities are really reliant on fishing, and it's a little more limited geographically. It's mostly the Albemarle-Pamlico region, and that's because there's a lot of other sort of diversifying factors that influence the economy in these other regions, and so engagement might be high, but there's lots of other economic activities to participate in, whereas, particularly in these regions, the Albemarle-Pamlico, it's primarily fishing.

I think that gives you a -- Hopefully that gives you an overview of the indicators, the types of things that are included, and we have -- We are, right now, trying to synthesize some of these, and so this is ongoing, and so I don't have clear results to show from this, but just sort of an idea of what you might expect to see. We can synthesize these indicators using various multivariate techniques, to start to see and pull out patterns.

One of the things that, at least preliminarily, has come out is that a lot of these components of the ecosystem are relatively stable through the 1980s and 1990s. You can kind of see that in the graph here, where all of these years were overlapping each other, and they are kind of clustering together in this left graph, but there seems to be some shifts that were occurring in the 2000s, and we got some changes that were occurring in the early to mid-2000s. We've got a period of statis in the early and late 2000s and early 2010s, and then some changes over time, and perhaps some sort of return to more of a condition indicative of the 1980s and 1990s, and so there's a lot of information that goes into this, and so teasing apart exactly what's happening is something that we're working on now.

There could be fundamental changes in the system, or we're trying to identify what indicators are contributing to this, or perhaps there is some issues with when data actually comes online in time, but these are the kind of larger-scale patterns that we're tracking, to see if there's been some fundamental changes over time and then what are the underlying indicators that might be driving it, and so there's more on that that should be forthcoming.

I wanted to just spend the last few minutes here talking a little bit about how ecosystem status reports can be used, and hopefully that can lead to some feedback from the panel about these indicators, or the datasets, or interpretations of those.

This is from a survey that was done nationally, and it kind of shows the different roles that ecosystem status reports are playing, and so the most obvious one is as an informational or a contextual report for managers. In almost all of the regions that an ESR is being sent to managers, it's often being present alongside the stock assessments and as a way to provide context for discussions around various management decisions.

One of the best examples, I think, of that is the New England report, and so the Northeast Center puts out a state of the ecosystem report every year, and this is the one for 2020, and so it's a high-level report, and it has a short kind of two-page summary, and it's easily digested, and it's geared towards addressing ecosystem objectives that have been identified by the council, and so, in the case of the Northeast, those center around economic and social condition of the fisheries and fishing communities, issues with protected species, and it could be right whales or things like that, patterns in harvested fish and invertebrates, habitat quality, and then ecosystem productivity.

Then the details are included in essentially a forty-page report that details some of the bullets that are highlighted here, and so this is available online, and it's one example of a product that could

be generated from an ESR and then provided to councils as they go, as a way to contextualize the decision-making.

The second way is an operational report for managers, and so this is a case where the ecosystem status report has been operationalized, and it's actually being used to make management decisions. About half of the regions are doing that currently, and the types of decision-making that this influences tend to revolve around ABCs, and so what sort of -- Most councils have some latitude around a recommended ABC level, and can often be more, or perhaps less, conservative, and so it's a way to inform deviations from the recommended ABC for a particular species, or they're being used in risk assessment, which basically involves trying to assess the potential magnitude and consequences of negative events that might affect some of those biological, economic, or social objectives.

Probably the best example of this is for the Eastern Bering Sea, and this for the Bering Sea pollock. The ecosystem status report, in that case, indicated that temperatures were increasing, and prey abundance, in the form of krill, was decreasing, and predators, in the form of arrowtooth flounder, were increasing, and so this kind of traces how that information made its way through the management process.

In the pollock stock assessment, there's a statement that additional precaution may be warranted, since warm conditions are thought to negatively affect survival of larval and juvenile pollock. The SSC, in reviewing the assessment, stated that our current understanding of pollock early life dynamics suggests that survival may be low, due to low availability of suitable prey, and then the council ended up implementing a more conservative management -- A more conservative ABC for pollock in that particular year, based on the ecosystem indicators. This is an example where the ESR is very much tied to tactical management decisions that are made by the council.

A third way is these ESRs often provide a synthesis of the science, as it exists, that can be used by other researchers or be made available to the public, and so a lot of ESRs are being used in that sense, and I think the Gulf of Mexico ESR, which is fairly recent, is a good example of that. That report is available on a nice website, and the report can be fully downloaded from that site, and the key indicators can be visualized on the website, and the actual data that goes into those indicators is downloadable as well and can be used by others. Those are three sort of approaches for how ecosystem status reports are currently being used in other regions and that may be useful in the South Atlantic.

I think I will stop there, and I don't know if we have time for questions or feedback, and something that we could consider here, or perhaps in some follow-up meetings, but some of the things that have crossed our minds that we've been thinking about, in developing this report, is what are the council's objectives with respect to ecosystem issues, and a better understanding of that would help us to improve the ESR and make it more useful, in terms of addressing those objectives.

Then the other component is the communication and what sort of framework is most useful for communicating the information in the ESR to decisionmakers and trying to facilitate more of an exchange, or a back-and-forth, between the science and the management, and so I will just leave it there, and, Roger or Anne, I will turn it back to you and see if we have any time for discussion.

MR. PUGLIESE: Kevin, I really appreciate the detailed presentation, and this is exactly what we were hoping to get down the road. I think we'll open it up, and Rene has the first question.

DR. BAUMSTARK: Thanks. That was a very comprehensive and great review, Kevin. There's a lot of amazing progress that you all have made. I want to bring one thing up, and it's a comment and a question. In Florida, one of the things that we're dealing with is disease and the fish health, fauna health in general, and disease can be, I guess, both an indicator and an implication for the health or the status of an ecosystem, the health of ecosystems.

I'm wondering -- You did mention that there was an episodic event and a virus that changed that effect of the trend and the cetacean strandings, and I think this happens a lot, and we tend to be very reactionary to these kinds of episodic events, disease events, and I'm wondering -- I don't know if the data is there or comprehensive enough, or maybe distributed well enough, to include information on this, or some sort of indicator, but has this been considered in this region, or any other regions?

DR. CRAIG: To my knowledge -- We haven't considered disease, and, to my knowledge, I don't think it's being considered in other regions, and I think probably partly because it's difficult to quantify, and, as you mentioned, it's often sort of episodic. If there is information on that, then that's something that could potentially be included. I mean, what we've tried to do, in developing these indicators, is we focus on things that we have long-term time series for, but there are a number of issues, and I think that disease would fall into this category, and I think tags would fall in this category as well, where we just don't have good scientific information, and so we try to make reference to that in the report, mostly as a way to stimulate or point out that gap and maybe stimulate others to kind of address it or to bring to our attention any sort of datasets or things that we may have missed.

I'm not sure if that answers your question, but I think disease is one of those things that I haven't heard come up. My sense is it might be difficult to get sort of quantitative information on -- If you're talking about things like maybe coral disease or something like that, we do have -- I didn't show it here, but we do have some indicators that are related to coral mortality, in particular, but we haven't really looked at disease issues beyond that, or beyond just the often kind of anecdotal information that's available in things like strandings.

DR. BAUMSTARK: Fish health, we do have a lot of data that goes beyond just disease, but, yes, corals is certainly one, and I think you do capture some of that. Florida, as you all know, has a big issue. Thank you.

DR. CRAIG: If you have information -- I think part of the -- I should say that we didn't undertake a really broad or formal scoping exercise in developing this report, partly because of time and resources, for obvious reasons, but we've tried to do these updates and presentations like this, and in other forums, as a way to get feedback, and so, if you have information that you think we should consider, that should be considered, please email me or let me or Todd know, because, like I said, we didn't do a formal scoping process, and so we're doing this on the backend, through these presentations, and trying to get feedback. We would like to know things that we should include but haven't, or at least consider including.

MR. PUGLIESE: Wilson.

DR. LANEY: Thank you, Roger. Kevin, thank you for the detailed presentation. I really appreciate it. Sort of tagging onto what Rene said here, one of the things that I think you all might be able to fairly easily pull together would be trends in fish kills, and Anne, or some of the other North Carolina folks, can speak better to this than I can, but I know there's a pretty good database in North Carolina for fish kills, and I think that is an annual report that the state provides, and I'm guessing maybe the other three South Atlantic states also provide that information.

I think that that database does include what they speculate was the possible cause of the kill, and what would be interest, I think, would be especially to look at cases where those kills are attributed to low DO events, and this is a fairly common occurrence in North Carolina, and the Neuse estuary in particular, and may be similar in other South Atlantic states, and so I would suggest that that's one additional factor that you may want to add in, if it's not already included in the ESR.

DR. CRAIG: That's a good point. Thanks for that, Wilson. Those are certainly things that we can consider. I am familiar with the North Carolina fish kill database, and so you're right that that has gotten to a point where it's fairly systematic and easily accessible, and it has some sort of indication of causation.

I'm not as familiar with the other states, and I think this is kind of one of the general problems that we have, is that, often, states will do things very differently, and so we don't have, for a lot of the inshore indicators, and I think habitat is probably the most obvious, is there's lots of state-level habitat sampling programs, and I suspect fish kill programs, and it can often be hard to synthesize across those, because they are -- The methods are different, or the time scales are different, or so on, and so I think that is a point where we could improve the ESR, if we had the time and resources to do some more of that, but I think that is the major impediment, as I see it, and with a lot of the nearshore indicators, is just that we're looking for things that are regional in scope, and we're trying to reflect what's going on in the South Atlantic as a whole, as opposed to any particular region.

To do that effectively, we would have to be able to sort of integrate those fish kill data across the different states, to come up with something meaningful, and so I think it's worth investigating, and it's worth doing, but it's just something that hasn't been our priority, at least so far, because we've been more focused on federal management issues, as well as some of the issues with integrating across disparate sampling programs that occur at these smaller scales, and that's a good thought.

MR. PUGLIESE: Laurent has a question.

DR. CHERUBIN: Thanks, Roger. Hi, Kevin. This is really good material, and it's very good information, and, to that point, I am wondering if your presentation is going to be available through the briefing book. I can't find it.

DR. CRAIG: I was late in getting that. I did send it to Roger, and I think Roger should be able to distribute it, and so yes.

MR. PUGLIESE: We just got it, and so it just went out to everybody. Paula.

MS. KEENER: Thank you. This is a very informative presentation. This is a lot of data, and a lot of information, and a lot of different categories and indicators. Have you all used any type of like artificial intelligence to try to pull up any of this to a higher level, to look at connections?

DR. CRAIG: That's a little bit of what I was getting at at the end, and so the primary focus has been on collecting the data and developing the indicators and trying to interpret them. We have drawn some connections among various indicators, and, in particular, there does seem to be something going on with ocean ecosystem dynamics associated with temperature and upwelling and primary productivity, and that's something that we have really focused on recently and are hoping to pursue further.

In terms of higher-level things, we haven't really gotten there yet. I mean, typically, as you might imagine, a lot of these indicators are probably not related to each other, and so part of the work, I think, is kind of understanding what is relevant and what's not, and so the furthest we've got is those plots that I showed that sort of start to use some multivariate approaches to integrate across the indicators and see if there's been some kind of pattern of change, and, as I mentioned, it does look like there is some change that has occurred in the South Atlantic in the early to mid-2000s, primarily.

Then trying to decipher what's contributing to that change, and is it just something associated with when these various datasets come online, because they often come online at very different times and very different durations, or has there been some sort of fundamental change in the system, but I would say that that's something that we're in the I would say middle stages of addressing, but I would say, in general, ecosystem status reports are often a building block for others to kind of try to do some of those higher-level syntheses. I know, in the case of the Gulf, a lot of the time series from the Gulf were used in sort of funded research projects, to try to look at some of those higher-order patterns.

MR. PUGLIESE: Wilson, Trish, and then Anne.

DR. LANEY: Kevin, I just wanted to follow-up. On the fish kills, to me, the big linkage there between what's going on inshore, in terms of water quality, particularly dissolved oxygen, has to do with recruitment to offshore stocks, in many cases, because the estuaries are such critical nursery areas, and so I agree with you that I think it's definitely worth looking into. I would look to the state representatives on the AP to say if the other three states all have fish kill databases that could then we used to try and come up with the regional pattern in fish kills, especially those related to low DO, and I would think that would be of great interest, because it has a direct bearing on nursery area health, but also on recruitment as well. Thanks.

DR. CRAIG: Thanks for that comment, and I think sort of what you're pointing to, Wilson, is -- This goes back to sort of the communication aspect, but that is what would be helpful in that endeavor would be to have increased sort of collaboration with the state agencies, and so I think that's something that this report has brought out, is that we're very familiar with a lot of the federal datasets and sort of the federal issues, and maybe the state issues where we live, but it was an effort just trying to find the people to talk to, you know who is the person to talk to about fish kills in Florida, for example, and so I think what you're kind of pointing to is to get at some of these inshore indicators a little better, and we need to have better sort of collaboration, or perhaps sort

of representation of the states in the development of the ESR, so they can kind of point us to the right people.

DR. LANEY: A follow-up, Madam Chairman. I think, in the form of the AP, Kevin, you have a resource that is there, because each of the state representatives on the AP can serve as a conduit, I think, to any kind of information that you feel that you need from the states.

DR. CRAIG: Yes, and so that's good to know, and one thing that we did in the Gulf is we did send out a survey to people, a variety of people, and I think the AP would be one group, to kind of solicit feedback on what indicators are important, and maybe which ones are not so important, because the intent is that these reports are iterative, and they are updated, and they are sort of made more relevant to the management over time, and that would involve adding potential indicators, as you're suggesting, of fish kills, and maybe getting rid of some of the indicators that may be less relevant.

One thing we did in the Gulf was a survey of stakeholders, or kind of the end-users, to see what their thoughts were on the indicators that were included and anything that we may have missed, and so that's one approach we could take in the South Atlantic that we could get some sort of feedback on that, that issue that you're describing.

MR. PUGLIESE: I think Trish has a question.

MS. MURPHEY: Really more an observation and thinking out loud a little bit. The disease discussion there kind of got me thinking about blackgill in shrimp, and that tends to be a climate -- It's linked to climate change, and I guess where I'm going is that maybe also think about Mike's talk on the CVI, and I wonder if incorporating some of that information collected in his vulnerability index report into this ESR might actually make it a little bit more informative, as far as maybe trying to get at some of these diseases, especially if the diseases tend to be increasing because of climate change.

DR. CRAIG: I think that's a good point. I mean, in two respects. One, disease is something that's hard to monitor, and so I think one of the strengths of the ESR is that it is trying to look at quantitative trends, but that's also one of the weaknesses, right, because we tend to focus on things that we have quantitative information for, and I think disease is one of those things that it can be very difficult to quantify, and so, in thinking about how to broaden the ESR, to perhaps address some of these issues that we don't have sort of long-term quantitative time series for is worth considering.

Another point you're making is these products are developed independently, but they might benefit from some synergies, and so the CVA and the ESR have pretty much been developed independent of each other, and I think what you're suggesting is maybe some sort of cross-fertilization between those two efforts.

MS. MURPHEY: Yes.

DR. CRAIG: I think that's a good point, and we haven't done that, and so that is something -- A lot of these kind of ecosystem products, I think, are fairly new, and so we don't have long track records of doing ecosystem status reports or CVAs, or we don't have an integrated ecosystem

assessment for the South Atlantic region, and so they're fairly new, and so I think maybe that's something that, as these efforts kind of mature and start to become more common and more accepted, then we can kind of look for ways to cross-fertilize between them.

MS. MURPHEY: Yes, because both reports that you guys gave -- Both were really, really interesting and fascinating, and that CVI, to me, could be a piece of your ESR.

MR. PUGLIESE: Thank you. Anne is, I think, going to be the last question for now. One thing I would like to say is I do appreciate everybody's input, and I think you're seeing why we have pressed that the AP is a critical component that can provide, as Wilson indicated, the links back to the partners and really refine this process into the future, and so hopefully, as the draft comes out, we have the opportunity to maybe have a dedicated webinar for the AP, and maybe a lead into that, and answer some of the questions that you're identifying here and provide linkages to everything from other partners, such as the Ocean Observing Association and the SECUS efforts in the Southeast, and a lot of other things that I think can really be brought to bear to make it even more substantive, but let me give it to Anne, and then we have to --

MS. DEATON: Thank you, Roger. You kind of said what I was going to mention. My favorite part of this was where you say how -- Your examples of how this information can be used for management, especially that second option, operational reports, and I can see that as exactly how it could help.

Even if it's not included with a stock assessment, they have that information to decide how conservative to be, and so thank you, and I think the examples you gave of the visual framework of communicating were also very good, and so, for that last question you have on this bullet, what's the most effective framework for communicating, I think it needs to be simple and visual, like those were, and I was wondering if you want input on that, and is there a deadline?

DR. CRAIG: A couple of things. I think your point about the operational update is a good one, and I would point out the North Pacific, because I think that's where that has been most effectively done, and that's, ideally, what we're shooting for. The way that tends to occur is often in fairly subjective ways, and so, in that case, you present the ecosystem status report, and it's presented actually before the stock assessment, and so it kind of sets the context and says, well, this is what we know about the ecosystem, and these are things that have changed in the most recent time.

Then the stock assessment gets presented, and then the wiggle room -- There is some wiggle room that the managers have around the recommendations in the stock assessment, and so that's where the ESR plays in, and it's kind of in a -- It's an informative way, and it's in a direct way, but it's in a qualitative way, and so I think that's a good goal for the South Atlantic, particularly as we move forward with addressing some of these broader sort of ocean ecosystem changes and how they might be related to recruitment, and that might actually be a process that we could mirror in the South Atlantic.

In terms of the communication, I guess these reports -- As you might imagine, they can get very sort of long and detailed and unwieldy, but we also -- Other regions do this, and it's something we could potentially do, is provide the report in different sort of formats, and so there's the detailed version that's got -- It really kind of looks under the hood and details everything, and then there's like the -- In the Northeast, they do a very reduced two-page just highlight summary version that

gets distributed to managers, and then we do hope to put this on a website, so that it would be available to others to access and download and use as they see fit.

MS. DEATON: All right. Well, thank you, and I guess there will be public comment, or opportunity to review, as Roger mentioned.

DR. CRAIG: I do think it would be worth some sort of dedicated webinar, because part of -- For us to really make the report effective, we need to understand some of the objectives, and so having a webinar where we could talk about what some of the objectives are and how they can be addressed through the ESR I think would be worthwhile.

MS. DEATON: I think that's a great idea. All right. Well, thank you very much, Kevin. With that, I think we're going to take a five-minute break before we get into the Ecopath with Ecosim section. Does that sound good? It's 11:37, and that would be 11:43 that we'll come back and resume. Thank you.

(Whereupon, a recess was taken.

MS. DEATON: Roger, are we ready to restart?

MR. PUGLIESE: I think we're good. For everybody's benefit, I think the last sessions were just too important to trim down, and Anne can get into the details, but what we're going to do is move the FEP update discussion to tomorrow morning and try to get the ecosystem activities done before lunch, get the presentations, and move forward with a very connected topic, if that works. Anne.

MS. DEATON: Okay. What this session is entitled is the South Atlantic Ecopath with Ecosim Model, and so we've got several people that are going to speak. First is Roger and Lauren Gentry from FWRI, and so I will leave it at that, and this is Attachments 6 through 8.

MR. PUGLIESE: I am just going to give you a very brief opener, and Lauren is going to get into more of the guts. All I want to do is to re-highlight the fact that this has been a process that's been ongoing since literally back to when the University of British Columbia engaged in building The Sea Around Us Project, and we built the first strawman Ecopath with Ecosim model back in 2001, and it evolved through a number of different iterations that have advanced, tailoring it to potential council-structured species complexes back in the 2004 iteration, and that changed, and we didn't have resources to really advance it into full parameterization, and so it sat until a subsequent model was developed in 2014 that was really to address and begin to investigate some forage fish issues, impacts from the environment, et cetera, and large-scale changes and what implications were there.

That went from a forty-four-group to a ninety-nine-group model at that stage, and then we went into a 2019 model that was funded through our collaboration with the South Atlantic Landscape Conservation Cooperative, and they funded the development and expansion to fully create this model and to address a lot of the shortfalls of the models up to that point, and we ended up with a 143-box model, and then what we have done now is pick up and collaborated and built a modeling team that is expanding and coordinating directly with FWRI and other partners to build the 2020 model that is 140 boxes and 700 species plus, and that's what Lauren is going to touch on.

This has gone through an SSC review workgroup review, and Yan Li will provide some of the details on the outcome of that review and discussion and advancement of the efforts through the Scientific and Statistical Committee, and this will be discussed at the council's Habitat and Ecosystem Advisory Panel meeting in December, and so, with that, I will pass it on to Lauren to start this.

MS. GENTRY: Hi, everyone. I am Lauren Gentry from the Florida Fish and Wildlife Research Institute, and I'm going to build on Roger's intro and to give you a look into some of the progress that's been made on this model in the last year, and, also, just some of the details of how it was done.

Before we get into the updates, I thought a quick Ecopath crash course might be a useful refresher, especially for our newer members, or anyone who hasn't seen this before, and so the name of the program itself is Ecopath with Ecosim, nicknamed EwE, and it's made up of these three parts that you see here. The first is Ecopath, which models an ecosystem structure and function as a snapshot in time, and the basic inputs are listed here, though there are other things that you can add, and these inputs are put in for every single group in the model.

Then the program assumes a mass-balance system in which like a predator's consumption is its prey's mortality, and all of the groups are connected via the diet matrix, and you can see that on this flow diagram on the right. It's not terribly useful at that size, but it's at least demonstrative of how interconnected all of these groups are via that diet matrix.

Now, once the user gets all the inputs and outputs balanced in an equilibrium model, this Ecopath model, base model, becomes a starting point for all further simulations, and a user can tweak an input to observe the effect on the ecosystem, which you will see at the end of this presentation, and they can build an Ecosim model on top of this, and it uses the Ecopath model as its base, and Ecosim adds time dynamic simulations, in order to model catch and biomass over time. Now, this is done by feeding the program time series of almost anything you want, biomass, landings, effort, discards, et cetera. You can also add an environmental forcing function to help drive estimates, like a chlorophyll-A monthly variation or seasonal sea surface temperatures, anything like that.

Then, using these time series, the program creates what you see on the right there, and so the solid line in that -- That's the biomass estimate of snowy grouper from EwE, and the circles are the actual biomass from the stock assessments that we put in, and we can further fit that model line to the real data by systematically and then individually modifying the vulnerabilities of certain prey to certain predators, in order to finagle that line just closer and closer and closer.

This could, theoretically, go on indefinitely, and so it's done, quote, unquote, done, when the modelers and everyone involved agree that the estimates for every important species, at least important to them, are as close as they want it to be, and so then, with a fully fit Ecosim model, a user can tweak an input and test a scenario. Like you could explore the effects of climate change by adding like those predicted sea surface temperature maps that we saw, or sea surface temperature time series and then you can compare it, versus entering in say stable sea surface temperatures, and predict into the future.

Now, finally, there at the bottom, there is Ecospace, which models the ecosystem in time and, well, space, because that's the name, and the way it works is it's a raster of the model area, and it runs

the fit Ecosim model in every single cell, and, since the biomass is allowed to move between cells, and between each time step, you can test spatial scenarios, like the benefit of the new marine protected area, or maybe like where are the big dolphinfish going, or things like that.

As Roger said, the South Atlantic model has a long history of expansion and articulation, and one of the things that we are particularly proud of, one of the things that has had the most progress done to it, is the diet matrix, and, as you can see, a lot has been done since April of 2019, and this is when we started counting this, and we went from seventy diets up to 250, and we removed all of the proxies, and that means that we were using a diet from a similar species for another group, and there's no more of that, and there's no more kind of best guesses or filling in what we thought it might be. The only diets left over from the old West Florida Shelf model that this was kind of originally built on -- Those are just for invertebrates, because, you know, a worm is a worm, kind of regardless of where it lives.

Now, primarily, these diets have come from gut content studies done by SEAMAP and NOAA from published literature and from our own gut lab here at FWRI, and these images demonstrate how we would start with a publication -- At least in this picture, we would start with a publication and copy the stomach contents along with a percent weight or a percent volume, copy that into Excel, and then determine which of our 140 groups each prey item belongs to. Even if it was from outside the study area, you would say, well, what's the closest one that it would fit into here.

Then we add it all together and get a final diet record, with a list of every prey group and the proportion of the diet that each group contributed. On top of that, individual prey items were also added to kind of flesh out the details of the diets, and those came from places like the new BBC Planet Earth 2 that has a shot of crevalle jacks hunting seabirds, and there was the Okeanos video of a wreckfish eating a dogfish that everybody sent to each other, and then, like in Hawaii, they've got a research collective that has a photo catalog of social media photos of beaked whales chasing prey up at the surface.

Now, a lot of thought also went into capturing the full breadth of each predator's diets, and that also meant adding in, sometimes individually, or sometimes in higher diets, like juvenile-specific prey items or kind of like habitat changes, like little tunny goes from coastal to pelagic areas seasonally, and so we made sure to capture both of those diets.

Finally, on this slide, that table, up in the right-hand corner, that gives you a breakdown of the general quality of the diet records we used, and, to keep track of even more of that kind of data quality and figure out what we have and what we don't have, we also created a metadata organization scheme seen here.

We're not going to go into the specifics right now, but having a score for each diet source and for each of these categories really gives us a standardized way of finding which groups need better data and for what reason specifically, and so we can go do a deeper literature dive, and, if we find that there's nothing there, then we can make a research recommendation and say that we need to get some gut data on this species, but how do we get the most bang for our buck? Those are expensive studies, and maybe we don't know what shallow gobies eat, and maybe that doesn't matter, what shallow gobies eat.

EwE gives us this, and this is a sensitivity analysis, and it's actually built into the software, and this function is a Monte Carlo routine that works towards reducing the sum of squares by adjusting the prey proportions up and down within the matrix, but, obviously, the predators with the rich, detailed diets have more prey items to be adjusted, and so they're going to end up with the largest overall change, and so you just take those out, and what you're left with is a group of -- A set of which groups diets have the biggest change, the biggest adjustment, and, therefore, the model is the most sensitive to changing their diets.

Some of these are groups that are leaving heavily on a few prey items, and there is nothing to be done about that. We talked to experts and commercial fishermen about getting deep-sea groupers to the surface with an intact stomach, and they said, no, we can't, and so that's fine. There's nothing to be done there, and menhaden and herring both lean heavily on a few prey items within our model, simply because that's all that fits in their mouths, and so that's fine, but like Auxis mackerels, and that's your bullet and frigate tuna, and blue runner, they both have a large impact as both predators and as prey, but we don't have very much information about their feeding habits, and so they were isolated as high-impact research recommendations.

Now, I do not want to beat this to death, but we can further dig into which individual interactions were outliers in that sensitivity analysis, and some of them show me where we just need to add more detail, like halfbeaks do not eat 10 percent seagrass, and, when I looked closer at the paper, it said that that was incidental ingestion from the other things that they were eating, and so I simply took that out and added some other halfbeak diets.

The program didn't like that red snapper was eating 19 percent black sea bass, and it turns out that that was only from 200 fish from SEAMAP, and it could have been net feeding, and so I hunted down additional diets, and none of them had black sea bass listed as more than just a tiny percent of the diet, and so, once those were all added in, that helped balance out that heaviness, but some stuck out as interesting and reliable, like they were coming from reliable data.

Coastal bottlenose dolphins eat 30 percent weakfish, but you would too if you were hunting in a muddy estuary and the only thing that was croaking loudly was also delicious, and so that one makes sense. The shortfin mako, that was 400 sharks collected across three decades, and, in all of those samples, bluefish were around 80 percent of the diets. We also have two different sources saying that Auxis mackerels are over 50 percent of the diets of blue marlin, and so that one stays, obviously, but, overall, we have this kind of granularity not just for the diets, but for other inputs too, like biomass and things like that.

That was an intense amount of detail just about the diets, kind of just to give you an idea of how this data collection process has generally gone for all of the inputs, but we'll speed it up now, and so the biomass inputs came from primarily from stock assessments, but FWRI staff, and the modeling team, we calculated other biomass inputs by using things like the FWC manatee survey and these areal seagrass surveys and lots of GIS, and so the picture that you see on the right is a map of Duke University's cetacean density data, and I overlaid the bounds of the South Atlantic region, and ArcGIS summed up the annual number of each animal, of each species, and they you just multiply that by the average weight of each species and there you go. Biomass.

We ended up with sixty-one groups with input biomass that we calculated from the stock assessments and put in there. Then we allowed Ecopath to estimate the rest of them, which we did

check, in the balancing process, to ensure that all of those Ecopath estimates were reasonable, and this is another point at which we can modify biomasses and see which groups biomasses have the biggest impact, and therefore would benefit the most from better biomass estimates, you know like a research recommendation. For us, it's generally the forage fish, and we just don't have very good numbers for them, and they are very important, as you can imagine.

Now for landings, and landings are, obviously, important, and the commercial landings came from ACCSP, and those included caught fish and discarded dead fish, and they assigned an excellent data analyst who worked with me to ID 1,100 species, plus those higher taxon groups, like records that are only at the genus and family level, and we also worked together to reallocate ninety-million pounds of previously marked "unknown" landings that had been distributed like kind of across the groups.

We found that that was seaweed and inverts, and they have their own groups, and so that went there, and ACCSP -- Their analyst was also kind enough to track down outliers all the way back to their paper records, and like this one person in Georgia who apparently did in fact catch a large bull shark by hand with no equipment on the beach, and we thought that that was a typo, and it wasn't. It was real, but okay.

We also discovered small problems here and there, like their query code was switching the landings for large coastal sharks and dogfish sharks, and so some of you may have heard, at the April 2019 SSC meeting, that it was brought up that large coastal sharks were being overfished, and that was just a problem with a query.

Then we did the same thing with recreational and headboat landings time series from the Southeast Region Headboat Survey and from MRIP, and I found the expanded MRIP species list with like 400 species landings that hadn't previously been in our recreational data, and that added twenty new landings time series for groups that didn't previously have landings time series in Ecosim, and then Wilson Laney, also on this call, lent a hand, by knowing people who know people, and he helped us track down a handful of the MRIP data outliers and track them back to instances, like one in which a fisherman caught thirteen cownose rays for bait in one year, and somehow that got extrapolated out to 130,000 individual rays as the catch for that year, and so, obviously, points like that were -- Those were remedied.

Other inputs and steps that you all care about, those are here, and discarded alive numbers were obtained from MRIP and elsewhere, and each fleet and gear type is assigned its own discard mortality rate in the model to estimate how much, or I guess how many, of those living discards ended up as detritus, or should end up as detritus, each year. The SAFMC's Chip Collier sent me the numbers that are used in the stock assessments, and then Brendan Runde of NCSU, the descending device guy, he provided me with a number of updated rates from brand-new research that they're doing up in North Carolina.

Further, Luke McEachron, of our modeling team, also added a monthly satellite-derived chlorophyll-A time series from NASA. Let's see. What else was done? The outputs were checked against best practices thermodynamics rules, and also just kind of rules of thumb that have been published for using EwE, to make sure that everything was kosher with that, and then, finally, we made a huge pedigree to rank every input source, and that's ongoing. Every new input source gets

its own pedigree ranking. That is both used for finding data gaps and also for Ecopath to use. You can put that pedigree directly into Ecopath, and it will use that to direct or constrain its calculations.

One question might be kind of just what have we learned by doing this, just by building this monstrosity of fish, this huge thing, and, well, first, we got a giant diet matrix out of it, and it played a part in the scoring process of the climate change vulnerability assessment that you guys just saw a moment ago, plus all this data is going into the SAFMC Ecospecies database, which most of you should be familiar with, which is also positioned to serve as a long-term, easy-to-access repository for all the inputs and outputs from this model, and so that should make it a little bit easier to access.

Further, this model provides a quick and accessible comprehensive prey list for any time that that kind of thing is needed, and I think there was a recent SAFMC discussion of a possible new ecosystem component species, and was it like sailor's choice and saucereye porgy and a couple of others, and those diets came directly out of the matrix, with very little additional research needing to be done.

This building process, and the systems that we kind of put in place, all these pedigrees and metadata, it also helps us ID species that can be researched further, either for stomach contents or biomass, but with an assurance that those results will have an immediate and tangible benefit to the performance of the model and science in general. It also helps find some of the strange anomalies in fisheries datasets that kind of need to be scrutinized, like that cownose ray situation, and there may even be another one that we found recently for blueline tilefish, but I think we have to wait for that assessment to see what happens.

Finally, down at the bottom there, we can find these valuable interactions, like shortfin mako relying on bluefish, or marlin needing their bullet and frigate tunas, and it was really timely that those bullet and frigate tunas were designated an ecosystem component species like right as I was doing this analysis for the very first time, and it was very validating to see that the model does know what it's talking about, to some extent.

Further to that point, as we wrap this up, I wanted to show you a little scenario testing that we did to see how the model was behaving, and does it know what it's talking about, and so, while talking discard mortality rates, Brendan Runde sent me a paper that they just did recently in North Carolina showing reduced discard mortality of black sea bass if they were either descended with one of those descending devices or stabbed with a venting needle.

Just to see what happened, just to see if the model was behaving properly, I reduce the recreational discard mortality on black sea bass accordingly. Now, it was already pretty low, and it was like 14 percent, and so I dropped it to 9 percent, and that's a 1.5 decrease, and I did this back in Ecopath, to see what would have been kind of the hypothetical effect if we had been using these devices all along.

The model did just what it was supposed to do. It predicted the annual biomasses, and, as compared to the results from the higher mortality runs, there were winners and losers. Now, interestingly, all of the groups you see listed there, those are all prey of black sea bass, but, due to trophic cascades and those interconnected diets, the planktivores and squid and bivalves all ended up somehow coming out on top, and they eventually gained some biomass, likely because they are

prey of prey or prey of prey of prey of prey, or some other larger interaction than just being a food item of black sea bass. This was just a nice hypothetical test, to see that the model is behaving the way it's supposed to, even when the change was just a little 5 percent drop in the recreational discard mortality.

Finally, here is my favorite function so far, because, while I was doing the diets -- You know, you think you're seeing patterns, but maybe you're just seeing the same prey groups over and over again, and this is an actual quantification of who eats the same food and in what proportion, and so this, quote, prey overlap function lets me create a matrix of species, like the ones that we've all been talking about recently, and look at whose diet is overlapping whose, and so red snapper and red porgy have a 41 percent diet overlap, while red porgy and red lionfish only have a 17 percent overlap.

Now, I should add the context, that the average overlap of fish predators is around 20 percent, and so, while black sea bass and red lionfish have about an average amount of their diet in common, black sea bass and red grouper have an above-average diet overlap, and then, on the bottom here, we can also look at each predator individually, as a column, and list out the top species that share prey items with them, but some of this is kind of inevitable, especially for invertivores, like red porgy and spiny lobster, and there are only so many invert groups in the model, and so, if you eat crabs and shrimps and oysters, which I know that I do, then there's going to be a lot of diet overlap, but this is at least a neat place to start, with a lot of those shared resource questions, and we can also look through the diets individually from here and see actually what's going on in a one-by-one kind of thing.

Last, but not least, I would like to thank our data contributors and consultants, and this isn't even a fraction of the total list, to be honest, and especially all the folks who have expressed interest in the future of this model and have been keeping in touch and helping us make the connections that we need. Having a network of collaborators like that really makes every question, every outlier mystery, every data search, just easier and faster than otherwise, and so thank you. Before I head this off to Yan for the workgroup's report, does anyone have any questions for this one specifically?

MR. PUGLIESE: I don't see any right now, and so thank you, Lauren. I think what we'll do is go through Yan's presentation, and then we'll reach back on any questions. What we're going to do is I have -- You were provided the actual SSC workgroup report, which is included as Attachment 7, and then I have a one-pager that I will project on the outcome of that report. With that, I think we can pass it over to Yan.

DR. LI: Thank you, Roger.

MR. PUGLIESE: Okay. I think we should be projecting the review report, and are you all seeing that screen?

DR. LI: Yes, I can see the review report.

MR. PUGLIESE: I've got that, and then I've got your one-pager following this, and just let me know what you want.

DR. LI: Thank you, Roger, and thank you, everyone, for being here. My name is Yan Li, and I'm with the North Carolina Division of Marine Fisheries, and I am the Chair of the SSC Review Workgroup for the Ecosim with Ecopath model. Before I start the review report, I would like to acknowledge that the whole effort -- It's a great effort together, and it takes a huge collaborative effort to get us this far, and the effort among the model team and the review workgroup and the support from the council staff and the support and expert opinion from all the other technical experts is incredible.

The purpose of this review is to support a defensible base model for the South Atlantic region, and so the review focused on the data validation and the model parameterization and decisions and the functionality of the model to influence management. Overall, the workgroup is very impressed with the tremendous effort that the model team has dedicated to developing and maintaining and updating such a complicated model system with the great details, and I believe you got the impression from Lauren's presentation.

During the review process, the model team was very responsive to the workgroup's questions and requests, and also the modified model, according to the workgroup's recommendations, which eventually, when we get to the stage -- This part will significantly strengthen the functionality of the future use of the model, and so, overall, the workgroup concludes that the model team did a great job, and this EwE model provides a valid base model that can be modified for specific research and management needs.

The base model was developed based on the best information available currently, and it will be updated and improved as new data become available, and the model will serve as a tool to complement stock assessments and fishery management and to inform management decisions and to test hypotheses at the ecosystem scale, and so, here, today, I am presenting the major recommendations from the workgroup.

The workgroup spent quite some time evaluating the individual input values, to make sure the model is realistic to represent the South Atlantic ecosystem, given that the model is such a complex model system, and it has a huge number of inputs, and so the workgroup recommends establishing a well-maintained and regularly-updated documentation of model inputs with justification for the use of individual values.

The model team has been doing a great job of documentation, and the workgroup recommends to continue such great efforts, as we move on, and, also, the workgroup recommends adjusting the biomass accumulation, based on the available information, that can match the biomass trend for the species during the reference time period, which is 1995 to 1998. Those trends, information, can be requested, or obtained, from like fishery-independent indices, biomass estimates, from stock assessments and for some species, like shellfish, that can be obtained biomass estimates, like surveys, directly from the surveys.

Also, the workgroup recommends validating individual discard mortality rates, and, also, the model-estimated biomass, to make sure that those numbers are realistic. The workgroup recommends potentially adding a discard fleet in the future, which would allow for a time series representing changes in discard mortality over time, such as different changes to the gear regulations.

Also, the workgroup recommends looking at other alternatives for the default value of 20 percent to calculate commercial discards. Also, the workgroup recommends requesting discard estimates from states, especially for inshore species, and you can see here that the workgroup spent quite some time focusing on the individual input values, and especially the workgroup emphasized that it is very important to model the discards in a correct way.

During the review process, the workgroup reviewed the initial outcomes of the model, and the workgroup recommends identifying and evaluating extreme estimates. Here, the extreme estimates refer to the extinction events or the extremely high biomass estimates from model outputs, and so the model team dedicated quite some effort to explore the approaches and how to deal with those extreme estimates during the review process and the modified model, accordingly, and so, overall, the workgroup is very satisfied with the model team's approaches dealing with extreme estimates, and the details of how to deal with the extreme estimates are in the full report.

Also, during the review, both the workgroup and the model team realized that the inputs of biomass and the inputs of diet are critical to improve the model performance of Ecopath, and it also can further affect the fitting of Ecosim, and so, based on this, the workgroup recommends research into the biomass estimates for those species that are important to either the ecology or the fisheries of the South Atlantic region. Those ecologically-important species may include the forage fish, such as the herrings and anchovies and shad and sardines and the bullet and frigate mackerels and red drum, and the fisheries-important species may include Nassau grouper and the goliath grouper.

Also, the workgroup recommends research into the diets of the species that are lacking the necessary information in the current model setting, and those species may include, again, the bullet and frigate mackerels, blue runner, tarpon, mutton snapper, and Nassau grouper. Also, based on the importance of lionfish in the ecosystem, the workgroup recommends further monitoring the lionfish diet, in order to fully evaluate the impact on the ecosystem and to be able to incorporate that information in the model.

For the future development, for increasing the functionality of the EwE model in fishery management, the workgroup recommends establishing a standing workgroup to help with future updates and development of the model, including Ecospace, and I think that's all I have for today. Thank you, all.

MS. DEATON: Thank you, Yan. Are there any questions?

MR. PUGLIESE: Wilson, did you have a question?

DR. LANEY: Not a question, Roger and Anne, but just a comment to express appreciation to the model team and the model review workgroup for the tremendous amount of work that they have put into this and to say how much I am enthusiastically looking to future Habitat AP meetings where we can, hopefully, have a session, with Lauren and Luke in particular, and Yan as well, if she wants to participate, where we would be able to pose some what-if scenarios to the model team and just see what the outcomes are when those scenarios are run using the model, and so this has been a long time coming, and it's taken a tremendous amount of effort by a whole lot of people to make it happen, and just thanks to you especially, Roger, for your vision in seeing what could be done and what was possible, and I'm glad the day has finally arrived,

I guess, really, the last step, sort of, in the review process here is for the council to go over it at their December meeting, and I would think that, given the SSC's report, and, basically, the SSC pretty much concurred with the model review workgroup, and the SSC did have an opportunity to review this, and Steve Poland is the SSC liaison, and Steve heard all that discussion too, and so I am very optimistic that the council will receive it as enthusiastically as the SSC did and that, certainly by next year, it will be ready for primetime, and, hopefully at our spring meeting next year, or possibly before, we will be able to do some what-if scenarios with it. Thank you.

MR. PUGLIESE: Thank you, Wilson. We did have one question for Lauren, asking about if there's any sense of how frequent diet inputs should be updated?

MS. GENTRY: I think, because the model is really trying to get an idea of the breadth of all of the possible diet items, I think that it's not so much a time-scale kind of thing, unless there are particular species that we're worried about are going to shift their diet because of shifting prey availability or climate change or sea surface temperature or whatever.

Then I think, if there's a biological reason to say let's do another study, or something like that, then, yes, obviously, you would do it. I don't believe -- I haven't read anything about it needs to be done every ten years, and there are papers in the study, or in the model, from the 1950s, and there are papers that are still yet to be published, and I just got the data ahead of time, and so I think it's important to add data as it comes across my desk, or as it is published, but I don't think that there's a specific every year we need to do this. I think it's just an as-you-go kind of thing.

Having said that, if anybody has diet data that is not published, or it was published, and you don't know if I've seen it, or if there are specific species that you know, like the little tunny, that they go offshore and they eat one thing, and then they come inshore and they eat something else, and you don't know if I know that, if that's been captured yet in the diet matrix, shoot me an email, and just go ahead and send that on over, the diets or your concerns or species of interest, anything like that. I'm always open to learn more and do a deeper literature dive on the particular species of interest.

MR. PUGLIESE: Are there any other questions for either Lauren or Yan? I don't see any more. Anne, what is your preference at this time? We still have Luke to do his presentations on the applications of Ecopath/Ecosim/Ecospace, and it's already 12:30, and I guess the only option would be to go to 1:00 and then start back up at 2:00, or just start back up at 1:30 with Luke's presentation. That's your call.

MS. DEATON: My call. Well, I've been snacking, and so I can wait, if it would be better for the flow to keep it going.

MR. PUGLIESE: Are there any members that have a problem with that? Sorry about the timing, but it's just too critical to get off-track on some of the issues discussed earlier. If not, we can just go ahead and go on, and then we'll just start up a little bit later with the afternoon session.

MS. DEATON: Either way. I mean, honestly, people might need just a break. If Luke can wait, I mean, why don't we just take a break? Why don't we take our lunch break? I'm sorry.

MR. PUGLIESE: Okay. Let's go ahead and break until 1:30, if that works with everybody, and we'll pick back up with Luke's presentation after lunch.

MS. DEATON: Okay.

MR. PUGLIESE: Thank you. Just a quick note is that, as you noticed, we have shifted a little bit. What we're going to do is the FEP Implementation Plan Roadmap discussion tomorrow morning, and you will be getting an email about that. Since it is going to occur, what I do have is an Excel table with actions and alternatives, as transferred from that draft, and actually more expanded, and I'm going to send it out to everybody, if they would look, and you may have ideas of additional materials to add in, either added directly into that document, if you look at it and see something that jumps out at you, or be ready to discuss it in the morning, and so we're going to push that item to first thing in the morning. With that, we can go ahead and break until 1:30.

(Whereupon, a recess was taken.)

MS. DEATON: I think we should go ahead, because we're behind a little bit.

MR. PUGLIESE: Okay.

MS. DEATON: Next we have Luke, who is also at FWRI, and he works with Lauren Gentry on Ecopath/Ecosim/Ecospace, and all of those eco-things, and so, Luke, if you want to go ahead, please do.

MR. MCEACHRON: All right. Great. As was just mentioned, I work with Lauren. I mainly work with the Ecospace side of things, but I've been involved with the modeling team throughout the whole process. Today, I just want to give -- I will kind of back up a little bit from Lauren's talk and give a high-level view of the ecosystem model and talk about how we use different components, because it can be confusing to keep everything straight, and so I will walk through each component, and, hopefully by the end, it will be clearer how and when you use each component, and, in this context, I will talk about the South Atlantic model and where it is and where we can go from here.

The first component, Ecopath, we're just constructing a mass-balance model to represent this one moment in time, and we're simply defining the groups, the diets, and we're inputting growth and fisheries data and getting a snapshot of the trophic structure and function of the ecosystem. If we just stop here, and some people do, we could get a sense of the key groups in the system, and we could produce a wide variety of ecosystem indicators that describe the system. In fact, there's a series of best practices papers and acceptable ranges of some of these quantities that can help us determine if a model is reasonable. For example, there's a paper by Jason Link that is often cited for that. Importantly, Ecopath serves as the foundation for Ecosim and Ecospace.

In Ecosim, we convert our Ecopath master equations into differential equations to model biomass over time. In this case, we use time series data to tune a vulnerability parameter that defines a relationship between prey mortality and predator density and calibrates the model. When you do that, you get a baseline understanding of the time dynamics in the system, and so how could you use this information?

Well, I think you guys saw the Chagaris paper in the meeting documents, and they used Ecosim to look at the effects of lionfish on reef fish on the West Florida Shelf, and they evaluated different lionfish and reef fish harvest strategies to mitigate possible effects, but how exactly did they do this?

Well, first, they took an existing Ecopath with Ecosim model and just modified it. In Ecopath, they added a lionfish group, and they added lionfish growth information, and they created artificially high fishing mortality, to make sure that adding lionfish after the fact didn't disrupt their initial model balance. This also made it easier for them to modify harvest strategies in Ecosim, and so they modified fishing effort in Ecosim to assess different mortality rates not just on lionfish, but on different reef fish as well, and then they did a series of alternative runs to --

Here, they plotted predicted lionfish biomass under different reef fish fishing mortality rates, and so this is showing that the model predicts that lionfish biomass will increase if you increase reef fish mortality and that lionfish are here to stay, even with really low reef fish fishing mortality. The model would predict a decline in biomass of nearly all the reef fish groups in the system, but this crustacean group might increase in biomass, probably because the predation pressure on the crustaceans is reduced when these other reef fish predators decline.

Next, let's talk a little bit in detail about Ecospace. Here, we're basically applying an Ecosim model in a spatially-explicit cell, like a raster map, but biomass can move between cells in the map in different time steps, and so this results in a series of biomass and catch distribution maps for every group, and the distribution biomass is covered by several things. First, you have to define these environmental preference functions that determine a cell contains environmental conditions favorable to a given group.

For example, in a specific location on a map, there will be a depth value and distance value and a temperature value, and these curves, these functional response curves, ultimately determine the relationship between environmental conditions, which will vary over time, and spatial distribution, because the product of these values becomes a habitat capacity value, and biomass in the model will gravitate towards cells with high habitat capacity. How quickly they move to higher habitat capacity areas depends on a dispersal value, and, last, the fishing effort is distributed by a gravity model that considers distance from ports and species targeted in the different fleets.

Now we have a full picture of the Ecopath/Ecosim/Ecospace modeling suite. In Ecospace, we inherit the Ecosim model, and we then define environmental preference functions from raster layers of depths or other imagery, and this other imagery might be satellite imagery, like SST or model-derived products, like sea surface height. Now, we also define the port locations for fishing effort, and we get catch and biomass maps out. Ecospace doesn't replace Ecosim, and Ecosim doesn't replace Ecopath. Each component is used to address different questions.

How do people use Ecospace? In the Gulf, Kim de Mutsert wanted to look at the effects of hypoxia on the ecosystem and ask questions like should we restrict effort during hypoxic events off of Louisiana, and so, on one hand, you have these seasonal increases in nutrients that will increase primary production, and too much can lead to these seasonal hypoxic conditions.

Kim used the model-derived raster data to represent nutrient enrichment and hypoxia and ran different Ecospace simulations to look at what happens to biomass when you include these

environmental effects, and she found that, when you include nutrient enrichment and hypoxia in the model, the model predicts increasing biomass in catch, rather than a decrease, and so, therefore, they recommended that effort didn't need to be restricted during these events.

Where are we at with the South Atlantic model? We're here, and we're approaching a calibrated Ecosim model, and we're looking at time series data to identify the most appropriate vulnerability parameters, but, simultaneously, we're looking at the available spatial data and spatial relationships in anticipation of moving into Ecospace.

Where could we go? We've heard about some general interest in questions like climate change impacts, and, like many models, there is many approaches that you could take. If we wanted to run Ecospace in the future, to look at different climate change scenarios, you could include different IPCC scenarios as raster data here, and define habitat capacities around that, to evaluate different scenarios compared to a baseline scenario.

At the end of the day, we have an established framework for looking at these different types of questions, and the strength of the approach is having the ability to predict indirect effects and complex food webs that otherwise we would be hard-pressed to predict on our own, and, in some cases, as we saw in Dave and Kim's work, you can get these indirect effects of management decisions for environmental perturbations to predict change, but sometimes they don't predict any change, but, in most cases, when we're looking at different simulations, we're not building the model from scratch.

I can come in here and tweak one parameter, and I don't have to build the entire model from scratch. Because this is the most common model in the world for ecosystem modeling, chances are that anyone else trained in the model could come in and do the same thing. If you had a chance to look at those papers, and I think they are included in the data documents, but each of these is a good representation of what you can do with Ecopath or Ecosim or Ecospace, and that's it.

MR. PUGLIESE: Are there questions? Laurent, did you have a question?

DR. CHERUBIN: Yes, Roger, and thank you. Hi, Luke. I wanted to ask you, when it comes to Ecospace, you talked about some of the drivers and the values you can get at the surface using satellite imagery, but what about the depth information? How did you get to that, because most of the information, I would say, is point-wise, and so how did you get distributed information at depth?

MR. MCEACHRON: I think the HICOM model has a depth property, but there are -- Generally, you're talking about interpolating that point pattern data, or I think, in the case of the South Atlantic, we have higher resolution maps in some areas than other areas, and so we can either take the approach of trying to combine all of that into one layer, but I think, for this, we just used the HICOM depth values.

DR. CHERUBIN: When it comes to biological data, you looked at archives and climatologies?

MR. MCEACHRON: When you're using some kind of like biomass time series, you just have one point in time of what the average biomass was for that year for the whole South Atlantic region for this group, and you're just using a sums of squares routine to fit the model, which is represented

here as a line, to train vulnerability parameters that will come up with the best fit to this observed biomass.

MR. PUGLIESE: I think Paula has a question.

MS. KEENER: More just a comment. Thank you, and thank you for this information. All of what we've heard this morning and the beginning of this afternoon is all related, in many ways, and so it's just -- It lends itself, certainly, to predictive capabilities for management, and so I think it's wonderful to be challenging to be able to look at -- Trying to look at all of this data and think about how it relates to habitat challenges and management of species related to that with all of these different variabilities in these predictive capabilities. It's really challenging, and in a good way. It's great to have all the data and all of these capabilities, and so I will just leave it at that. Thank you.

MR. PUGLIESE: I think Wilson has a question, but, just as a follow-up to your comment there, one of the aspects that is really important with all these, and that's why you have so many coming before this group, is that the opportunity to see these convergences and the opportunities to identify where the different data capabilities are and other things that can make all these different efforts complement each other or draw on other information that may be available, and one of the great things we have in the South Atlantic that we've been building, and collaborating on building, is our habitat and ecosystem online information system, and so building spatial layers on habitat, as Luke had indicated, habitat distribution information and connections to our fishery-independent surveys and oceanographic information.

One of the really interesting next things that's going to happen that will enhance a lot of these activities is there is -- Marcel Reichert will touch on progress on this, but an effort to connect and serve the fishery-dependent data through the Ocean Observing System, from the SEAMAP data system that will cover SEAMAP and MARMAP and SEFIS, and so you'll be able to connect in with the oceanographic model capabilities.

One of the really interesting points, and Luke can just touch on this, is that, in some upcoming new contract work they're going to be doing, is they're going to be building beyond that AI capability for the Ocean Observing Association, SECOORA, so that then some of these different things that you were talking about, of species distribution, habitat, other aspects to be determined, may be something that could be built with AI, and that's the foundation that could really advance the crosswalk between the modeling, the reports, the vulnerability, et cetera, and so hopefully we've set ourselves up for a collaboration across this, and this group plays a critical role to advance it, and I think, with that, Wilson had a question.

DR. LANEY: The question is, I guess, Roger, to you and Luke and Lauren, and that is my understanding, based on having the presentation multiple times now, is that the Ecopath component is pretty much completed, but, of course, it's still a work in progress, from the perspective of being able to add diet and other data to it, pretty much on an ongoing basis.

Then, from Luke, the Ecosim portion, I guess, is still somewhat under construction, and so the question is at what point, and I presume that will be sometime next year maybe, but at what point will the model be completed to a point where the AP, for example, or the SSC, or the council, could start asking what-if scenarios and be able to tinker with it to see what the results are?

MR. MCEACHRON: I think the Ecopath model is there. When people -- Before we went to break, there was a question about how often do you need to update these diets and things like that, and you have to keep in mind that these growth parameters, these diets, they are like average rates, and so, really, you're just trying to capture what is the dominant prey item for a species.

Coming in here and tweaking some diet information by like 1 or 2 percent, just because it's been updated, depending on the group, probably is not going to affect a balanced Ecopath model. Where you would want to come in and do a big adjustment to diets is if you saw a predator eating something that we had not identified it eating before, because it's like in Ecosim. In Ecosim, things can change the prey they are focusing on, but you have to define, in Ecopath, that Species X can eat Species Y, and it's not going to -- In Ecosim, it's not going to identify totally new prey items. You have to define that these are the ten things that eat -- Maybe Number 10 it only eats 1 percent of the time, but you still have to tell the model, at the onset, that that is a possibility that it will eat that tenth item. I think Ecopath is there for looking at ecosystem snapshot type information, and Lauren spoke to that a little bit already.

With Ecosim, where we're at is we're really just trying to fit these lines to these time series, and, because we have a-hundred-and-forty-something groups, it just takes a while, because, anytime you tweak a vulnerability parameter to maybe make this group fit a little better, it can affect the fits of another group, and so it's just kind of a lot of back-and-forth there. I think we'll probably have a calibrated Ecosim model by the end of this year, I would think, because we have started that process, where we're in the middle of it, and it's not like we haven't started it at all.

MR. PUGLIESE: To follow-up with Luke, I think the key is that's an important point, is that you're getting that advancement of the refinement, and, really, what you do to then test it is do exactly what you're saying, Wilson, is to begin to identify some questions, and then, once you do that, you can fine-tune the ecosystem to address those individual species, or groups of species, that you want to do that, and then you can fine-tune it to make it fit and operate well within what those questions are, and so that's, to some degree, why we had started advancing that in some of the discussion to the SSC, and hopefully at the council meeting and the committee meeting, in some of these discussions on what -- Once this does get to that point, what some of the questions may be, whether it's interactions between species, prey competition, et cetera, but provide some capability then to test the way the Ecosim operates, and I think Luke can follow-up with that, but I think that's then the next step beyond here, is then you really can operate and fine-tune Ecosim to begin to be used in that manner.

MS. DEATON: Thank you, Luke. I think we should probably move on, Roger.

MR. PUGLIESE: I think we're there. There's a lot more to come, as you see, and, as I said, there's going to be continued discussion, and the SSC has advanced recommendations on creating a standing workgroup to see this evolve further and move into the Ecospace, and so more to come and additional refinement and operations and really moving into the application, and so we're going to move into the next section now.

MS. DEATON: Okay. Thank you again, Luke. We're now going to go into Session 2, which initially was supposed to start at 1:00, and so we're about an hour behind, but it's okay. This afternoon, we're shifting more to some presentations about mapping of essential fish habitat, and

so, first, we'll be hearing about the continued studies on the deep corals on the Blake Plateau, and that will be followed up by some information about mapping of the sand shoals in relation to their value for sandmining, as well as fish, and that leads us to the further discussion on the EFH policy statement on beach dredging and filling and renourishment.

For that topic, there are several presentations, one on the Folly Beach Renourishment Study and one on an assessment of time-of-year restrictions in North and South Carolina. First up is the mapping and characterization of the South Atlantic deepwater ecosystems, and so we have, hopefully, Heather Coleman and Kasey Cantwell here to give that presentation.

MR. PUGLIESE: I think we have Heather is going to introduce -- We have both Heather and Kasey, and they will introduce Derek Sowers, and Peter Etnoyer is going to -- They have two back-to-back presentations, and so, Heather, I think you're ready. Heather, you're unmuted, but, if you're speaking, we can't hear you. Derek, I will go ahead and make you the presenter, and hopefully Heather can step in here shortly.

MR. SOWERS: Okay. That sounds good. I think Heather and Kasey were pretty tied up with some --

MR. PUGLIESE: Yes, and I think it was like on the bubble, and a couple of minutes, and they're probably going to step in here like within minutes, but I think the main thing we wanted to do is -- We've been working closely with Heather and Kasey over the years, and our AP has had multiple presentations on status of different individual cruise efforts and the deep-coral research and collaborations with the Okeanos and beyond, and this was a real opportunity to step forward with engaging you all in both a more comprehensive view and review of the research that's been done, essentially since the development of the last coral amendment. With that, I think I will pass it over to you, Derek.

MR. SOWERS: Great. Thank you very much. Just a quick introduction to myself, and I've been working for NOAA's Office of Ocean Exploration and Research for about seven years, and I'm saying hi to Paula out there, who used to be part of our team. It's good to hear your voice again. My background is really in hydrography and ocean mapping, and I'm leading and conducting ocean mapping exploration at-sea, and I've had the pleasure of working in your region several times, doing both ROV and mapping cruises, and I will be presenting the office's collective work in that region.

A quick overview of what I'll cover here, and this is a very brief mission statement, basically about ocean exploration and research, and I think most of you are well familiar with what we do, and I will be covering a lot of the data, exploration data, collected to-date and summarizing that for you and basically just kind of showing it off in a 3-D visualization software.

I particularly want to emphasize the availability of backscatter data, this newly available bathymetric synthesis grid, and so we take twenty different mapping surveys, and we will highlight those for you. Based on that bathymetric grid, I will be showing you a geomorphic classification of seafloor features, and so a strong emphasis there on the cold-water coral mounds in the region, and we'll talk about some of the substrate types we observed from submersible dives, the recent work anyway, and then we'll do a recap of some of these newly mapped features relative to the current habitat area of particular concern for corals.

A quick background on our office, and we are the only federal organization dedicated to exploring the ocean for the purpose of discovery and the advancement of knowledge. We are filling gaps in the basic understanding of the U.S. deep waters, and, by that, typically, I mean deeper than 200 meters. We are providing critical information to support many different benefits, as you can see on the right of this figure, and our exploration model includes ocean mapping, visual surveys of marine habitats, as well as sampling, and that includes biological and geological samples.

One of the primary exploration assets that we currently have to use is the NOAA Ship Okeanos Explorer. It's America's ship for ocean exploration, and it's currently the only federally-funded U.S. ship assigned specifically with a mission to systematically explore the largely unknown deep ocean. You can see that it's an impressive ship when it's got a fresh paint job, which it does not always have.

I am going to cover the mapping systems that are onboard the ship. Right now, we have a deepwater multibeam sonar, the Kongsberg EM302, and it's going to be converted this year to a state-of-the-art EM304, and there's only several of those just going into production in the world, and so it's a very state-of-the-art mapping system. We have, also on board, EK60 fisheries sonars, and those are looking at targets in the water column, such as deep scattering layers of fish, gas plumes, and it does that -- It can take calibrated measurements of target strength.

We also have a Knudsen sub-bottom profiler that allows us to see the shallow geological layers in the sub-seafloor, such as that image in the middle there, and so that helps scientists understand the shallow geology of the seafloor that we're exploring, and then we also have two Teledyne acoustic doppler current profilers, shown in the far right, and those help give us information about the direction and speed of currents underneath the vessel.

Other assets that we have onboard during an ROV cruise are the dual-body remotely-operated vehicle systems Deep Discoverer and Seirios. These are designed and maintained and operated by our close partner Global Foundation for Ocean Exploration, and these are both depth rated to 6,000 meters. They dive together at the same time, and they have HD cameras, to get amazing closeups of the seafloor and optics in the water column, and we do biological and geological sampling with these vehicles, between four and eleven per dive, and typically about six is pretty common. All of those samples are archived in public repositories and made available, like the rest of our data.

As a lot of you know, we've had a pretty long-standing collaborative working relationship with the South Atlantic Fishery Management Council, and we have been trying to respond to a lot of your management priorities, at least with respect to the deep-ocean areas, and so this is a cumulative map showing different survey polygons of our different cruises on the Blake Plateau. The black boundary is the current HAPC boundary. We've done ten OER cruises that have mapping data on the plateau, and three of those were ROV expeditions. There's also been two deep-search effort cruises in the area, and some of that work is partially funded by OER, and two OER-supported contract surveys for mapping data, to highlight in this next slide.

This is basically a similar slide showing you all the different cruises, and then, on the far eastern side, that big block of bathymetry that you can see is the survey that we basically funded and have done in 2019, and that was last November, and it was quite a large survey done in two different

areas, and, as you can see, the green hash marks are areas yet to be explored, to kind of fill in the main gaps we have there, as well as areas to the north.

I won't be talking a lot today about backscatter data, but I just wanted to make you aware that we do collect it all the time with our multibeam when we're doing a survey, and we do have this data type and imagery available for anything we've mapped in your region, and, for those that aren't familiar with what backscatter is, it's basically an intensity measurement of the multibeam signal that returns from the seafloor to the sonar, and it provides some remotely-sensed insight into the relative hardness and the roughness of the seafloor, and that is, obviously, useful for trying to understand and interpret the habitat there.

In this image, the light colors are strong intensity, and so reflections that you might get off of hard rock, like hard flatbed rock, and the darker colors represent weaker-intensity returns, and typically something like a mud will have a weak return.

I am going to show you this recent bathymetric survey that we put together, and so, thanks to COVID, we had some time to actually data instead of just always collecting it, and we were able to synthesize data from both OER and other surveys in the Blake Plateau, and so this entire area has been cleaned and quality controlled, to minimize any artifacts, and it really helps visualize the region's features in a seamless way. The great focus is on areas that should mound or scarp features, and so some of the flatter areas on the eastern edge of the Blake Plateau that have been surveyed are actually not going to be shown as part of this particular grid.

I am going to cut over to the 3D visualization software that we use to look at this type of sonar data, and so now you should be seeing a view of the region, with bathymetric datasets shown, and, for reference, the blue boundary that you see in this polygon is, again, the HAPC boundary, just to kind of orient you to that.

The orange and big yellow polygons were those survey areas done last year, and I'm actually going to turn those off, because they're not currently part of this synthesis, and I'm going to turn off some of the flat areas that we've mapped as well. Let's zoom in and just take a look at the features that we're talking about here today.

I will start off by just pointing out, on this southeastern boundary, there are some coral mounds that we were able to map just outside the existing boundary, as we can see some smaller mound features, and then, as we move into the main mound province here, you can just see thousands and thousands of mound features. You can see a lot of the complex geology here, dramatic scarps, and it's just really, really striking. It's some of the most beautiful places that I have ever mapped.

You have got to think about what kind of attention a place like this would garner on land, and some of our national parks out in Utah type of wild features, and so what's really striking, obviously, here is the density of mounds, and then this scarp geology is kind of up towards the northeast.

One of the focuses on our mapping expeditions was really trying to make sure we could find sort of where that eastern edge of the apparent coral mounds was, and so this area we mapped last year, and you can see this very big ridge feature, and it's kind of the end of the dramatic mound province to the west there. Then we sort of came into this region of flat seafloor, until this area further out

to the east, well outside of the current HAPC boundary, where you can see there is sparse mounds, but large relief mounds, and very consistently sized, and so clearly another important area just beginning to be discovered and characterized.

I'm just going to move north and feature this other area that we recently mapped, and this has an interesting combination of thousands of mound features as well as some very interesting underlying geology there, and so, again, this area is currently outside the HAPC boundary, and this is a very unique area. I have actually never seen seafloor, myself, with these kind of polygon patterns that you're seeing here, and so that was an interesting find, this kind of mesa feature, and then you've got this interesting kind of wavy geology, and so it's just a fascinating and diverse and complex seafloor you have in your region.

As we move north, you kind of get into the little bit shallower territory, with these warmer colors, and it's still very rough terrain, and I just want to point out some of these really densely-packed mounds up in this region, and so it's physically kind of separated from that area that's been referred to as Million Mounds, but it's still very concentrated and clearly sort of a directional orientation to those features. I hope this isn't too jumpy on your screens back home.

This area up here I'm sure you've heard a lot about, and it was featured in some nice news stories, and the DeepSEARCH group has done a lot of great work here in defining the oceanography. This is Richardson Reef, or the Richardson Mounds area, and this supports some of the largest cold-water coral mounds that we've discovered thus far around this area. Just to the north of that is this other dramatic feature, with the scarp, and then many mounds kind of forming out of it, and so I'm just taking you on a quick trip, and then we'll head back to the PowerPoint.

All of that is to say that, in putting all this mapping data together, the big picture here is that we have a nearly continuous cold-water coral mound province. If you look at this white line on the map on the right, it's about 472 kilometers long and up to eighty-eight kilometers wide, and so that's covering an area of about 6.9 million acres. For perspective, that white polygon is about three-times larger than Yellowstone National Park.

If you want to be very conservative, I have basically delineated out this yellow polygon, which is kind of this core area of very dense mounds, and, essentially, where one kind of mound ends, it's touching another one, and so that could be thought of as the core, or the densest, areas we have, and that's about 1.2 million acres, in that yellow polygon, and so that's an area larger than the Grand Canyon National Park.

When you look at the literature in other places around the world, this appears to be the largest continuous cold-water coral mound province yet discovered globally, right in our backyard. Again, the HAPC boundary is shown in blue, and it's just kind of remarkable how well that boundary was selected and what a good job it's doing of actually protecting a lot of this key habitat.

The talk, thus far, I've been focusing on sort of what -- Just a summary of the explorations that have been done, and now I would like to lend some interpretation, just as a case of what you can do with this data, and so one of the ways to better use this data to help characterize the seafloor is to do a geomorphic classification.

In the case of the Blake Plateau, you actually are in a unique situation, where you have cold-water corals that serve as the ecosystem engineers and are actually building seafloor features, and so geomorphic characterization is actually a way to start to delineate these features and quantify some of the habitat metrics associated with the cold-water coral reefs. In many settings where these interpretations are done, they're done by an expert interpreter, and they're done sometimes manually, in a GIS, and it's not always clear how the decisions are made to delineate features, and so it's not always transparent and repeatable by other researchers.

The current study that I will be talking about today, the goal is really to classify the terrain geomorphology using a repeatable and transparent method, taking advantage of some of the powerful computing software that we have now, and the key theoretical basis for this work was recognizing that most of the terrain features that you see in a visual terrain model can be described by these terrain types, like the ones you see here, and they're referred to as geomorphons, or bathymorphons, and so you've got to simplify the terrain into these features, and then, for any given bathymetric grid, you can look at the surrounding terrain and the eight principal directions, and they fit into one of these classifications.

We did this for the Blake Plateau, and we adopted a fairly simplified landform classification, with flats, peaks, ridges, slopes, and valleys. I want to take you back to the 3C visualization, to see what the results of this work actually look like draped onto the bathymetry itself. I will just turn off the bathymetry grid. I am going to turn on the resulting landforms here, and so this layer that I just turned on, again, is that five seafloor types, landform types, and let's zoom-in on the dense Million Mounds area here and see what it looks like.

These whitecap peaks are just that. They are the mound peaks, and the red represents ridges, and the green are the slopes of the mounds, and the blue is the valley features, and you can see that it's done a good job at delineating these, and so the topographic relief features, from the complex terrain. Imagine trying to do this manually and digitizing each one of these polygons individually, and it would take forever, and so that's kind of one of the reasons to do this using sort of a computer algorithm, as opposed to a manual interpretation.

As you get more into the scarp terrain that we have, again, this does a good job, and you see a lot more of the slope coming through, but the ridges are still highlighted, and they are still identifying mound features at the peaks of these scarps, and so this is just to give you a sense of what it looks like when you drape the results onto the terrain, and I'm just going to highlight the Richardson Reef up here, and so you can see, very clearly, the valley at the base in blue at the base of the scarp, and you can see the red along the ridge line, and the prominent pinnacle and mound features. This does have quite a bit of vertical exaggeration, but it's just to emphasize that the features pop out, and so that's what that looks like in 3D.

Then we're going to go back to the slides, and we'll look at this data more in terms of numbers, and you can see a lot of this area was flats, but you still have big proportions of slope, ridges, valleys, and peaks. While that peak area looks relatively small, it makes up a very important component, ecologically speaking.

One of the benefits of doing this type of approach is we are able to actually quantify how many likely mound features there are in that study region that we just looked at, and we found that there was 59,760 of those individual peaked polygons, and so that's a pretty good estimate of the number

of actual mounds, and not all of them are probably coral mounds, but the vast majority, in this case, would be.

Also, to put this in perspective, those peak features represent about 84,500 acres, and that's almost six-times the area of Manhattan. If you count the areas of peaks and ridges together, that's about 814,000 acres, an area bigger than Yosemite or Joshua Tree National Parks. Based on the submersible explorations to date, we know that many of these peak, ridge, and slope features have deep-sea coral rubble, coral framework, or live coral substrate that provides high ecological value, and so one of the benefits of this approach is you can start to inventory and quantify the resource that you are managing.

Now I'm just going to quickly walk through -- What I did is looked at some of these geomorphic complexity of sub-regions within the overall study area, just to kind of highlight the differences and evaluate how they were different, in terms of the mound relief, and so, again, this is focusing kind of on the cold-water coral mound features, and just bear with my nicknames, and it was just easier to remember names than a bunch of A or B or C study numbers.

This site I nicknamed Jellyfish Mounds, and the red indicates the mound peaks in the area, and you can kind of see this visual fingerprint, so to speak, of what the geomorphology looks like. The Richardson area, that's what the looks like. This is Streamlined Mounds, and you can see, on the left, the red circle indicates where these areas are in the larger study region. By the way, this is what some of the backscatter data for an area like this would look like, and so it's a pretty remarkable data source to look at in more detail.

This is an area that I just nicknamed Ripple Mounds, and it has these interesting, widely-spaced-out and interesting orientation, compared to the other mounds, and so it's very -- It kind of begs new research questions about how those mounds formed, if there's underlying geology they're attaching to or if they're sort of self-organized in that pattern, and you can see the pattern kind of called out and made more distinct through the geomorphic landforms. This is, again, what the backscatter sonar data looks like there.

Pinnacle Mounds are shown, and that's the area on the far eastern part of the plateau, outside the HAPC boundary, and that's kind of the pattern you see there. Mini Mounds, this was an area that's very small, and I think the average mound height here was about nine meters, but very uniform sizes, and there have been ROV dives here confirming coral rubble habitats and associated biology.

Sparse Mounds, again, this is another region to the east, and this is an area of few mounds, but high-relief features, and then the Million Mounds high-density kind of core, and sort of that -- You get a sense of that sort of fingerprint and patterns, and so that's a little bit more of just a visual, and then, when we look at some of the numbers behind these things, there is more to tell about how the sub-regions differ from each other.

Looking at this chart, I just want to highlight quickly the numbers. This table provides a summary comparison of the morphology metrics for the eight cold-water coral sub-regions evaluated. The mound relief values that you see kind of in the center columns, those were calculated by creating polygons of the peaks of the mounds and then clipping a spatial statistical layer containing the maximum change in relief, and so this is relief from the surrounding seafloor, and so these are measures that give you a sense of how tall these mounds are compared to their surrounding terrain.

I have bolded some of the sort of standout numbers in the relief, and a couple of things to highlight here would be that the core area of the Million Mounds sub-region, on Row H, contains 24,819 individual mound features, and so that's about 42 percent of the total number of mounds mapped in the entire region thus far. The peak density, in the areas of peaks and ridges, was also greatest in Million Mounds, and you can see that the Streamlined Mounds area had an almost equivalent peak density, and it was also clearly a standout in the group.

You can also see that Million Mounds supports the largest depth range of coral mound features, with some mounds as shallow as 356 meters and some as deep as 918. The Richardson Mounds sub-region is also clearly a standout, and it has the largest mound peak relief metrics of any of the sub-regions looked at.

Here is a plot of those maximum mound reliefs, and it's important to note that you shouldn't interpret this as a direct measure of the height of the biogenic mound created by accumulation of the coral skeletons and sediments. We would really need to look more at the sub-bottom data of this area or have some drilled cores, to see what those mounds are actually composed of, as some of these are built on high-relief geology, but, with those caveats, this still provides important insight to be characterized in comparing the type of cold-water coral mounds in the region.

Richardson Reef stands out as having the highest maximum relief in the eight sub-regions evaluated, and Million Mounds and Jellyfish Mounds are essentially tied, as did Sparse and Pinnacle Mounds. The Mini Mounds area had the lowest maximum relief, and so I picked a good nickname on that.

This plot shows you a graduated symbol of the relative vertical relief of the Richardson and Jellyfish Mounds area, and so, the larger the red dot, the higher the vertical relief, and, from this, you can quickly see that most of the mounds with the highest relief are found along the edges of the large scarps in the region.

Perhaps more meaningful is looking at the mean and the medians of these features, and so Richardson still had the highest values, but closely followed by that Sparse Mounds region, and so, while that Sparse Mounds area did not have a great number of mounds, the mounds that are there are, on average, some of the largest, and it's also worth mentioning that we did explore one of those features with an ROV dive, and we documented lots of coral rubble and live lophelia and patches of madrepora corals, and so those mounds do currently reside outside the HAPC boundary, but they do have high biological importance.

This just shows basically the range of depths at which the coral mound peaks occurred in each sub-region, and so the green bar is really that overall range of depths, and, in looking at these bars, it's clear that the greatest variation in mound depths is within Million Mounds.

This figure shows you just an overview, in GIS, from the twenty-three recently-completed dives, fifteen with OER Deep Discoverer ROVs, four done with Alvin, and four with Jason, and those were through the DeepSEARCH effort. Substrate annotations were done every fifteen minutes for all the dives, and what we had, at the end of this, is, if you just get a one-minute look at what substrate the vehicles were covering, that was about 6,081 class annotations total to look at, and so a great groundtruth dataset to compare against the bathymetry that we were analyzing, and I did

want to mention that a lot of these dives were annotated by the Deep Coral Ecology Lab, and so Peter Etnoyer, who will be speaking next, did a lot of great documentation of both the corals and the substrate, and, also, twelve dives were annotated by Ryan Gaspar, another graduate student in Eric Cordes's lab, and so thank you very much for that data.

This is what those areas look like and how they are classified when you use terminology from the coastal and marine ecological classification standard, which is what we used here, and so that gives you an idea of what the habitat classes actually look like in the video imagery.

One question we had was how does the substrate classes differ with these different landform classes that we have identified, and so, on the X-axis, you can see the landform classes, and the Y-axis is the number of observations, and, given that cold-water coral mounds were typically the target of most dives, it's not surprising that most of the observations occurred traversing up the slope and following along the ridges and peaks, and that means that the flat and valley landforms only really represented about 9 and 6 percent, respectively, of the observations that were made, and you can see the relative composition of those.

This is basically the same data, but it's just viewed as a cumulative plot, and so it kind of gives you a sense of, within each landform class, what the dominant substrates are, and it's measured by percent cover, and you can really see that coral rubble was dominant, both in the slope and ridge and peak and, in this case, the valley, and so, really, it's basically a validation that the interpretation of these bathymetric features, as cold-water coral mounds, is supported by all the groundtruth data that we've collected thus far.

Then you can see the yellow bars are the unconsolidated sediment class, and that's mostly absent from peaks, but they do occur sporadically on ridges and slopes. The orange area, you can see it's a dead standing coral reef framework, and it really comprises an important component of the slope, ridge, and peak landforms, and you typically have more of this framework in the higher reef areas. The high coral rubble and the valleys may indicate that the rubble is pushed down the slope by things like strong currents and biodegradation and gravity, and it accumulates in valley features between the mounds, and then it's notable that, on some of the flats that we traversed, you get these hardbottom habitats, and so that's something you can sometimes see acoustically in the backscatter data, and it's being validated, in some cases, by the video imagery.

I just did have to put one slide in just showing the striking alignment between the Gulf Stream and the distribution of cold-water coral mounds that have been discovered thus far, and so this is from the Ocean Prediction Center, a day or two ago, and the green line on the left is basically kind of the north main wall of the current at this time of year, and the darker-green line is sort of the south wall, and so clearly it's just feeding this whole ecosystem with a strong current and high food supply.

This final closing figure provides a quick summary recap of the extent of the mound and scarp features mapped, to-date, that are located outside of the HAPC boundary, and so I've just made some rough green polygons here, to just kind of bring attention to those for you. The points on the map are the twenty-three submersible dives that were part of this analysis, and the red line shown is the current HAPC boundary, and, basically, those green areas are what we sort of quickly walked through the visual characterization today, and those are the areas where I have provided the metrics on the mound relief. I think I will just go ahead and stop there. If you have follow-up

questions, I would be happy to talk with you and share any of the data that we described today. Thanks. I appreciate the opportunity to talk with you all.

MR. PUGLIESE: Thank you, Derek. Are there any questions? One thing I would like to do is thank you for all the efforts. It's one thing to get some of the different cruises and different components presented over time, and it's a pretty amazing thing when you combined it all and have been able to provide kind of the bigger view, and I think that's where we were at, is to try to look at the bigger view of how much work has been done, and, again, I really appreciate the fact that a lot of this is focused directly on council priorities.

Going in and really defining past conservation efforts in the existing HAPC, and it's really good to hear the comments about the alignment and the efforts that went forward and being able to validate that, and it really provides that foundation for past efforts, but also efforts that the council may look into the future for conservation of the newly-discovered areas.

Just a quick point, and I've got a couple of questions, but I was going to make it clear that we will be discussing Coral Amendment 10 later in the meeting, specifically with regard to Oculina. However, originally, the council was looking at both the combination of addressing this one area in the Oculina shrimp access area as well as all the new areas and how we would begin to discuss that, and the focus right now is to address the one action under Coral Amendment 10, and then, as we continue to coordinate and collaborate and provide this information, we'll look at how this can advance into conservation efforts in the future, and so, again, we really appreciate all the efforts, and I think we do have a question from Wilson Laney and then Paula Keener.

DR. LANEY: Thank you, Derek. Great presentation. Wow. What a tremendous amount of work you all have done, and it is just fascinating to have you fly us over the terrain, so to speak. The one question I had was with respect to the coral rubble classification, and can you all tell -- Well, let me just back up a second. Is that classification due to mobile fishing gear impacts, or is this a natural process of coral death and deterioration, or both, and can you tell the two apart, when you're looking at it?

MR. SOWERS: Well, I think the main answer here would be the coral rubble, by and large, is just a natural -- In many settings, it's the natural long-term evolution of these mound features over time. A lot of living coral can die off, and, as the coral kind of stays at the high-relief areas, and then you get the dead standing coral framework, which then is broken down, and then that turns into rubble, and so a lot of what we see, at least in the imagery, looks kind of undisturbed, and it's just kind of a natural -- It's the way these cold-water coral mounds are formed over thousands and thousands of years.

I personally don't know exactly what the indicators would be for something that was clearly disturbed physically, but other studies have definitely documented that, and I think you tend to get scar marks and drag marks from heavy gear and areas that are just kind of swept more cleanly than what you would see and what we usually see in an undisturbed coral rubble area, and so it's not meant to indicate any large-scale damage. That's not the purpose of the class, and it's more just describing that the dominant cover is a stony coral skeleton that is not standing anymore.

MR. PUGLIESE: A question from Paula, and just a quick comment with regard to that. One aspect is, on the western boundary of the HAPC, it's essentially at 400 meters, and so all of this

area is deeper than that, and the only fisheries we have in the South Atlantic that operate trawl fisheries were the royal reds, which are inshore of those areas. Paula.

MS. KEENER: Thank you. Hi, Derek, and it's great to hear your voice, and see you as well, and so thank you for all the great work and all the great work that the office has done and continues to do. One quick question. I just want to make sure that I've got this right, and you said that this particular area is the largest continuous area of deep-water coral mounds ever discovered, and is that correct? I want to make sure that I have that right.

MR. SOWERS: I think that's a fair interpretation. I mean, how you define that is up to some discussion, but I think the point being here that, yes, some mounds are physically separated by unconsolidated sediments, but, when you step back and look at the bathymetry, the mounds are close enough together where you kind of look at this area and say, okay, this is basically a cold-water coral ecosystem that we're looking at, and so I guess you could define what's continuous in many different ways, but the way I look at it is very close adjacency between mounds.

MS. KEENER: Okay. Thank you. The area that is unmapped, in the slide that you have up right now, is some of that area targeted as part of the Seabed 2030 project?

MR. SOWERS: Absolutely, yes, and so -- Well, first of all, the entire EEZ is targeted by that project, hopefully by 2030, or that's what we're shooting for, but I would say, in the shorter term, as early as hopefully this spring and summer. We hope to be back out with the Okeanos Explorer, specifically mapping those priority areas that you see there as gaps. We do have a very short-term goal of getting to that and trying to map as much as possible.

MS. KEENER: Perfect. Thank you.

MR. SOWERS: Thank you.

MR. PUGLIESE: Are there any other questions for Derek? Again, thank you. This is exactly what we wanted to be able to see, is the bigger picture and how much you backfill the protected existing area, and, as mentioned earlier, the council does manage these areas as deepwater ecosystems, and so they have designated -- They co-designated them as essential fish habitat habitat areas of particular concern, so that, in any of the permit and other activities, they have to look at all the connected and interconnected habitats that are supporting the system, and so we appreciate this, and we look forward to even more work to take it to the next stage.

MR. SOWERS: Definitely. Thank you. I appreciate the time.

MR. PUGLIESE: Wilson, did you have one more question?

DR. LANEY: One more quick one, and not so much for Derek, but I guess for Lauren, since she's still on, and I think Luke has left, but, Derek, the fact that you all have actually been able to quantify the habitats now, and I presume that that will continue as you map additional areas, but that, to me, begins to get us to the point where we can actually start looking at habitat and species production relationships, and I guess that's a big point of the whole mapping exercise, and so that's just tremendously exciting, to me.

I guess the question for Lauren, and/or Luke, and/or Roger, and/or Marcel, or Steve Ross, and I guess Steve knows a lot about this too, but it's whether or not we know enough about the individual species habitat associations to begin using the quantitative habitat information that you all are providing to us to begin to estimate production.

MR. PUGLIESE: I think Steve --

DR. ROSS: Hi, Wilson. You know, all of a sudden now, we have flipped the data emphasis, and we now have a lot more mapping data than we've got biology data, which is a little different than the situation in the past. The recent dives, and the dives that I made in Stetson Miami, don't really cover now the range of habitats and depth zones, especially the deeper end, and so I think you're right that we're getting close to the place where we can do that, but I think we don't quite have enough visual observation data, enough video data, on bottom yet, and so that would be a place to recommend additional research, is targeted video data to flesh out the biology.

MR. MCEACHRON: Wilson, I'm still here. If you do want to -- Basically, it would be building those environmental preference functions from observed fish occurrence or abundance or biomass or whatever on top of these different habitat classes. You can include categorical habitats in Ecospace, but the one thing to keep in mind is that the study area is very large, and, in Ecospace, higher-resolution data is not necessarily better. We can have a number of issues happen when you get into really high-resolution grids in Ecospace. A lot of people would say that like one-kilometer resolution is a high-resolution Ecospace model. That's just something to think about.

MR. SOWERS: I just have one point to add. An explicit point of doing this was to try to get to what the question was about, which is how do you -- If we're trying to quantify things like ecosystem services for large areas, you need to have some acreage, or square kilometers, to sort of put into your understanding there.

I did want to point out that the high-res -- Hopefully, while it might not be relevant to what we just discussed, it might be a benefit to increase the sort of accuracy and resolution of coral suitability models, and we're actually -- We have shared this data with the Cordes lab, and they're sort of testing out that -- Do any of these spatial layers, the things like peaks and ridges, can that be another spatial layer that goes into a coral predictive model that makes it more spatially explicit, and hopefully more accurate, when you're trying to project model results over a large seascape.

DR. LANEY: Thanks, Derek, and thanks, Luke. Just one more follow-up for Luke. If I understood you correctly, you don't need the tremendously high-resolution mapping for the purposes of Ecospace, but would you not need to know the coverage of each type? I mean, the table that Derek showed us that has the acreages of the different types, is that what actually feeds into the model, or do you need like a map in a lower resolution?

MR. MCEACHRON: You would need a map at a lower resolution, and so, if you had four different habitat classes, you need to think about the best way to convert that to one kilometer. Part of the reason too is that a lot of the satellite imagery that we use in Ecospace is not going to be below one kilometer anyway, and so it's about matching scales, but also some of the nuances of Ecospace don't do well with really high-resolution data.

MR. PUGLIESE: Okay. Any other questions right now? As I mentioned, this is an ongoing effort, and it's really good also to hear that additional areas are going to be filled in into the future, and I remember seeing some of those projections of cruise opportunity, and so it's great that things are still moving forward on it. Any other thoughts or comments? If not, we can go ahead and move on. Thank you, Derek, and, again, we will continue to collaborate.

MR. SOWERS: Great. Thanks very much.

MR. PUGLIESE: Thank you. I think that -- Heather, are you online? Did you want to introduce Peter?

MS. COLEMAN: It's great to be here again, and hi to everybody on the AP, and we're really happy to be able to share this work with you, both Derek's from OER and Peter's from the deep-sea coral world. Peter I know is online, and so if we can share -- Perfect. Peter is our Southeast Deep-Sea Coral Principal Investigator, and he has been heading the Southeast Deep-Coral Initiative Team from 2016, and he's just wrapping up, and they're finishing data analysis now, and he's done a lot of great work, and organized a lot of great work, by a number of PIs he's going to tell you about today, and so it's really great to be able to have both Peter and Derek here to show, together, what their work is doing, and I think Peter can add some insights to the questions that were just asked, and many others, and so thank you, guys, for listening, and I will turn it over to Peter.

DR. ETNOYER: It's good to be here, and thanks, Heather, for the introduction, and, Derek, that was a great talk. I am based here in Charleston, South Carolina, and, as Heather said, I have been working very closely with deep-sea coral research technology to organize and motivate this enormous team, mostly from NOAA, in this multiregional, multiyear, multimillion-dollar initiative that was sponsored by the Deep-Sea Coral Research Technology Program.

The Office of Ocean Exploration was a key part of the research in the Southeast, as well as the DeepSEARCH team and others, but we also had other cruises that I'm going to talk a little bit today, some on the NOAA Ship Pisces that were led by Martha Nizinski and Andy David and Stacey Harter and John Reed. This was just a big team effort, and it was so big that I actually can't give you all the details of what has gone down over the last four years, and so I'm going to focus on our most recent products of our analyses, and mostly on the products that are coming from the National Centers for Coastal Ocean Science and right from our lab here at Hollings Marine Lab in Charleston.

NCCOS is part of the National Ocean Service, and we have labs around the country, including Beaufort, North Carolina; Oxford, Maryland; and in Alaska. NOAA is currently consolidating in Charleston into the Hollings Marine Lab, and we've been kind of distributed around the Fort Johnson Campus, but we're now in Phase 1, and we're starting mission critical work, and people are coming back to the lab, after the last several months, and we are in this facility with the National Institute for Standards and Technology, as well as College of Charleston and the Medical University of South Carolina.

It's a great facility, and it's your neighborhood, and we're neighbors here in Charleston, and we bring a lot of field and laboratory expertise. Across NCCOS, we have experts in shallow and deep-coral taxonomy and benthic surveys, and so many times for soft bottom and hard bottom. We also

do a lot of GIS work and image-based analyses, and I think, most recently, among the most important projects out of Hollings and other labs was the damage assessment for the Deepwater Horizon disaster, but we're geared towards doing science for management, and we consider the councils to be one of our most important applications of our work.

I have personally been involved in EFH work going back to 2004 in the Gulf of Alaska, and we were able to produce the evidence necessary to support HAPC designations for about a dozen seamounts there in the Gulf of Alaska, but we've also been successful, using deep-sea corals as a model species, and producing the data necessary to justify the protection, and we've been very successful in southern California, and there have been enormous new closures and fishing restrictions and HAPCs and EFH and sanctuary designations, and it's all kind of a matrix of different management measures out there.

Most recently, we have supported the new HAPC designations in the Gulf of Mexico, and so I suppose that you guys have heard recently that twenty-one new areas of protection for deep-sea corals were signed-off by National Marine Fisheries, and so those are now official, and so we look forward to continuing this kind of work with the South Atlantic Council.

One thing that I wanted to introduce to you is the people of my lab here at the Deep Coral Ecology Lab in Charleston, and I only have fifteen or twenty minutes here, and so, if there's any message I want to get across, it's that we have a staff of trained experts here in Charleston, and we want to help you with these future analyses. I've got multiple analysts, each with at least five years of experience in taxonomy, ecology, GIS, and we work with enormous datasets, with thousands of rows and hundreds of columns, and, because we have multiple analysts, we're able to kind of raise the bar on quality control, which is a very important thing that came to bear for Deepwater Horizon and other damage assessments. We need to have cross-validation of these kind of annotations, and, because we have a large group, we're able to do that.

We favorite quantitative analyses, like the type that Derek showed you and the others that I'll be showing you here today, and a lot of that information is produced visually as maps and images and graphs and plots, and so we have this team of people, and we're doing a lot of image analyses for many cruises around the country, but this goes towards multiple applications, and, more and more, we're trying to think how can a single image dataset serve many purposes, purposes such as damage assessment, and we want to feed into habitat suitability models, with both presence and absence data, and we also want to archive this data in perpetuity and make it publicly available to you and to others.

Increasingly, we're seeing applications of neural networks and artificial intelligence, and we think that computers can do a lot of the drudgery work that we have to do, going through tens of thousands of images, and so we're trying to refine these image datasets now, to make them AI ready and useful for training these kinds of algorithms in the future.

Now, all those introductions aside, I can get onto what are the most recent products that are coming out of our initiative, and I think the thing that will be most useful to you, just to know off the top, is there's between 30,000 and 50,000 new high-resolution images that are available for you to visualize the seafloor, and each of these has annotations in more than a hundred different fields.

These new images were drawn from nine cruises since 2016, and this is just for the South Atlantic Bight, and this is skipping over the Gulf of Mexico efforts and the Caribbean efforts. We had at least nine new cruises just in the South Atlantic, and we were able to go back and recover twenty-five other cruises that have been conducted since 1998, and these were mostly by Harbor Branch and by National Marine Fisheries, and a lot of work from John Reed and Andy David and Stacy Harter and Stephanie Farringdon, and I know, also, Chuck Messing and Sandra Brooke, and probably Steve Ross is in the mix there, too. We were able to write contracts and cooperate with the cooperative institutes to acquire these images and ingest them into our national database.

On the lower-left here, the Deep-Sea Coral Program produced a little chart showing the growth in observations since our initiative started in 2016. You guys had maybe about 3,000 coral records, and it looks like about 1,500 sponge records, and now we're talking more like 12,000 sponge records, 14,000, and 18,000 coral records, and so we have tripled, if not quadrupled, the number of observations that are available in your region and in your HAPC area and beyond, and these will all be made available through the national database of deep-sea corals.

That data layer is the most important data layer that we produce, but it needs context. It needs the context of protected areas, shipping lanes, oceanography, in order to kind of geo-rectify all of these things, and, to make it accessible to our PIs and our partners, we built an online database. That includes these coral and sponge records, but it also includes multibeam footprints and things like this, and so this is one of many portals that that's available for your research, but we did invest in one brand-new layer that didn't exist before, and this is a comprehensive layer of all the submersible dives that have happened in the Atlantic since 1964.

We found that most of these happened in the South Atlantic Bight, thanks to Johnson Sea Link, and the UNC-W ROVs contributed enormous numbers of dives, and, all combined to-date, we've had almost 2,800 submersible dives in your region. Getting the data for those is not an easy thing to do, but at least you know that they happen, and you'll know where they happen. We're working to put this deep-sea coral layer and this sub dives layer in the Ocean Reports tool, which is linked to this presentation. If you haven't seen it, I would encourage you to go check it out. Not only does it kind of map out certain boundaries and occurrences, but you can also produce PDF reports, at the click of a button, for any box that you draw for a region. Ocean Reports will tell you what's there and what we know about it.

We have also produced, from my lab, just two brand-new photo ID guides. This is something that we get a lot of requests for, and people want to know what do I call this animal, or what do they call that animal, and, because of ships like the Okeanos Explorer, that are out there with terrific ROVs and cameras, we've got some really beautiful images of these animals, and we have samples, and there are very few of those, but those samples are vouchers that we can use to put the reliable names on the animals that we're observing on the seafloor.

We have collected all the samples collected by the Okeanos Explorer into one report, and then all the shallower stuff, which is really important for our damage and restoration work in the Gulf of Mexico, these have been collected into another report, and so I would encourage you to go look at those guides, if you're interested in knowing more about what kind of animals we're seeing in the region.

Just to give you a quick insight into how many records we've added at different depth zones, Robert McGuinn was able to produce this plot on the left, which is showing the number of records inside the managed area, and on the right is the number of records outside your managed areas, and the gray is since 2016, and the green is the areas before 2016, and I think you will see that, actually, the deepwater zone, between 300 and 600 meters, had the most records before and after our initiative, but, because of data rescue efforts, we've now got a whole kind of treasure trove of information in the fifty to 150-meter zone, mostly outside the managed areas, but a whole bunch of new stuff inside, and so thanks, Deep-Sea Coral, for that summary.

Most of the data that is being collected the ROVs is imagery data, and it used to be that, mostly, we were getting samples from either trawls or dredges or these kind of things, and now what we get is tons and tons of images from these cruises, for which very few have voucher specimens, but we can get a lot of information from these images. You might look at this and say, hey, that's something we should put on our website, or something we should put in a brochure, but, to us, when we look at this, we see at least a dozen different soft corals here, and probably a half-a-dozen different taxa, and we can also come away with some measures of the health and condition.

Most of those we're looking at here are healthy octocorals, but, if you look over on the right, you can see an exposed black coral skeleton, and those yellowish aggregations on that colony are probably encrusted zoanthids, and that's right next to a healthy black coral, and you can see the arms and tissue, and it's got a couple of lobsters there in the upper-right corner, and that's a healthy colony right next to an injured colony, and so we can tell you about the diversity, the abundance, the health and condition, and also about the substrate in which these are growing, and all of these images are georeferenced, and many times they are also referenced to CTD information, and so these images will have oxygen values and temperature values and even salinity.

Many of these are in incredible high-resolution detail, and so this is one of the examples sent to us from the Global Foundation for Ocean Exploration, and we have automated ways now to extract periodic images from large volumes of video data, and that's a lot of what we do, is reduce many, many terabytes of video into a few megabytes of rows and columns and spreadsheets that can be useful in models and in analyses.

When we look at these dots in this map of the new and the old records since 2016, think of each of these dots as an image, especially if they're recent ones. Many of these don't have images though, especially I think some of those from the Johnson Sea Link, and so what we've done here is we've zoomed-in on the coral HAPC area, and we've shown that in pink, and we have given you three different flavors of records.

The little green dots are all the records that we had before our initiative, and the big purple dots are the records that are processed already since 2016, almost all of them from the Okeanos Explorer, and we still have a couple of cruises in process, and they will be available soon, but I want to call your attention, in particular, to these yellow records, which are the ones from cruises that occurred mostly before 2016, but the data hadn't been currently available.

If you will notice, many, many of these are on the western boundary, and I'm hoping this has some interest for Chip Collier, because I know, when we started our initiative, one thing that was emphasized by the council is that we need more information about this western boundary. We want to know what's happening here, and there are MPAs out there for snapper and grouper, and

I think that was the motivation for many of these cruises from David, Reed, Farrington, and Harter, and these go all the way back to 2003, and one thing we've seen is, not only are they good for snapper and grouper, but many of them have exceptional abundance of corals and sponges, and we haven't been able to go through yet and do a real kind of breakdown of the biology for any particular managed area or any particular depth zone, but I'm going to get into that as I move forward in this presentation.

Derek also pointed out there is large areas out there that are still unexplored, and I put these in the slide just to show you that, even though we may have some new records coming out of these, it's just one dive here and two dives there, and I don't know if we have enough to build a good sample size for any one of these features, but we would expect that any one dive would crisscross one or more of those feature types, and we can take the biological information and attribute to those to the future, as some of our questioners were alluding to.

I am going to show you just some fresh, out-of-the-oven data from Okeanos Explorer 1907, and this was the last cruise of our initiative, and I am just representing these twelve dives here as dots that are scaled by the frequency of occurrence of corals and sponges. The large dots on the right, we had at least two colonies in each image, on average, and the smaller dots, the Dive Number 1 there, had coral, or a sponge, every-other image, and so the take-home message is that every dive had lots of corals and sponges.

The type of corals and sponges you're seeing depends, of course, on what your depth is. Over on the left, you will see Dives 1 through 7 were all between about 700 and 900 meters, and these are in this relatively unexplored zone, and so that data will be useful and relevant, and then, I think because of weather and the intensity of the Gulf Stream, this cruise was kind of redirected towards the south, and a lot of work, another five dives, was conducted in the Florida Straits.

Our two dives with the highest abundance were in two different places, one on the Blake Plateau and one right there in the Straits of Florida, and they had abundance of different types of animals, and so this is something we're learning too, is that we may have a high abundance or diversity, but it might not be the same animals you're looking at on any given dive or any different depth zone.

One thing we can know, going into it, is that there is a high diversity of corals and sponges in the overall South Atlantic region, and so Heather and I went through the lists that were published in the State of Deep-Sea Coral Ecosystems, and we found 110 species of octocorals on record, fifteen stylasterids, eighteen black corals, and we think mostly about the habitat-forming stony corals, for which there is only maybe five or six, but there is another seventy species of cup corals down there. The sponges, this is just a guess, that there is 118 species. We know there is fifty-five families, but there's a lot to be learned about the sponges in the region.

One thing that's clear is that, not only are they diverse, but we have a very high abundance, and this is a combination of all the dives seen through this cruise, and it's shown on the right as a pie chart, so you understand the relative abundance of these groups, and you will see that it's mostly gorgonians, sponges, and stylasterids down there.

We talk a lot about the lophelia, and we see this in the maps, but among those lophelia aggregations are all kinds of other associated invertebrates, including the sponges and gorgonians and other corals, and so I think it's important to take an ecosystem approach as you think of these

communities, and don't just think about the lophelia mounds, but think about all the other animals that are living on and among them, and this doesn't even go into the fish and the crabs and the shrimp, which are probably of great interest to the council, and our expertise is in the sessile inverts.

We can't count everything that we see, and sometimes we have to give it a categorical abundance, because we know that there is somewhere between twenty and fifty lace corals in this image, but we can't count them, and it wouldn't be practical, and so what we do is we give you a range total, and that's shown here on your left, and you will see that, from this whole cruise, in twelve dives, we saw somewhere between 6,000 and 12,000 gorgonians, between 4,000 and 10,000 sponges, and 5,000 to 11,000 stylasterids, and so we're able to break down these data in any way you need them, by region, by depth, by cruise, by dive, and this is just an example of one way of representing this information, but we want to work with you to give you the breakdown that you need to be most useful.

Here's some examples of the sponges that we were seeing down there, and they're really beautiful, impressive animals, and they're also very structure-forming, with associated species, just like we see for the corals, and some of these are carnivorous sponges, which are kind of interesting to learn about, and others are quite familiar, like this Euplectellid sponge in the middle, and we've seen many of those.

I think a lot of our work in the Southeast was targeted at sponges originally, because we thought of their biopharmaceutical potential. More and more, people are starting to look at the corals, and the sponges, in terms of the new biomaterials that they can inspire. We are seeing hundreds of thousands of dollars being invested by the National Science Foundation, and there are some recent articles out in *Nature* and other places about how these sea sponges and their kind of architecture can inspire fiberoptic cables, and they can also inspire new lattice works and new designs that can help us understand how to build better bridges in the future. Keep in mind that there's a lot of reasons to study these animals, and it's not just the corals down there, but it's the sponges contributing substantially.

Of course, we saw corals when we went down there, and we saw some that we had never seen before, like this Victorgorgia octocoral that's down here in the bottom center, and we also got pictures of stuff that maybe we never had pictures quite this good before, like the Trissopathes black coral. Most of what we know about this coral is from museums, from broken preserved samples in ethanol jars fifty years old or so, and so a lot of what we're doing is getting the first documentation of these kind of animals alive in their natural habitat.

As I said, we can interpret the health of the animals we're seeing, because the living tissue is so colorful and apparent that, when it's absent, you can actually quantify how much of that is absent, and that's now how we did it for this study, and that's how we do it for a damage assessment, but you'll find that many, many of the records in the national database have these categorical attributions of was the colony live, damaged, or dead. The bars here show the percent live in blue. As you will see, most of the corals that we observed were healthy. A few of them had injury, and some of them were dead.

I would say that the levels of injury that we're seeing were on the order of 5 to 10 percent, and this is typical of what we see in the Gulf of Mexico and in the Channel Islands. Even in our most healthy aggregations, we can expect to see about 5 percent of colonies with some level of injury.

It was interesting to note that the black corals seem to have more injury than the others that co-occur in the same area, and we don't know why that it is, but I will get into a little bit, some possible explanations, but it is generally understood that the stony branching corals, like lophelia, have live parts and dead parts, and the live parts grow on top of those dead parts, and so, although we're seeing a relatively high level of dead coral in the stony branching category, I wouldn't call that particularly concerning.

Some of this injury may be attributable to fishing gear or to marine debris, and we have evidence of that, and some of these images are shown here. The one in the upper-left has a black plastic bag at the base, and the two in the middle, the top and bottom, have monofilament line running through, and so does the lower-left image. It shows a monofilament line running through, and we don't know if that's old or recent, but we can make some assumptions about how long it's been there, based on the level of fouling. In the one up top, you can see that it looks like a number of crinoids have found a home there in that line, and that's not unusual.

Fishing isn't the only way to injure corals, and there's also quite a bit of predation going on down there, and most of that predation is coming from the echinoderms, and I think that's a cookie star up there on the right, and that's actually climbing up on top of some kind of sponge or coral, and it's hard to make out, but that will be feeding on that organism, and they can certainly do some damage.

There is other unseen culprits, and I would say the elephant in the room right now for the Southeast, and other parts around the world, is the threat of climate change. I could give you a whole talk just on this alone, but, instead, I just kind of want to alert you to two recent papers, of which I played a small role, but these were large collaborative efforts, supported partly by SEUS.

The one in the upper-right was published in *Frontiers*, and it was led by Sebastian Hennige from UK Bristol. What we learned here is that the corals in the southeast Atlantic, although they are seeming real healthy, they are under threat of increasing aragonite saturation, and they are kind of at the tipping point, or at the inflection point, of aragonite saturation, in terms of their depth. The saturation horizon is to get shallower, and they are to become subject to undersaturation, and we would expect them to suffer, on some level, in terms of their calcification rates or in terms of the robustness of their skeletons.

One thing we can do is just look across the country, on the west coast, and we can find lophelia there that's growing under the conditions that are predicted for the Southeast in a hundred years. The corals that are growing there now, under their conditions, are not large reef formers. They form small patches. They can survive under saturated conditions, but they don't build reefs, and we would expect that, if the climate models are correct for the deep sea, we would expect to see compromised skeletons in the lophelia, and you can read this paper and come to some conclusion, and, basically, we're able to identify the mechanisms of failure under ocean acidification.

Also, the sytlasterid corals -- I am not saying these are as vulnerable to warming or acidification, but they are useful, in that corals incorporate environmental signatures of their environment as

they grow, and this study in the lower-left in *Earth and Planetary Science Letters* is able to show that, surprisingly, stylasterids gave us the best correlation, the tightest correlation, for projecting warming in the future. We're able to track temperature, using these corals as a proxy, better than we're able to track temperature in the lophelia or other corals, and so there is some utility there in stylasterids that is maybe underappreciated.

Just to summarize for you all, there were lots of new cruises since 2016, and not only under the auspices of SEDCI, but also from OER, the Coral Reef Conservation Program, which sponsored a lot of the work in the snapper grouper management areas, and BOEM contributed a lot, and so did the DeepSEARCH Team, led by Eric Cordes and Sandra Brooke.

Our rescue of these data, besides the new cruises, we were able to triple the number of records that are available, and, as expected, many of them show extensive lophelia, healthy and less healthy aggregations, but there is also a very high abundance and diversity of the soft corals and sponges, and we need to appreciate that, too. Most of the corals were healthy, and consistent with what we've seen in other areas, but is of interest that the black corals and the stony corals have higher rates, and this is what we would expect under a climate change scenario.

I would encourage the council, and others working in this region, to start monitoring the health of the stony corals with respect to temperature and alkalinity and oxygen and DIC and aragonite saturation, and also start collecting some stylasterids and maybe working with universities to develop some new proxies there, but, all in all, we've got a lot of new data coming your way, and it's a good opportunity for a synthesis of not only all the data that Derek showed, but all the biological observations that we'll be able to share with you over the next several months, and we know you guys have good ideas, and we want to support those however we can, but I tried, in this presentation, to give you some examples of the ways that we can use to illustrate those observations. That's all I have, and thanks for your time.

MR. PUGLIESE: Thank you, Peter. Do we have any questions for Peter? That's an amazing amount of work over a period of time, and, again, it's great to see it combination, because things start coming, in terms of the bigger picture, and the emphasis on understanding the entire system is really appreciated. I think we have a question by John Galvez.

MS. K. GALVEZ: Kimberly Galvez, actually. Peter, great talk. I had a question. As one of the science leads that was on the expedition for 1907, we noticed that there was a potential difference in fishing gear within the HAPCs and outside the HAPCs between the different dives, especially the one that was actually right on the border, and I was wondering if you saw, analytically, if that can either be confirmed or denied or if there were any similarities that you happened to see during your analysis of the video footage.

DR. ETNOYER: You know, we actually don't -- We don't investigate the fishing gear so much, but I know that Heather Coleman had a graduate student who focused very specifically on that aspect, but that is a good comparison to make, inside and outside areas, but, Heather, if you have anything that you could contribute there to Kim.

MR. PUGLIESE: Heather, actually, I think is gone for the day. She had another session that she attend, straight from this to another one.

DR. ETNOYER: Okay. Kim, I will make sure to send a note to her and ask her to let you know, and so it's EX1907, dives inside and outside the coral HAPC.

MS. K. GALVEZ: Yes.

DR. ETNOYER: Okay. We'll look into that for you.

MR. PUGLIESE: Okay. I think Wilson had a question.

DR. LANEY: Thank you, Peter, for the presentation. That was another great presentation. Do you all have -- I guess you all -- You didn't cover it today, but that's because you're focusing on the invertebrates, the sessile invertebrates, but do you all also have photographs of all of the molluscan fauna that you see, and I know you do, or I think, but do you have photos of any of the fish at all? Have you pulled all those out into the database?

DR. ETNOYER: There will be photos of fish, but that's not our expertise, and that's more of a fisheries thing, with the Ocean Service, but what we've tried to do is develop a set of images that people can build on. If I've got all the annotations of corals and sponges, and Derek has got annotations of geology, people should be able to come to those same images and add some level of information, whether it's fishes or crustaceans or mollusks or sea stars, and that's one of the challenges of the work we do, is that nobody can be an expert in all these groups. Because it's video, everybody might have a different time increment that they're looking at, and so we're trying to focus now on getting a shared set of images that we can build on, but I'm sorry to tell you that we don't have counts of the mollusks or the fish or crustaceans.

MR. PUGLIESE: Okay. Any other questions for Peter, or comments? Okay. Well, thank you, Peter, again. This convergence of all the information, and your last note about the opportunity for a cross-census, and I was talking to Derek too about that, is that real opportunity to work between both the mapping and the characterization and the coral information, and that's a real opportunity to advance both efforts and provide the most extensive understanding of the systems, both in the protected areas as well as some of the newly-discovered areas, and really provide that, as well as, I guess, a focus on future work and areas to complete, and so that's going to be really important, and, as we move into next year and some of the new cruises that begin to fill in other areas, it's just the perfect timing for the consideration of the council to look about future conservation efforts under the Coral FMP.

DR. ETNOYER: Yes, and it sounds like a great opportunity and shared interest among everybody on this call, I think, and so I just want to let you know that my team is here, and we're available to help. We've done this before, and we want to do it again, but we know that the councils have a very kind of specific type of information that you guys need to move forward, and so we're happy to contribute however we can, and we'll just be looking to Heather and others to kind of coordinate that and figure out what are the research questions, moving forward, and how can we address them.

MR. PUGLIESE: Thank you, Peter. I guess we'll go back to Anne. Under this session, before we get into the next major session, I think most of the presentations, and most of the information, that you had provided set the stage for the discussion about future efforts, but I will pass that over to Anne, and we can go from there.

MS. DEATON: Okay. Thank you, Roger. Are you asking -- You confused me a bit, and so you want to have discussion on future conservation action recommendations? Is that what you're talking about?

MR. PUGLIESE: I was looking at the last item. Given what all has been provided to the panel, just kind of a broader sense, at this stage, because we're still -- You know, we've got the one aspect that we're going to deal with tomorrow on an amendment that's moving forward, but this would be things to be considered in the future, the value of conservation of these different systems and what maybe some of the opinions of the members are about advancing that into the future and continuing our work with them and collaborating on getting the research to support that.

MS. DEATON: One thing I was going to mention is that, while Peter was giving his talk, I got an email that came in through NOAA that there is public comment open right now for a U.S. National Ocean Mapping, Exploration, and Characterization Council. They are seeking input on ocean mapping and exploration and characterization efforts, which is so applicable to what we were just discussing, and I didn't know if Peter or any of the other deep-coral folks here, Derek, knew if that's about prioritizing future expeditions or something separate, and that was one question I had.

MR. SOWERS: (Mr. Sowers' comment is not audible on the recording.)

MR. PUGLIESE: Is that you, Peter? You are breaking up really bad.

MR. SOWERS: Sorry about that. I was just going to mention that my boss, basically our division chief, was in OER, and she is heavily involved in that strategy being referred to, and the acronym there is NOMEC. She is actually the co-chair of a group that is charged with this aspect of, okay, how do we move forward with a strategic plan to further map and characterize within the EEZ of the U.S., and so, yes, we are heavily tuned with that at our kind of leadership level.

I would just say that I think where they're at right now is fairly broad, in terms of just making sure that there's good coordination at the federal level and that we're getting input from industry on best practices and sort of standards, and I think like the actual details, in terms of assets to use for implementing the plan and cruises going out is a little bit down the road, but, that being said, there are pieces of this in motion, because this just builds on existing mapping strategies that are already part of many agencies and, even at the state-level, different missions.

MS. DEATON: All right. Thank you, and so that might be something that members of this Habitat Panel might want to weigh-in on.

MR. PUGLIESE: Yes, and I will forward the notice you just sent me to the members right now.

MS. DEATON: Okay. Then the second question, just for the panel members themselves, is, given this new information, and seeing where these coral features have been documented relative to the existing HAPCs, is there interest in considering taking an ecosystem-based approach, in the possible future, to protect these new areas east of the boundaries? Any comments on that?

MR. PUGLIESE: You have Paula.

MS. KEENER: I would say yes.

MR. PUGLIESE: Okay. Wilson.

DR. LANEY: I would say yes as well, Madam Chair, for sure. I guess I will look to Roger and other council staff for guidance on exactly how that would be done. Roger mentioned the fact that Coral Amendment 10 is only going to address one particular question at this point, but I guess the Coral FMP, Roger, would be the vehicle for making any additional conservation recommendations in the future?

MR. PUGLIESE: Yes, and that would be a consideration, and so all the different information would be brought forward on looking at what we've just been provided and some of that timing, I think I mentioned, is really good, because additional work is going to be done, and additional coordination and consolidation, and so just messaging to the council on advancing that, and that would be the vehicle, in a future conservation action, under the Coral FMP. In the past, the Habitat and Ecosystem has helped guide that from its beginnings, because of that ecosystem approach.

One good benefit of some of the discussions that we're having with this type of habitats, and the extensive nature of it, is the fact that there are limited benthic fishery operations in the area, and so advancing conservation of those areas may be good, plus the timeliness of keeping on top of the desire not to see oil and gas and other exploration that's going to impact those systems, before they are even in conservation, is probably important to keep at the forefront.

Definitely what is in place was provided, and hopefully helped advance a number of discussions or policy discussions relative to those activities and I know these were a lot of that information, as well as inshore information was provided when the State of South Carolina was considering the CZM issues relative to seismic testing, and they ultimately found that inconsistent with state activities. Close coordination on providing that information was important. Opportunities to continue to support and enhance that type of conservation in the FMP is definitely a direction that would be taken, and so, yes, the avenue would be through a subsequent action under the conservation actions under the Coral FMP in the future.

MS. DEATON: Roger, I know that we -- I think we've talked about this in the past, and, at that time, and I forget if it was a year ago, but I think the consensus was there were too many holes still in the area and that they needed more surveys, to sort of get the bigger picture, and, therefore, to wait for a while. Also, because there wasn't any evidence of fishing damage going on at the moment, but I heard a little bit different today, and more is filled out. The question is, is it enough, and when would more of that immediate area be complete? I mean, it's close.

MR. PUGLIESE: Yes, and they've done a -- They did like 3,500 square kilometers inside, at least that much inside, the existing HAPC, and probably almost as much outside of the HAPC, in especially that eastern side of the Stetson-Miami Terrace HAPC, and, as Derek has indicated, and Peter, the plans are already in place to have cruises scheduled to complete work within some of those large gaps that are still existing within the area.

As I mentioned before, and I don't want to underplay this, and they have been extremely responsive to the council's priorities on identifying that, and they have followed-up significantly from the last time we had these discussions on really filling in a lot of that with really high-quality information and extensive mapping and characterization of specific species and coral information that's going

to provide additional activity and substantive efforts. Truthfully, this is beyond what we had when we first looked at this, the originally designations, and this has gone a long way. I think Cindy has a question.

MS. COOKSEY: I had a question, and I wanted to throw my support behind bringing the expansion of the HAPC up through the council, and an additional question to the researchers is have they encountered any signs of damage associated with submarine fiberoptic cables during any of their mapping expeditions, and I am specifically interested in this as, as we continue to expand our protected areas offshore, we're likely to see kind of a concurrence of these expanded area and fiberoptic cable highways, and I just want to try to get a handle on what that mean from a regulatory perspective.

MR. SOWERS: I can just let you know -- That's a great question, and I think, from our standpoint, we very carefully try to understand where cables are laid on the seafloor, and we intentionally avoid doing our ROV exploration dives there, for safety considerations. We're trying to make sure that we don't become entangled in a cable, and so I would say that we don't have a good understanding of that, and I don't think we really have evidence, at this point, one way or the other.

MS. COOKSEY: Just something I'm throwing out there is that it is an issue that we have -- It's been raised on occasion, and we just don't really know what's happening on the eastern seaboard with these cables and potential impacts to our deep-sea corals and our protected areas, and so it's a topic of interest to me.

DR. ETNOYER: Cindy, I can tell you that part of our data rescue included surveys conducted by Chuck Messing on what I believe was a liquid natural gas pipeline, and so, if the procedures are the same to install those, maybe you can infer something from that, but, no, we have no experience with the fiberoptics.

MS. COOKSEY: Okay. Thank you, guys.

MR. PUGLIESE: I think you bring up an important point. It would be good to at least know what the distribution and potential interactions may be, to document where those exist at this point. Are there any other questions or comments? I think that set the stage for I think follow-up, a lot of additional follow-up, on information and on future work, and hopefully discussions that advance conservation in the future. With that, I will pass it back to Anne.

MS. DEATON: Thanks, Roger. Again, thank you to Derek and Peter. That was very interesting information, and it seems like a good example of a positive thing that happened from COVID, because you were forced to stay in and do all that GIS work, Derek.

MR. SOWERS: A silver lining.

MS. DEATON: A silver lining. Only one. Okay. Now we're going to move into another topic, and it's the sand shoals and fish habitat value for sand mining and EFH assessments. This is very timely, because, just last week, there was a two-day meeting held by BOEM looking at the value of Frying Pan Shoal, which is off of the Cape Fear River in North Carolina, but it has very relevant information that, between those meetings and what Chris and Deena are about to go over for us, and so we've got Chris Taylor and Deena Hansen. I believe maybe Deena first.

DR. TAYLOR: Anne, could you activate Brad Pickens, please? He's going to be sharing the slides in the beginning, and we're going to do it together. I appreciate that.

MR. PUGLIESE: I need to have him as the presenter then, and I will get him to unmute, because I just did Deena as the presenter, but I will make him the presenter.

DR. TAYLOR: I appreciate that. Yes, he's share his screen, and I think we'll be good to go. Thanks, Roger. I appreciate that.

MS. HANSEN: Then, partway through, I will actually ask for some screen control, but Brad is going to do the first part.

MR. PUGLIESE: Give me a heads-up, and I will transfer it over.

MS. HANSEN: Okay. Perfect. Thank you.

DR. PICKENS: I'm actually going to pass this over to Chris. Chris, you can take it from here, and I will run the slides.

DR. TAYLOR: Great. Thanks for that, Brad. Thanks for allowing us to speak to you today, and I guess we're taking a very dramatic shift in our discussion of habitats here, and we're going from the deep part of our EEZ to some of the most shallow areas of our EEZ in the marine environment. I am Chris Taylor, and I'm an ecologist with the habitat mapping team for NOAA's National Centers for Coastal Ocean Science.

I am based at the NOAA Beaufort Lab, although I am currently occupying my home office in Morehead City, North Carolina, and I'm the NOAA technical lead, the federal technical lead, for a project where we did a synthesis and assessment of fish habitat value of sand shoals, to aid in the essential fish habitat assessments for sandmining activities. It all culminates in a product that we call ShoalMATE and it's the Shoal Map Assessment Tool for EFH, and we're going to talk to you about how we developed this tool and the synthesis.

Our team is made up of members of the Bureau of Ocean Energy Management, and you will from Deena Hansen in a bit, as well as Laura Turner, myself, and Brad Pickens, again with NOAA's NCOS, and our colleague Mark Finkbeiner with the Office of Coastal Management and the geospatial decision support tool, ShoalMATE, was developed by Quantum Spatial and with Alexa Ramirez, with Liz Rogers at the helm.

We also want to recognize the close partnership that we had with our colleagues at the National Marine Fisheries Service and the Southeast Fisheries Science Center, the Northeast Fisheries Science Center, and colleagues from South Carolina DNR and academia, particularly UNC-W, where Brad Pickens is currently based.

We're going to talk about the background and where we're coming from in the development of this project, and we're also going to show you some modeling that we're doing that helps us understand the broader distribution of sand shoals in the outer continental shelf, and we'll discuss some overall findings from fish species distribution models in the region, and we'll specifically

focus on some outcomes from species distribution models in the South Atlantic, and then we'll pass it over to Deena, and she will give you a demonstration and run-through of the capabilities and data that are available in ShoalMATE.

Many of you are aware, and I guess this is a topic for your next discussion, that marine sands are used for beach nourishment and barrier island restoration, and the demand for these offshore sands has increased rapidly, as we continue to deplete the nearshore sand resources. This sandmining activity has increased severalfold over the past twenty years, and it helps us to counteract the effects of storms and erosion, and it contributes significantly to coastal infrastructure, particularly beaches and the effects they have on our blue economy and tourism.

Sand shoals, large shoals, especially the cape-associated shoals, represent some of the largest bodies of sand in the outer continental shelf on the east coast, and dredging of these sand shoals may be the most efficient of obtaining marine sands for nourishment projects, but these shoals are often designated as essential fish habitat. That said, the full extent and the full shapes and quantity of these shoals in the continental shelf are largely unknown, because of the lack of mapping data that Derek alluded to in his presentation earlier.

An essential fish habitat consultation is required for all dredging activities, yet we know little about the actual effect of sandmining on the habitat value and the habitat value that shoals have for fish, and what this means is that we need a consistent and science-based assessment of fish habitat value, in order to implement a more strategic approach that BOEM can use for planning and permitting for sandmining activities.

Of course, under the Magnuson-Stevens Marine Fisheries Conservation Act, EFH designations allow for the protection of fish habitats, but, as we see in these maps here, often, these designations of EFH are at the Level 1, meaning they represent largely presence/absence data across a range of life histories, and this often doesn't provide the fine-scale detail necessary to make local decisions, as in what is the actual impact on habitat value for sand shark or tiger shark if we were to consider some feature like Frying Pan Shoals?

Working with BOEM, we came to understand their needs and their assessment of data gaps and their requirements. First of all, we need to come to an understanding and a common language and define an effective shoal classification scheme. BOEM recognizes the utility and the credibility that is provided by citable reports and syntheses, as well as peer-reviewed manuscripts, in developing their essential fish habitat assessment documents. They see a need for a consistent format in the content of EFH assessments with regard to sandmining, and, to get everybody on the same map, or on the same page, they see great advantages in the development of interactive mapping tools that include things like unified geodatabases that offer and make available a wide range of oceanographic, physical, biological, and geological data in one mapping environment.

NMFS is on the other side of this EFH assessment issue, and they see the value in citable reports and syntheses, as well as peer-reviewed manuscripts, to provide those biological and conservation recommendations, and they also see advantages in the consistent format and content of these EFH assessments and the reports that support those.

DR. PICKENS: I think I will take it from there. This is the framework of our study, and everything points to ShoalMATE, which again is the decision support tool, the Shoal Map Assessment Tool

for EFH. Going clockwise there, starting with the gray boxes, you see we have dredging history going into the tool, and we have the spatial designations for EFH going into the tool, and we actually have some descriptive habitat characterizations for EFH as well going in.

The blue is the science portion that we added to the tool. First off is the literature synthesis, which summarized the potential effects of dredging on fish and fish habitat associations. Then what I will talk to you today about is the sand shoal identification and classification, as well as the fish species distribution models, and these all go into ShoalMATE and the output from ShoalMATE -- This is an internal tool, to be used by BOEM, and they will be sharing this information with NOAA National Marine Fisheries Service, and this whole process has the outcome of having an automated EFH assessment report and maps that go with it.

This is our study area, and it's a large one here, and, basically, we're covering the Atlantic and Gulf of Mexico coasts that are relevant to dredging, and so we restricted our data and analysis to offshore federally-managed waters of a maximum depth of fifty meters, and this was just more than enough, and that's actually just a little deeper than what is currently capable of being dredged.

This is our sand shoal identification process, and, previous to this, sand shoals were really delineated on a project-by-project basis, and we wanted to provide BOEM with a more strategic, holistic approach here, and so we conducted a seafloor classification using distance to shore and several of the geomorphology metrics that you see there, and so, basically, we're describing the sloping sides of a shoal, and then the BPI is bathymetric position index that's describing the topography. Are you higher than the surrounding areas?

With the slope and the topographic relief, we came up with shoals, through a geographic classification, and you can see there that, particularly in the South Atlantic, the cape-associated shoals in purple really stand out, and these are blown up, and so it's actually right around 4 percent of the study area that was shoals, and so you can see that we mapped shoals for the Atlantic coast and the Gulf of Mexico.

This is a couple of zoomed-in pictures of Cape Canaveral and then the North Carolina coast, and those images that you see there -- The black outlines are previous Bureau of Ocean Energy Management mapping efforts, physical mapping, and the pink are sand shoals from the classification, and so you can see they fit rather well, and we do have a quantitative analysis that validated that as well, and we basically found that our modeled shoals matched very well with the BOEM-identified sand resources.

This data is now available on BOEM's MMIS Online Viewer, and we actually have this article in press in the *Journal of Coastal Research* as well. I will emphasize that we really provided a more comprehensive model of where sand shoals are, and so you can see we went beyond, well beyond, what was already known and into areas that have not been mapped.

We took this shoal identification a step farther, and we used the Coastal Marine Ecological Classification Standard, CMECS, and we developed a classification scheme from expert opinion and several workshops to describe shoals, but really with the perspective of fish and sand dredging, and so, if you follow the black outlines there, you can see we start with a shoal complex, and this might be several individual shoals, maybe connected as well, and, following downward, downward

in the hierarchy, you see individual shoals, and then those are also classified into, as examples, cape-associated shoal or bedform shoal or isolated shelf shoal.

From there, we actually have a whole slew of other characteristics, and those get into whether there is shelf present, what's the sediment grain size, and just basically everything we know about an individual shoal, and that is all within the CMECS classification scheme.

Let me move to fish habitat modeling. We had to decide what species to get into with the habitat modeling, and so we started at the top there, and we limited our possibilities to those fish with essential fish habitat, and we focused on those that have been already documented using the sand shoals. Data availability, of course, is a factor there, especially in the South Atlantic. We looked at species that were particularly vulnerable to dredging, such as demersal species, and we also considered economic importance.

This is the broader view, including the other studies areas, and the Gulf of Mexico has eight species, including three penaeid shrimp, juvenile red and lane snapper, blacktip, spinner, and Atlantic sharpnose shark. For the Greater Atlantic, I was very fortunate that Kevin Friedland at the Northeast Fisheries Science Center was doing modeling that was concurrent with our study, and we used thirty-four species that were both EFH-related and were captured very well in trawl surveys.

For the South Atlantic, we were more limited, and we actually used -- For example, in the Greater Atlantic, there was one trawl survey that captured thirty-four species. In the South Atlantic, five surveys were able to capture five species, and so we looked at a lot of different sources of data, and we looked at red snapper, black sea bass, tiger, sandbar, and blacknose shark in the South Atlantic. Today, I'm going to give you kind of some lessons learned from the Gulf of Mexico as well.

Let's back up a bit to look at species distribution modeling, and this is really up and coming, and so I will give you a broad overview here, and, basically, we're taking fishery-independent surveys, whether it's trawl, trap, video, or longline, and then we are looking at habitat relationships, and we calculated thirty-four habitat predictor variables, and the key there is that these predictive variables have to have a spatial depiction.

If you know the habitat relationship, as you see there, the graphs are all -- The Y-axis there is the probability of presence for each of the graphs, and then the X-axis, the horizontal, is the environmental variable, and so, for this example, these are tiger sharks, and they're associated with nearby wetlands and deeper water depths and their associated survey time. We can map all of those things, with the exception of survey time, and you can see what that map looks like. That map is -- Actually, each ninety-meter cell is a statistical model.

I wanted to give you some context, because we learned a lot from the Gulf of Mexico to apply to the South Atlantic, and so, in the Gulf of Mexico, we found that oceanographic factors were most frequently selected, and they were also most important, particularly in mixed layer depth and salinity, and you can see the graph there of the different types of variables, including oceanography, geography, prey, substrate, and estuarian, and the variable importance there is on the Y-axis, and so you can see there is a lot of ocean variables that were selected.

Prey species were correlated with snappers and sharks, and then substrate, which we were very much interested in, with our focus on sand shoals, substrate was of minor importance, but it did come out like we thought it would for snappers, and I will note that nearby wetlands and estuaries were selected by sharks as well, and that was true in the Gulf of Mexico and in the South Atlantic.

I mentioned nearby wetlands a couple of times, and so here's what this looks like. If you can imagine yourself out in a boat on the water, and you drew a radius of 130 kilometers around you, and you added up all the wetlands in that area, that's how we measured nearby wetlands, and this is the idea that the wetland and the terrestrial side may have influence to where marine fish are located. For example, in the Gulf of Mexico, actually, three out of three sharks were related to estuarine wetlands as well.

Some geomorphology results, we knew, going into this, that juvenile red snapper were known to use sand shoals, and, yes, in fact, the fact the model did show a positive relationship with them, but it was only of very minor importance compared to other variables, and so, if the oceanography was right, they were able to select sand shoals.

You can see, in the graph there, the red areas are higher probability, or, actually, it's higher catch per unit effort, and so you can see distance to shoal, and the red area on the left side are areas close to shoals, close to sand shoals, and you can see it has a much higher probability of occurrence, and there's lots of red, and the other axis there, the proportion of the topographic index, and that means it's a higher-relief area, and so they were related to both shoals and higher-relief areas. However, again, they could only really select being close to a shoal and topography if the oceanographic factors were correct.

Let's move to the South Atlantic, and these are adult red snapper, and you can see the map there, and you'll see several maps coming up, again with the blue being low probability of presence and the red being the highest probability of occurrence. In this map, you will shoals in pink, once again, overlaid, and so you can see that red snapper are predicted to be in an area of North Carolina, and also South Carolina, Georgia, and Florida.

We actually tested nearby wetlands with adult red snapper, because of our findings in the Gulf of Mexico, and so we found, in the Gulf of Mexico, that juveniles were related to brown shrimp, and shrimp are related to wetlands, and so we actually decided to go ahead and test the hypothesis, and, again, it came out to be correct that there was a positive association to nearby wetlands. Water depth was also a factor, and the distance to Gulf Stream, and so red snapper had a higher likelihood of presence within about twenty-five kilometers of the Gulf Stream, and that would affect the area in North Carolina that you see there, and also Florida.

They also followed a westward current, and so a westward current close to the Gulf Stream makes some good sense, and I also want to emphasize there the interaction plots there, and they're the colorful ones, and they did select water depth, but it was also dependent on context and so they were really most abundant, or most likely to occur, in areas with the proper water depth and lots of nearby wetlands, and, likewise, they were very likely to occur at the proper water depth when the currents were westerly, and so it was more complicated than a simple linear relationship, or even a variate relationship.

These are shark species overlapping with sand shoals. Again, the bigger message here is that some shoals are more important than others, but it's not because of the shoals. It's more because of the oceanography, and it's about how much estuaries are surrounding it and how many wetlands are surrounding it and what's the salinity, et cetera.

You can see the blacknose shark on the left, sandbar in the middle, and tiger shark on the right, and blacknose shark, in particular, were related to chlorophyll, and they had this relationship with currents and estuaries, which really highlighted the capes and inlets for that species. Tiger shark, as I showed much earlier, had a very much positive relationship with nearby wetlands, and you can see, for example, in the tiger shark on the right side, you can see, off of southeast North Carolina, areas that are probably a little too shallow for this species, if you can see my cursor there.

Some conclusions, and so the value of sand shoals -- We initially thought that the value of sand shoals was going to be either positive or negative for a species, but it turns out that it's really dependent on the greater context. Is the oceanography right? Is the salinity right? Is there mixed layer depth? Is there currents? All these other factors.

There are few relationships with geomorphology, as we suspected, but those are pretty minor, and I want to emphasize here too that species distribution modeling could inform a review of EFH designation, and it produces both the maps and new habitat relationships that may not have been tested before, and I will emphasize that with sharks, especially thinking about sea level rise and impacting wetlands and potentially wetland and estuary productivity, and that may actually affect sharks in the marine environment, and so that is something to think about. I have also included the BOEM website there that has our report and more information on our study, and, with that, I will hand that over to Deena.

MS. HANSEN: Thanks, Brad. This is the landing page for ShoalMATE, and, as Brad and Chris mentioned, this is a tool that's internal to BOEM, and this is based partly on our need and funding availability that we had to kind of confine the limitations for this particular tool, and so it starts at the federal boundary, and so it's usually three nautical miles off of most states, and it goes to about fifty-meter water depths.

Even though BOEM is the only agency that has access to this tool, we can create these reports and then further refine them with our partners, like the Army Corps or a locality, like a town or county, that is interested in dredging activity, and so we start with a broad view, and then we can zoom in here, and you will notice that, as I zoom in on a particular area, we start to see the shoals that Brad mentioned that have been modeled, and so, as we get in closer, you can see that we have a combination of both modeled shoals, like these here, and then we also have BOEM-identified sand resources and lease areas, and so these are going to be the boxy ones, and those are not modeled shoals, and those are most likely study areas and previously identified sand resources.

I am going to zoom in here off of Carteret County, North Carolina as an example area. On your left-hand side, this is sort of where we have our main driver, and then, as we click on things, we can see them up here in our map here on the right, and so, when we begin the assessment tool, we zoom in, and then, once we click a given box, it highlights it, and, as we have several different overlapping areas, it will give us a list of the three different options that we have, in this case, and so one being a modeled shoal, one being an offshore dredge material disposal site, and then one that's actually a lease area.

I am going to select the lease area, and then another really nice feature that we have in ShoalMATE is seasonality, and, while this is changing in different areas, sometimes we do work in environmental windows, so that we can select for only winter or only fall where dredging might occur, and so I'm going to select winter for this area. As you make your selection, the tool sort of walks you through the different components that are going to eventually go into the assessment report.

When you first look to view and intersect all essential fish habitat species, you get this comprehensive list that you can sort live in the tool, either by species name -- So we not only have the species, but we also have their life stages and then whether they overlap with these season selected, temperature range, and the water column zone is indicating demersal versus pelagic and then if there's a known affinity to sand and then if they have the depth range that overlaps with the particular lease area that we selected.

Based on whether we have all of these overlapping, or only some of these overlapping, we have this impact potential that we have quantified as high, medium, or low, and so this helps us kind of hone-in on the species that are most likely to have an impact from dredge-related activities, and so, that way, we can focus our analysis and our assessment on those species, while still providing this entire comprehensive list of all the species that overlap. This table does go into the final report.

We can also look at habitat areas of particular concern, and so, in this, you see that coastal inlets are a HAPC that is in occurrence with this lease area, and so that's something that will be flagged in the report, and then now we get to the species distribution models, where we can look at relative abundance and probability of presence. These are the models that Brad specifically created for this project.

You can see these are the five species that Brad showed you already, and so what we did is we looked at the species, and we looked at their probability of presence on this exact footprint of the lease area, and then, just to have some kind of comparison, we also chose a buffer of twenty kilometers, to say those are probably a presence within a broader footprint, and then we compared to the entire geographic range, which in this case is the South Atlantic. You can see, for example, that the sandbar shark has very low probability of presence on the actual shoal, but, within the region, it is much higher, and so we can kind of use this to infer that they're more likely to be somewhere off the shoal than on it, and so we have this for each area that we looked at.

We can also look at some other marine minerals information, and these are mostly geology related, and then, finally, we have best management practices that we can proactively select, and so we have BMPs that are common to a lot of BOEM leases, and then we also have some mitigation measures that -- We pulled these from a variety of different EFH consultations, and so these are things that we might see often or that might be applicable to multiple projects, but then, in addition to having these kind of pre-selected, we also have a blank space where you can add a new mitigation measure that you might already know for a particular project.

That way, we can sort of frontload our assessments with any mitigations that we know about, so that, when NMFS is reviewing it for conservation recommendations, they can kind of zero-in on any gaps that they might see.

Once you select these, you see that again goes into the assessment, and then, finally, we have a couple more options for maps, and these are sort of our popular maps, and so having an overview and just showing the general geography of the area, and we also have a bathymetry map that will show current direction, and this is seasonal as well, and this helps with some of our assessments of turbidity plumes, and so this will show the bathymetry of the area, bottom type for the area, and legends for all of this are included in the final report.

Then two things that we're still developing are accretion maps, which would show any show in the bathymetry from the end of a dredge project to any pre-dredge or follow-on survey, so that we could see if there are any areas where accretion is happening, because sometimes that is a preference, to dredge there, and then, also, an exposure map is another product that we're still working on, which would show you basically the footprint of where the dredge actually removed material on any previous projects. These can be included in the report as well.

Aside from those sort of standard maps, we also have a lot of other variables that you can choose to add to your report as needed, and so not only do we have things like hardbottom, management boundaries, benthic data, but we also have all of the species models that Brad showed.

For example, when you look at the blacknose shark, and it actually is kind of nice to zoom-out on these, so that you can kind of get that view of, in that particular lease area, it is a higher potential probability of presence for blacknose shark, and so that might be something that -- This might be a map that we would want to include in the report, as opposed to the tiger shark, which you see is less likely to be in that nearshore and more likely to be in that sort of farther offshore area. These species models really help us hone-in on the animals that are really more likely to be in a given borrow area before the project occurs.

We also have oceanographic variables, like bottom current, sea surface temperature, salinity, and then any infrastructure, and somebody brought up the potential for any energy cables, and so those things would go in here as well, so that we could see if there were any potential conflicts or multiple-use things to be aware of.

Finally, in the final step, we would put in our project name, the BOEM office, and any Army Corps office that might be implicated in a project, and then we would export the report. Exporting the report can take a little bit of time, but I can try to do that now, but, otherwise, I think at this point, we can open it up to the group and offer any questions or discussion.

MR. PUGLIESE: Are there any questions? Wilson.

DR. LANEY: Thank you, Roger. Thank you, Deena and Brad, for the presentation. How easy is it, and do you plan, to add additional species in the future, and I am thinking, in particular, of Atlantic sturgeon as one that would be a very likely candidate, because it is a benthivore, basically, and I know the data for that species is very limited, and we being the partners who did the cooperative winter tagging cruises off North Carolina and Virginia during the winter, and we have provided all the data that we gathered on Atlantic sturgeon to NMFS for other applications. I don't know whether you all -- Hopefully you all have access to that database, but I would think that that would be a species that you would definitely want to be looking at, because it is a federally-listed species as well, and so I will shut up and let you answer the question.

MS. HANSEN: For ShoalMATE, specifically, we are focused on EFH, and we do have triggers in place to check, basically, at every five years, to see if there has been an update, and then just periodically build in any new essential fish habitat information or HAPC designation.

For Endangered Species Act species, they are not -- They wouldn't be in here unless they have EFH designated, and I guess that's the short answer, but impacts to ESA are obviously considered under both NEPA and under our ESA consultations, and so that information would presumably be integrated into those assessments, if not through the EFH consultation.

MR. PUGLIESE: Any other questions?

DR. LANEY: I've got a follow-up, Deena. If critical habitat was designated offshore, would that be something that you would factor into your report as well?

MS. HANSEN: That would be an interesting addition to this pool, and I could see the benefit of having it in this kind of interface, but, right now, we don't, and so, right now, it is still just essential fish habitat, and we don't have critical habitat in here, but we do include critical habitat in our assessment, and so we do screen for it, but we just don't have anything quite as dynamic as we do for EFH.

DR. LANEY: I know, when NMFS designated critical habitat for Atlantic sturgeon, they did not designate anything in the estuaries or offshore, because they felt, at the time, they did not have a sufficient amount of data to really nail down areas that could be considered critical habitat, and so maybe that's something that will happen in the future, and I don't know. I would think that, with some of our data, especially if those were combined with data from other fishery-independent monitoring, like NEMAP and the Northeast Fisheries Science Center trawl survey and SEAMAP, that you might be able to put together enough information to not only designate critical habitat, but maybe include it in your ShoalMATE model tool as well.

MS. HANSEN: I think having this interface is really helpful, and being able to overlay it with different seasons or environmental oceanographic information can go a long way, and so that's a good point. Maybe in Version 2.0 we can include critical habitat.

MR. PUGLIESE: Anne has a question.

MS. DEATON: Thank you. I have two questions, and they may actually be for Brad or Chris, and I'm not sure who wants to answer, but the thing about a 130-kilometer radius from wetlands, I am just curious if that is really -- That's quite a ways, and so I don't know how you could say a fish is that far from wetland, but they have some correlation with the wetland.

DR. PICKENS: I can answer that. The reason why we selected 130 kilometers was that's the farthest you can get away from a wetland, so that it ranges all the way down to one cell being wetland. It's a little more difficult in the South Atlantic, because it is a correlation. In the Gulf of Mexico, it was such a consistently positive relationship with shrimp and snappers that we felt very good about that. I would feel more confident in it if we had more species that had that same positive relationship, and it also depends on how close to shore species are as well.

I think the -- Another aspect of this is that we had more oceanographic data available in the Gulf of Mexico, and so we also had a data layer on mixed-layer depth, which was very important in most of the fish species models there. In the South Atlantic, actually we did not have that data layer, and so we used two variables that were correlated, and found to be correlated in the Gulf, which was the currents and the distance from the Gulf Stream.

In the Gulf, it was the loop current, but, nonetheless, and so those oceanographic factors also deserve more exploration, I think, and like the distance to the Gulf Stream combined with the westward current is not a coincidence, and, in fact, for the red snapper model, National Marine Fisheries Service pointed out that some of those high-probability areas actually corresponded really well with upwelling areas, and so, yes, I agree there is definitely more to learn with the wetland associations and some of the oceanography going on out there.

MS. DEATON: Okay. Thank you. Then the second question I had was -- I probably missed this, but so where are you getting your fish data from, or is it just life history characteristics?

DR. PICKENS: The fish data comes from everywhere. For the South Atlantic, it was the SEAMAP program, the surveys of hardbottom, and we used some data from bottom longline in South Carolina and Georgia for sharks, and we had video data and trap data for the Southeast Reef Fish Monitoring Program, and so we really took everything we could for the South Atlantic, and certainly we could use more. A lot of data in the Gulf of Mexico came from the same program for sharks, the bottom longline surveys, from the Southeast Fisheries Science Center, and they also have extensive trawl surveys, which are used to quantify some of the prey items as well.

DR. TAYLOR: I will add to that, Anne, and it's a great question, because I think what surprised us -- Well, maybe it didn't surprise many of us, but the dearth of fishery-independent data for the collection of species in the South Atlantic compared to say the Northeast and the Gulf, and, while there may be some datasets, and I know that DMF has sampled in the nearshore coastal ocean, and that was probably inshore from where our focus area was, and we really wanted to use datasets that spanned the geography of at least a region, and so at least the South Atlantic, and so we had to call on these large-scale, typically federal-government-operated, independent surveys, of which there are very few, as you know.

MS. DEATON: Yes, and I guess I'm thinking about the cape shoals, just because of that meeting last week, and saying, okay, I don't think -- I didn't know of any sampling programs on the shoals, or even right next to them, just because of the difficulty of sampling there. I mean, there might be some longline or gillnet sampling, but --

DR. TAYLOR: I think the best dataset would have a stratified design that would include a factor like shoals, and we hoped to see some evidence where the samples were -- There were abundant samples on a shoal, so we could sort of show that direct relationship, which is why I think we came to the conclusion that we were going to have to look at these indirect associations with oceanography and geomorphology and not necessarily directly connecting a shoal or shoals with fish distributions.

MS. DEATON: Okay. Thank you. That's very helpful.

MR. PUGLIESE: I think Paula had a question.

MS. KEENER: Just a quick question. There's been a lot of information today, and I may have missed this or misunderstood it. Thank you for the great presentation, but I thought that you mentioned that a particular species of shark preferred wetland areas, and then another species of shark preferred estuarine areas, and did I get that right? Did you mention that?

DR. PICKENS: I can clarify a little bit more, and I was trying to focus on the South Atlantic, but one thing that we noted in the Gulf of Mexico is that we chose two menhaden prey specialists of sharks, blacktip shark and spinner shark, and their models came out very much as you would expect for menhaden, and it was chlorophyll, the estuarine areas, and it was lower-salinity areas, and so that was interesting in itself.

We also had an interesting habitat association, and the shark biologists were working with -- They predicted, before we did the modeling, that spinner shark would have actually a positive relationship with hypoxia, and that came out to be true, and it was actually an interaction where the sharks were positively associated with hypoxia, and that was interacted with the amount of estuary nearby, and so it actually highlighted those areas that had hypoxia and estuarine areas nearby, which fit very well with what the biologists were saying there, and the explanation for that was that some of the prey species were congregating along the edge of the hypoxia, and so we were very careful about having kind of a hypothesis-driven approach throughout this project.

MS. KEENER: Okay. Thank you.

MR. PUGLIESE: Cindy has a question and then Wilson.

MS. COOKSEY: It's more of a comment than a question, and I wanted to acknowledge the large amount of work that went into creating this product, and I think they did a great job, given the limitations of the data, and that's where I just really want to just focus on the message of this data has some really big caveats associated with it, in that we're making some determinations and recommendations related to shoals, but it's based upon data that was not related to shoals, in many cases, and so I feel like this is a first step, and this is a product that we can look at and maybe see where do we need to go, from a research perspective, to continue to improve it and develop it over time.

MS. HANSEN: I would agree with that. I think this definitely helps drive future research, especially when you look among regions, and so among the Northwest Atlantic versus the South Atlantic.

MR. PUGLIESE: Wilson had a question.

DR. LANEY: A comment and a question, I guess. To Brad, are you familiar, Brad, with Jay O'Dell's work looking at the correlation between different species in the Mid-Atlantic ecosystem and wetlands?

DR. PICKENS: I have not seen that.

DR. LANEY: Okay. Jay is with the Nature Conservancy, and he's based in Richmond, Virginia, and I think, somewhere on my hard drive, I have a copy of that paper, and I will try and send that

to you, but he did some work looking at associations of species offshore with wetlands inshore, and, of course, the basic presumption there is that the species that show that correlation are feeding on either prey that are derived from the wetlands or somehow linked to them trophically, and that shows up in their C14, I guess it what they use to look at those sort of relationships.

There was one comment, and I didn't know whether you were aware of that work or not, and so I will try and make sure to get that to you, because it certainly substantiates the relationship that Anne was asking you about.

Then the other thing is, back to the sturgeon again, and, while the area that we sampled during the winter is spatiotemporally very, very limited, my recollection is, and we haven't done this kind of a fine-scale analysis, although maybe Andy Herndon and the Protected Resources folks may have used our data to do that, when they were doing the listing package back in 2012, but my remembrance is that we often encountered Atlantic sturgeon, on Wimble Shoals in particular, off the mouth of Oregon Inlet there, and then, also, further north on the shoals, off the mouth of the Chesapeake Bay.

Then I think Roger Rulifson and his group's data, looking at acoustic detections on the Cape Hatteras array, which shows animals moving past the shoals off of Cape Hatteras there, certainly detected a whole lot of Atlantic sturgeon, and so, just from a general perspective, I think probably that is a species that is associated with sand shoal use, and one that I would suggest to Protected Resources that is a relationship that they ought to maybe take a closer look at in the future, and I would hope that maybe, despite the fact that there isn't EFH for listed species, that is something that you all could hopefully incorporate into your model in the future.

A lot of the acoustic detection data are being made available in different publications, and I know Dewayne Fox is working on their Atlantic sturgeon, and we put acoustic transmitters in fourteen of them during the winter tagging cruises, and all fourteen of those fish were subsequently detected, here and there, and, of course, the information that you get back is totally dependent on where the receivers are located, and, unfortunately, I don't think there are very many receivers that are located on sand shoals, with the possible exception being the work that NASA, or I think it's NASA, and Roger can help me remember, but NASA, and the Navy probably, collaborated off the east coast of Florida there, around the Cape Canaveral shoals, and they did get a lot of Atlantic sturgeon detections down there as well, and so I would just put a plug in for that species possibly being incorporated in the model at some point in the future.

MS. HANSEN: The NASA/Navy work was a BOEM-funded project, and so we're actively working with them with figuring out any associations with a variety of species, and we also have -- BOEM has had an array on a shoal off of Virginia that has detected many, many sturgeon as well, and so we are trying to put those pieces together, and the telemetry data off of North Carolina, and I think it's the same dataset that you're referencing, I have seen it already in a recent assessment of impacts, and so sturgeon are definitely high on the radar for impacts, but I think that modeling is -- Having a more comprehensive model is still something that could be done, and so I appreciate the recommendation.

DR. TAYLOR: I think maybe a spoiler alert, but Lisa Wycliff will present on some of that hotpot analysis that she did on sturgeon, Wilson, and I know you'll appreciate some of the maps that she's generated, if you haven't read that document yet.

DR. LANEY: Thanks, Chris. I will look forward to that.

MR. PUGLIESE: Thank you, Deena. Just a couple of quick questions from me, but can this be accessed through a server, and is this something we could link with our existing habitat and ecosystem under the web services, to be able to look at other layers relative to what's included, or is this totally an in-house system?

MS. HANSEN: Some of the layers are available. The shoal layer is on MMIS, and then the species distribution layers we have hosted by NOAA, and so I think we could probably provide a link -- Chris, I don't know if you have that handy that we could share with everyone.

DR. TAYLOR: Eventually there will be a service through the Marine Cadastre, Roger, but, in the interim, we could just share them directly with you, and I guess a comment on Cindy's point. While I agree that there's caveats on the actual importance of the shoals, because we need to validate the use on the shoals, the accuracy and the validation of these models was quite high, and so we think that they're doing a very good job of predicting the regional distribution.

It definitely refines the understanding of distribution patterns relative to geomorphology on a larger scale, oceanographic factors, distance to shore, and some of these other teleconnections, like wetlands and estuaries, and so we think it does help us better understand the distribution patterns say over something like the current EFH designations. It takes us a little bit further towards understanding the relative importance of not just the shoals, but that region, the cape region, and, depending on the species, how important that area might be.

MR. PUGLIESE: I was interested in how many different variables you did have integrated into determining the species distribution, because there's a number of different efforts that I think you might have heard about, working either through the climate vulnerability or through our development of Ecospace and other aspects that I think we can inform and learn from different efforts, and so it will be real interesting to see that.

I am real familiar with our fishery-independent surveys, and so it looks as if you've drawn on key ones, and some of the ones that are probably more appropriate are the nearshore, the longline surveys for shark and red drum and the coastal trawl survey. Most of the other reef fish surveys are done in deeper water.

However, if some of the associations are done, where it can kind of predict its movement from inshore, especially estuarine-dependent species, into more offshore, or maybe some of that would be captured. One thing I am curious of is was there ever thought of including some of the key prey, like menhaden and other species, that may be shoaling in those different areas on a more routine basis? That's probably something worth at least investigating.

DR. TAYLOR: For the prey species, the data just don't exist, Roger, unfortunately. There's just not an extensive survey to provide enough resolution or extent.

MR. PUGLIESE: I mean, that's our same situation we're in, because that's some of the things that we've got on our fishery ecosystem plan as high priorities, to begin to look at distributions and potential shifts in distribution, because I think that's going to be some serious key things. I

mean, it goes back to, I think, Cindy's comments about some of the opportunities to do some additional work to maybe target species-specific sampling within certain areas that cover the range of managed species, as well as prey, and seasonally, et cetera, that would fine-tune this even further. A lot of work has gone into it, but that might be something that would be really critical. I think we have Laurent and then Anne and then Wilson.

DR. CHERUBIN: Just to follow-up on the model that you showed that showed the species distribution according to certain ecosystem characteristics, whether it's wetland or whether it's the distance from shore, et cetera, I think it would be a good test case for Ecosim with Ecopath, in terms of each assemblage can be seen by the model and either validate the model or maybe show that it could be maybe a flow in the other model that has been used for the map system, and so just a comment on that, but I think we have some elements that can be -- Some tools that can be put together to support each other, in some ways, and confirm some of the results of analysis that we do with either models.

MR. PUGLIESE: Actually, just to that point, real quick, before I get to Wilson, I ran this by Luke, because, as it was coming up on this, and one of his points that he was making was that a lot of the parameters are either going to be highly correlated with each other or may just be simple proxies for the distance from shore, and so I guess there's some -- It was interesting to see how many you actually did have in this.

DR. PICKENS: I can speak to that a little bit, and so we had thirty-four total, and I think the total for the South Atlantic was more around twenty-five, because we included -- For the Gulf of Mexico, we had sharks that preyed on croaker, and we had associations with red snapper and managed shrimp and penaeid shrimp, and so we were able to get at the prey a little bit more in the Gulf of Mexico.

Unfortunately, going back to the menhaden, the menhaden were not very well sampled by trawl in the Gulf of Mexico. We did try it out, and it did not seem to predict where the menhaden specialist sharks were at, but, interestingly enough, if one took the menhaden data and plugs it into the model, they relate to the same things that the sharks do, which are the chlorophyll and the coastal wetlands and low-salinity areas, and so there is a lot of potential for prey.

I just want to emphasis that, during the course of this project, we learned a lot from the Gulf, and I think it sets the potential to really have efficient surveys, if more surveys are conducted in the future, because we know some of the factors that are likely to be important, and also emphasize that we have a great framework for environmental variables. We took the best we could find, from hardbottom to sediment grain size and the ocean characteristics, and so we really do have a great environmental database that could have great potential for something like looking at Atlantic sturgeon or other species.

MR. PUGLIESE: I think we have Wilson and then Anne.

DR. LANEY: Chris, relative to the lack of prey distribution data, don't I recall a paper that you and colleagues did a while back about some fairly sophisticated electronic method for surveying prey, and has that -- Well, actually, it was not necessarily for surveying prey, and I guess it was just for surveying fish biomass at some distance from the equipment that generated a pulse that

you were using to detect the biomass, and has that progressed any further, and is that something that might possibly be used to get us a better idea of prey distribution?

DR. TAYLOR: Specific to shoals, it's a tool, and so using active acoustics, or fisheries echosounders, has come up in conversations, and we've evaluated it in some habitats, but not as much in shallow-water shoal habitats, but it does do a pretty good job of covering ground relatively quickly and indexing sparsely distributed, but shoaling, schooling species. I know they used to rely very heavily on an acoustic echosounder survey for herring in the Northeast, but it hasn't been adopted here.

There's also been other technologies for observing things like menhaden schools, such as unmanned aerial system for drones, to index the schools that are closer to the surface, and so there's a variety of techniques and technologies that are on the horizon, but we just have to find the funds to do some evaluations and maybe operationalize the survey.

MR. PUGLIESE: I think Anne has a question.

MS. DEATON: I just have one comment, and then I know we need to move on, and that is I have spoken to people about Frying Pan Shoals around here, and that they are fished a lot by recreational and commercial fishermen, and so it's not fishery-independent, but there could be information gained about some of these more distinct features, like the capes, and not every little shoal, but, anyhow, a potential data source, but thank you, and I think this was very interesting, and I'm really glad that you're pulling this information together.

DR. TAYLOR: Thanks, Roger, and thanks, everybody, for your comments.

MR. PUGLIESE: Thank you.

MS. DEATON: I think we better move on, in the interest of time. The next topic is -- Well, the broad topic is the EFH Policy Statement, the beach dredging and filling, beach renourishment, large-scale coastal engineering, but we have two presentations to that extent, and the first is by Andrew Tweel with South Carolina DNR, and he's going to talk about a project they did at Folly Beach doing monitoring of a nourishment project that was done in the summer. Andrew, go ahead whenever you're ready.

MR. TWEEL: Good afternoon, everyone. I am Andrew Tweel, with the Environmental Research Section at the South Carolina Department of Natural Resources. This is a project we just wrapped up kind of this summer, and it was a two-year project funded primarily by the Army Corps of Engineers, the Charleston District, and we did receive a little bit of additional funding from National Marine Fisheries Service here to look at part of the biomass that I will talk about in greater detail in a little bit.

The primary goal was to look at potential biological impacts from the beach nourishment on the beach kind of ecology, and so we looked a very wide variety of components of that beach community, ranging from the physical habitat, sediment composition, through benthic invertebrates, zooplankton, nekton, and even a little bit of fish stomach contents.

Just a little bit of context here, and most of us are aware of this, I'm sure, but the net general sediment flow in this area, and most of the Southeast really, is to the southwest. The Charleston Harbor jetties were built in the 1880s and significantly disrupted this flow pattern, and, consequently, there is a relatively high level of accretion, or land building, on Sullivan's Island there, and then, along with that, there is severe erosion along Morris Island, and the lighthouse stands out in the surf zone, and Folly Beach has experienced a pretty dramatic increase in erosion and has experienced -- I think this was the fourth major nourishment since the early 1990s, and there's been quite a few smaller nourishments on Folly Beach. The 2014 nourishment, just for some context, cost, I think, $30 million. This nourishment was the 2018 nourishment.

The borrow area for this nourishment was from the Folly River Navigational Channel, and is the southwest end of the island there, and this is a federally-authorized channel. The material was then piped along the bottom of the Folly River, exiting around the washout, if you're familiar with that area, and then moved up or down the beach. An additional relatively small amount of material was also placed on these islands and shoals in this area to replenish the declining shorebird and nesting bird habitat there.

This is what it looked like from the beach perspective, and this is the sand slurry exiting the pipe, and it was redistributed by this heavy machinery, and you can see some birds hanging out and kind of picking at stuff coming out of there. This machinery would build up this sediment and material into this desired profile.

Like I touched on earlier, the purpose of this was to get a better handle on potential biological impacts of conducting this beach nourishment. My predecessors have done quite a bit of work on this, dating back to the 1970s in some cases, looking at borrow area recovery, and one unique component about this project was the summertime aspect, and summertime is usually avoided, for potential impacts to turtles, nesting turtles, and some other organisms. This was done, I think, and was kind of authorized as an emergency nourishment, and so this was done in the summertime, and the concern was raised that this is also a time when fish and their prey base are highly active, both in terms of growth and reproduction.

We also wanted to explore some kind of less-studied areas, and, typically, these studies have targeted the intertidal zone, and so we did collect a few samples looking at sub-tidal areas, and we also did a little bit of food web and diet work related to the nekton community.

The monitoring timeline we were working with, we went out in May of 2018 to collect the pre-impact samples, and the dredging was supposed to start in June, and that was delayed, and so we went out again, to get a more representative and more tightly coupled pre-impact sampling event. Then we went out as soon as we could following the nourishment, and that was in September, and we went out another month later, in October, hoping to capture any kind of short-term recovery trajectories, and then, in year-two, we basically matched those same months, and that was done to kind of minimize the seasonal signals that might kind of confound our ability to detect something.

We also, in addition to the delay, and so that was one of our unexpected kind of changes to the study design, and that probably didn't have a huge impact on things. We were able to do an additional pre-impact sampling event, but we also experienced some unexpected changes at all of our sites, really. We had a northern reference site, and I will show these on a map in a second, but this site really experienced a slow accretion of material, we think, or I think at least, from a nearby

nourished section, and there is a possibility that some of this was also due to some inlet sandbar-type processes occurring simultaneously. We did add some additional transects, to try to offset this effect.

Our southern reference site also experienced some unplanned material placement, and so this was supposed to be four or five miles, I think, away from the nearest nourished site, and, about partway through the nourishment, some additional funding became available, I think from the Town of Folly Beach, and I could be wrong on that, and so additional material was placed on our reference site, although this was slightly delayed from the other sites, and the magnitude of this placement was much less, to the point where I went on the beach after that and I couldn't really tell much difference, visually. We also had some additional elevation and benthic samples following that, just to kind of cover our bases there.

One more unexpected change was that, following the initial placement of material on the impact sites, there was a tropical storm, and I honestly can't remember which one at this point, and I feel like there's been so many, that removed a lot of that placed material, and so they -- While the machinery and pipelines and dredges were in place, they went ahead and placed material a second time on those impact sites. We did the same thing in collecting some additional data to capture that.

In terms of what we measured at these sites, starting with the physical habitat, we took cross-sectional elevation profiles of the beach, and we took sediment characteristics, percent sand and silt/clay, at a variety of elevations and along each site, each time we were there. In the same place we did those sediment surveys, generally, we did -- We collected intertidal and sub-tidal benthic invertebrate community samples, and we analyzed these both for number of individuals by species, to look at kind of the community-level changes, and then NMFS provided some funding for us to also explore potential effects to biomass, either at the individual level or at the kind of per-unit area level. That part is still underway, and I do have a little bit of results from that that I'm going to share today, but we're still working on that.

In the water, we looked at the surf zone zooplankton community, using a fairly standard 505-micron mesh net, primarily targeting, or hoping to find, larval fish, but also to characterize the community in general, in terms of potential prey items for juvenile fish. Then, finally, we looked the surf zone nekton community by seine. Also, in a subset of those fish species that we collected by seine, for benthic-feeding fishes, we collected a subset of those and analyzed their stomach contents, to explore any potential relationships to the other communities and potentially impacts resulting there.

Also of this was designed and analyzed in a BACI sampling design, and, like I mentioned, there were some impacts to that design that were kind of out of our hands, but I don't think that those were too detrimental to what we saw.

Here is a map of the study site, and so the R means reference north, and these were our two impact sites, and this was our southern site, and so, initially, the nourishment was going to stop around here, and this area was nourished later, and the lion thickness indicates the degree of material placement, and so the material placement down here was significantly less than everywhere else. This side looks pretty close to the nourished area, but it's pretty far, actually, maybe a half-mile or

so, at least. It's as far as we could get away without really getting into the inlet, and then our two impact sites there.

A few on-the-ground photos here, and so this was the northern nourished section prior to beach nourishment, and you can see exposed rock there. These are about every 200 meters along the beach. For most of the beach north of the pier, you can see very little to no dune and lots of structures kind of right on the beach. You see a little bit of an intertidal trough, and then it's kind of gently sloping down to the waterline.

Following the nourishment, this is what it looked like. If you look at the rocks for reference, they're about halfway covered up, and the trough structure is gone, and then you can see this scarp feature here, up at the top, and that's where most of the material was placed.

By the end of our study, and so this was thirteen months following the placement of material, you can see the rocks there, and more or less kind of where they were at the beginning, and there is no trough structure, and there is a little bit of a kind of dune-type relic up there, and kind of a general flatter profile. Up at our reference section, this is what it looked like prior to nourishment, a kind of gently-sloping profile, and there is wood groins up in this area, and, immediately following the nourishment, it looked more or less the same, and you can see the wood groins there again, and, by thirteen months post-nourishment, almost two meters of vertical accretion had occurred, all the way to the point of dry sand occurring over most of the area, and this, like I said, was I think probably a combination of wind-blown material from the south, combined with some inlet processes, and you can see some of the breakers out there from the lighthouse inlet.

This was our southern reference site, and I just wanted to show this because it's quite a bit different than all the other sites, and this is the less, or least, erosive portion of Folly Beach, and probably, in an ideal sense, about the best you could hope for in terms of habitat, and you have a very wide beach, and you have a decent structure back there, a gently, sloping wide beach, and there's a pretty significant intertidal trough there, and a bar there, and another trough and another bar there, and so a very broad beach with quite a bit of habitat complexity there.

We did surveying using a high-precision RTK GPS for the dry and wet sand areas, and then, for the sub-aqueous portion of the survey, we tied that into a site-level more traditional surveying approach, and we basically went out as far as we could.

These are just some example profiles, and so, if you look at the graph at the top, this was the impact site, and the black line shows the original profile, and you can see that little trough structure that I pointed out in the photo. Following the nourishment, it goes up to the green lines, and you can see that big scarp formation, about two meters of vertical placement, and maybe about forty meters or so of lateral change, as far as where the shoreline was. Over the course of the study, this flattened out, and about 50 percent of both the vertical and horizontal profile is lost by the end of the study, and most of this material probably is down here in the sub-tidal zone.

The reference site basically gradually accreted throughout the study, and this was a big surprise to us, and kind of an unfortunate occurrence, given that that was a reference site, and it experienced a similar magnitude of accretion, about two meters of vertical accretion there, and very broad lateral change there. It did happen on a much different time scale, and this level of accretion

happened over the course of a year or more, and so it's not quite the same smothering effect that you would see at a nourishment.

On to the sediment and biological surveys, and so this is just a collection of one of our benthic cores there, and sediment cores were collected and paired with benthic samples. According to this kind of layout here, and so this is the rock groin that I showed, and this spacing is about 200 meters to the next rock groin, and so the sites were centered between the rock groins, to try to get away from any sort of edge effect that you might get from the groins themselves.

We collected samples at three depths, one at the water line at the time we happened to be there, and we tried to target fairly consistent low tides for sampling, and we went to a depth of about a half-meter, and then we went to a depth of about a meter to collect those sub-tidal samples.

In terms of the sediment characteristics, what we saw -- The big take-home was we saw no major changes in sediment type due to the nourishment, and the sediment from the sandbar was pretty good, or a really good, match, and you can see here there is no significant difference following the nourishment, and you do see a general kind of coarsening of the sand, as we head into the fall, and that may be due to the kind of higher level of storm activity maybe pulling away some of those finer materials, but the big take-home is there is no major change in the sediment.

As far as benthic organism abundance, and I'm just going to show a few graphs, and there is an overabundance of graphs and data from this project, and so I just pulled out a few things to show, and we did have a full report that we submitted to the Corps of Engineers that I can probably distribute if folks are interested. In terms of total abundance of benthic organisms, this really just varied so widely seasonally, and it really made it hard to distinguish anything else. I mean, you have almost an order of magnitude change just in a few months.

The solid lines here show our reference sites, and the dashed lines are the sites that experienced the sediment placement. Although I mentioned both of our reference sites were impacted, by this time, they were not. They had not been impacted, and so the impact sites started off a lot lower, in terms of total density of organisms, but they all went pretty low into the fall. By the next summer, things were back up again, more or less, and there is a little bit of difference there, but, really, these seasonal swings I think kind of dwarfed just about everything else, which makes determining a potentially subtle impact from nourishment kind of difficult.

In terms of species richness, we saw some interesting things, and I did want to point out, right here, that these three sites, by this time -- This is our two impact sites and our one reference site that did experience quite a bit of material accumulation by this point in time, and all did have quite a bit lower benthic species richness than our more, or most, pristine, but not totally pristine, site, the southern site. It's just kind of an interesting reduction in richness there, and I'm not sure if that's significant, based on the way that our study was laid out, but it was kind of an interesting observation. By the end of the study, all sites were relatively similar, again, in terms of benthic species richness.

A few more take-homes from all the stats and other figuring we did, and the benthic infauna community was composed primarily of bivalves, amphipods, other crustaceans, and polychaete worms, and we found sixty-one taxa total throughout the study. The greatest densities of organisms we observed at the low-tide line during the summer, the warm conditions, as you saw

in the graphs, and, at the low-tide line, these high densities were mostly comprised of mollusks, and, in particular, the bean clam, or Donax clam.

The more erosive sites, and those would be the nourished areas, had lower abundances in general, both before and after nourishment, and the shallow sub-tidal habitats were more -- The community was much more dominated by amphipods, rather than mollusks, which we observed at the waterline. We did see a significant decrease in Donax density at the impact sites that coincided with the nourishment. This was particularly apparent in the deeper sub-tidal areas in the fall, of both fall seasons that we sampled, and so in 2018 and then it appeared again in 2019, which was pretty interesting. By the end of the study, in October, there was no statistically detectable impact, and these were comparable to the pre-disturbance levels.

We did also see a small, but significant, decrease in certain amphipod species, and those were, I believe, Haustoriid amphipods, but this recovered relatively quickly by about two months following nourishment, and, in terms of most other species, we did see a fairly rapid recolonization of particularly small polychaete worms, and that's very consistent with most other research, from this area especially.

Just some of the potential recolonization mechanisms, it's a very dynamic environment, and there's a lot of forces acting on this community, like long shore drift wave action, and, also, there are quite a few species that we found in the benthic community that were also found in the zooplankton community, and so there's out there, and they're in the water, and it's not super surprising, I guess, that they're able to kind of recolonize these areas relatively quickly.

In terms of the benthic infaunal production, or biomass, component, we did receive, like I mentioned, funding from NMFS to analyze our samples, and that will be complete next month. Just to show what some of those look like, these are kind of our standard lab tins there, and this is an amphipod sample, and these are the Donax, or bean, clams, and you can see quite a range of sizes, and there are some tiny ones up there, and then a variety of polychaete worms, and so these are all per sample, and so that was a number of clams that were collected in a single core.

The hope, or thinking, behind this was to look for potential changes to size or overall biomass that might not be detectable by using simple count-based data, and we did this by looking at ash-free dry weight, and basically the soft part of the animal, and so, for the clams, for instance, we're not counting the shell weight. We did this in terms of per-organism estimates, to look at potential changes in body mass, but also per unit area, and the thinking is that this would be more like kind of mass available as prey.

We did see some interesting things, and, again, we're still working on this, and so this is all pretty preliminary, but total biomass at the deeper sites was significantly lower following the nourishment. This was primarily driven by decreases in amphipods, as well as mollusks, changes at the other strata, and so the shallower sub-tidal and the waterline were not statistically significant, and this was reasonably consistent with what we saw in terms of the abundance, but the biomass really made it a little bit more apparent.

Then a second kind of interesting thing is, across all elevations, the individual mollusk and individual amphipod biomass, or kind of per-animal size, in the nourished areas was generally higher, and so the overall biomass went low, but the organisms that were left, or the organisms

that somehow recolonized, were larger. In terms of amphipods, we saw kind of a shift in species, like I mentioned, and I didn't actually notice that until I started looking at the biomass data, and there was Micropterus raneyi, a more ubiquitous amphipod that's found in much of the sub-tidal areas, even far offshore, and so this was what we saw kind of shortly following the nourishment, as opposed to these surf zone specialists that appeared to come in later on.

In terms of the zooplankton, we used a fairly standard net for targeting fish, larval fish, and these samples were extremely diverse, and we saw up to forty taxa per sample. Fish, however, were pretty rare in all of our samples, and the community was dominated by crustaceans. Fish we found at a rate of about one per ten cubic meters. This list here is in order of decreasing abundance, and so larval fish were predominantly anchovies and gobies, and we did get a few sciaenids, spot croaker and a few more rare things, like filefish, burrfish, and pufferfish, but the overall catch of larval fish was too low to do statistics on, and so, even in a qualitative assessment, we didn't see any remarkable trends related to the nourishment.

Here is just what it looked like on the beach, for reference, and the nekton and seine sampling was pretty interesting. We, again, used two tows per site, and we tried to keep these in the morning, near low tide, as consistently as possible, and we used fairly standard beach seine that had been used in quite a few other studies on Folly Beach, so we could kind of compare our data to those. Then we used a twelve-meter rope to standardize the width of the net, to allow us to calculate catch per unit area. We towed parallel to the shore, with the current. This is what it looked like towing it out there.

Here are a few photos of our catch, and the upper-left -- Unfortunately, we did get quite a few pieces of debris in our samples, and you can see a hook there, and I think that's a piece of that fish bite material left on the hook, and it didn't appear to have any particular relation to the nourishment itself though. Snapper, this is a permit, a juvenile permit, that we got, and this is a fairly sizeable sheepshead and a pretty large black drum, a nice blue crab, and juvenile pompano there, and that was our most abundant fish across all surveys.

We tried to work everything up on site, as fast as possible, and return as much as we could alive. One pleasant surprise with this project was it turned out to be a very good and positive kind of outreach experience, to the point where we ended up bringing some of our DNR outreach staff, so that we could focus on the work, but not really ignore these people. In general, everyone was extremely supportive and interested in the project, and so that was really nice, and they were glad that we were out there doing what we were doing.

In terms of what we saw, the community, like I mentioned, was dominated by Florida pompano, juvenile Florida pompano, anchovy, whiting, as well as speckled crabs. The asterisks indicate benthic-feeding fish that we collected for stomach content analysis, and we saw thirty-eight total taxa in our nekton surveys. There's quite a diverse array of juveniles, as I mentioned, and I showed the picture of the permit, and we also got lookdown and quite a few snapper, filefish, and a couple of mackerels even.

A couple of adults, and I showed pictures of those, and so we did get a significant -- There were no significant effects in terms of abundance, but, interestingly, species richness was significantly and consistently reduced in the nourished areas, and this persisted through the end of the study.

I believe that the decrease in richness is probably tied to a reduction in habitat complexity. If you think back to the pictures that I showed, the loss of the trough structures and the covering of the groins, and this kind of general smoothing of the beach profile, I think it probably contributed to that. I think that, as the beach starts to recover, and hopefully some of these materials rework and the bar and trough structures form again, hopefully that richness will recover as well.

Just real quick, on the stomach contents, we got almost 200 whiting, and their primary prey was the siphons of the Donax clam, and so just the siphons. They are biting these off, and, on average, there were sixteen of those per stomach, and so that was pretty surprising for us. I ended up looking into the literature a little bit, and so those siphons apparently can regenerate, and so that's kind of an interesting little renewable protein source there.

Mysids and quite a few other crustaceans were common as well in the whiting. In the Florida pompano, we had fewer of those for gut content analysis, and their diet was somewhat similar, and a little bit fewer Donax, but, otherwise, fairly similar. We did get the adult black drum, and its stomach was completely full of Donax, very tiny clams, which it was just a sample size of one, but that one was pretty interesting to me, because you often read about the benthic community as the primary prey source for smaller fish and juvenile fish, but it was kind of interesting for me to see that, this very large mature fish targeting these very small organisms.

We did look at some spot and sheepshead, and those mostly -- Their diet was mostly comprised of amphipods, and we did see no significant impacts overall, in terms of changes in species consumed before and after or total amount or mass of food in their stomachs, and we did see a possible increase in foraging success by some species, particularly pompano, and I can't say for sure, but one guess is maybe this could be them targeting dislodged organisms, as the beach kind of continues to reach some sort of equilibrium, as the sediment redistributes. Here is Donax, just if you're not familiar with what they look like, and they're pretty small, and there's the siphons there, and so they're just nipping those off.

Just a quick summary recap here, and we saw minimal impacts overall to the benthic community. We did see some impacts, but they were generally small and short-lived, and fairly consistent with other literature. A lot of the studies that have found high levels of impact to benthic communities seem to also report high differences in sediment being placed, either coarser or finer, and so we did see decrease in Donax abundances that were a primary prey species, and so that's definitely of note, and a decrease in fish species richness.

We're still working on the full benthic biomass results, but I think a few important take-home points. I think these relatively low impacts are due to, one, that these beach species are pretty well adapted to change, I mean even on a tidal cycle or a given storm, and, I mean, the magnitude of change here is pretty dramatic. Very good similarity of placement material, and I think this is the most important aspect of this project. Also, placement of material following the spring and early summer recruitment periods, as has been suggested in other literature, and perhaps this delay in dredging did help with that.

Also, I think the placement of most of the material higher in the tidal frame may allow a more gradual reworking of this material to a full profile and kind of avoid smothering a lot of those waterline and sub-tidal species. That's a benthic-centric view though, and, I mean, I don't -- I

can't speak to the potential effects on other things, like turtle nesting or shorebird roosting and things like that.

Some future research needs and questions, we did have some loss of our ability to detect this impact, and this was the result of kind of unexpected changes to the reference sites, which seems to happen quite often in these types of projects. If I were going to do this again, I would maybe look at using off-island reference sites, but that can come with its own logistical challenges.

Also, I think to be able to incorporate multiple pre-impact sampling events is pretty important. I mean, you have so much -- Such a high level of variability, and to really base that all on one pre-impact sampling event, in such a variable landscape, is pretty challenging. Just to kind of caveat that some species are not well represented by this design, things like Emerita, or mole crabs, and larger fish are not captured in our small-mesh net there.

Then just kind of an ending thought that I have been thinking about, and I'm wondering, if some of these changes are due to habitat complexity, if habitat complexity can be incorporated into design. Can we jumpstart this habitat recovery process, and the Corps, obviously, has its own requirements and beach profile that it needs to abide by, but it's just kind of an interesting thought for discussion that I have had, and so I appreciate the opportunity to speak here. Feel free to email me, if you have any questions, and we're going to continue to kind of analyze this dataset, and thanks again, and I will take any questions.

MR. PUGLIESE: Do we have any questions? I have Trish and Wilson, and I think that may be what we're going to do for today, but I will -- Then Cindy. Trish first.

MS. MURPHEY: I came in in the middle of your talk, Andrew, and I'm sorry that I had to drop off for a while, but I came back, and I just wanted to let you know -- I don't know if you're familiar, but, back in the 1980s, Larry Delancey, who used to be with South Carolina, and has since retired, but he did his master's thesis on Folly Beach nekton, and I think it was -- I want to say it was mostly crustaceans, but that might be a source of something, to at least see what it was like in the past, and so I just wanted to throw that out to you, and you may already be familiar with it, but I used to work with him way back, and I remember him telling me about his thesis.

MR. TWEEL: I appreciate you mentioning that, and so the net that was used -- That was one of the reasons we used that size net, because that's what he used there, and then there was another study, a NOAA study I think, in the 1970s that used that same net, and so there was a pretty good amount of data already. In terms of what we saw, generally the same high abundances of juvenile pompano and whiting in the summer, with those other species, and we did not do any sort of rigorous statistical comparison to those yet, but that might be worth kind of exploring, if we can get our hands on some of that data.

MS. MURPHEY: Okay. Well, anyway, I just wanted to throw that out, in case you didn't know, but it sounds like you do, and so cool.

MR. TWEEL: I appreciate that.

MR. PUGLIESE: Wilson.

DR. LANEY: Thank you, Roger. Thank you, Andrew, for the presentation. With respect to your last point, I think about perhaps trying to minimize the structural impacts on the beach, are you familiar with the work that Dr. Bob Dolan and Dennis Stewart and others did on Pea Island National Wildlife Refuge?

MR. TWEEL: I am not. No, but I will look into that. Is that something that I can find online?

DR. LANEY: I may have some of those papers that I can send to you, and I'm not sure that I have them all, but, basically, the short version of what was going on up there was, because of the construction of the small terminal groin on the southern side of Oregon Inlet, sand bypassing was required by the National Parks Service and the Fish and Wildlife Service, and the project was done by the NC Department of Transportation.

Sand bypassing was required around the terminal groin, and Dr. Dolan and Dennis Stewart developed what they believed was a better way of depositing the sand on the beach, so as to create more of a cuspate morphology, and that did seem to improve recovery rates, if my memory is serving me correctly, and so, yes, I will make sure to pass those references along to you, and I think it would be something useful to you as you're writing up your results.

MR. TWEEL: Great. That would be great. I appreciate that.

MR. PUGLIESE: I think the last one is going to be Cindy.

MS. COOKSEY: Andrew, I wanted to congratulate you and your team for being able to pull this off. You ended up really being able to pull together a really interesting study. For anyone who has not spent time working in the surf zone, it's incredibly challenging, and, with all the changes going on with the nourishment study, that just made it even more complicated.

There's a tremendous amount of information to try to unpack that you presented, and I know that there's additional information coming on the biomass, and I'm particularly interested in the sub-tidal impacts, and we wanted to hear from you today because we are looking at revising our policy statement on beach dredge and fill, and one of kind of the big challenges that we are being presented right now is with an increase of this desire to -- The number of renourishments as well as having a broader window in which to conduct the nourishment activities, and so I would like to hear some more on your thought, that I felt was very interesting, that the fact that this missed spring and early summer recruitment period could have been a factor in why the impacts were not as bad as maybe they could have been or that I was, in particular, concerned about. This might be information that we need to help define a window that we would recommend to be avoided for activities, if you have any additional thoughts on that.

MR. TWEEL: Sure. That was originally proposed by some of my predecessors, Bob Van Dolah here, who was at DNR, and I think it was mentioned by some of the work by Peterson out of North Carolina as well, and we don't have a whole lot of data from that time of year. Now, most of our data, or a lot of our data, especially recently, has been from the wintertime, due to wintertime nourishment, but also particularly with regard to piping plover migration and piping plover habitat, and so we don't have a ton of data in-house to, I guess, refine that window.

Knowing that that question is of particular interest though, I think that would be a worthy exercise for us to kind of explore our database, and we have decades of data here, and see if we can maybe come up with a more targeted answer to that question.

MS. COOKSEY: It is a really important question, as we get more and more pressure to allow almost year-round nourishment, and it used to be that protection of ESA species allowed some window of restriction, but that's kind of gone away, as people are willing to pay for observers and pay for moving nests, in order to allow them to nourish year-round, and so really kind of getting into how can we work with communities to allow them to do what they need to do, and what they're willing to pay for, but in way that allows the speediest recovery for our resources, to protect our coastal fisheries.

MR. TWEEL: I think that's a great question and point, and however we can help, whatever data or more specific questions we can try to answer, we're happy to kind of help you and help the group refine that.

MR. PUGLIESE: I think we've got two more. Rene and then Lisa.

DR. BAUMSTARK: Thanks. That was very thorough and in-depth. Renourishment is really big in Florida, and a lot of other states, and I'm just wondering, and maybe it's just lack of my knowledge of the topic, but I'm wondering how transferable to -- You mentioned, for foraging species and zooplankton, that there's other studies that are comparable, as far as the impacts, and I'm wondering if that's the case, and if you have compared your results, or if they are comparable to other areas and methods, and I know that the sediment type and the methods, it sounds like, is a big part of the impact, but can you speak to other states and the renourishment projects in other areas?

MR. TWEEL: Sure, and, just so I'm clear, were you asking about zooplankton in particular or just the beach organisms in general?

DR. BAUMSTARK: In general. I know you said at least for zooplankton and forage fish.

MR. TWEEL: We did a little bit of lit review for this, and the overarching trend that I found was, if the sediment was a good match, then, in most cases, very little impacts were found. There has been a suite of papers out of North Carolina that did see significant impacts, and I'm sorry that I don't recall offhand any particular ones for Florida, although I know there is a lot of nourishment there, and I assume associated work, and then some out of California, and there's a pretty high-profile one recently, and I think it was in the San Diego area.

In all of those, the common thread seems to be sediment type, and I think, if you can get that sediment type on target, I think your impacts are going to be greatly reduced, and so hopefully that helps answer your question, and I know -- Let's see. What was it? It was somewhere I read it, but a pretty good synopsis of that, and I'm trying to think of where I read that. It's not coming to mind right now.

MR. PUGLIESE: I think we have one last comment from Lisa.

DR. WICKLIFFE: Thank you so much for your wonderful talk, Andrew. I think it's -- I know it's really hard to do a BACI design and not have something like accretion happen in one end, and it's hard for everything to work out, but I think you did a fantastic job. I was going to comment that, within the document that I'm going to present tomorrow, there is an overview of biological recovery times following nourishment, including one from Jute et al. from 1999 that is for Folly Beach, and it hits different benthic groups, and that may be another good reference, but I will be happy to shoot you a copy of this, so you can just have it as a reference, and you can just go ahead and pull those references from there, and that may kind of expedite your process a little bit.

MR. TWEEL: Thanks. I appreciate that. I will be sure to tune-in for that as well.

MR. PUGLIESE: I think that wraps up our discussion for today. As Lisa indicated, and Anne can go into this, but we're going to shift her presentation to first thing in the morning, and just I guess one other note on that, and I did send out an FEP roadmap, actually an Excel table, if anybody would like to look at what I did, and I transferred the information from the roadmap update to an Excel table, and that's what we're going to look at. If there are other actions or issues that could be added, feel free to be ready to discuss or highlight those, or even forward those. With that, I will hand it to Anne.

MS. DEATON: Thanks, Roger. We weren't sure if we should wait for Lisa's talk, but I think it's really informative for the group, and it would be better if we do it first thing tomorrow, and so we start tomorrow at 9:00. We're scheduled from 9:00 to 12:00, but we're going to add that presentation, as well as we bumped the discussion on what Roger was just talking about, the FEP implementation progress, and so we may run a little over 12:00 tomorrow, but there's other good things, like the BOEM research update and the Southeast Seafloor Mapping Prioritization Study, and so it will be good stuff.

MR. HOOKER: Anne, are we doing Lisa's presentation and the FEP just at the end of the --

MS. DEATON: I see, because you're first up tomorrow.

DR. WICKLIFFE: It's going to be really hard for me to be here in the afternoon, and I'm just going to tell you right now that I've already spent a good bit of the day that was unplanned for work, and so it's really a call of do you guys want to go ahead and get a quick synopsis for us setting the schedule tomorrow?

MS. KEENER: Is there any possibility of starting earlier tomorrow?

DR. WICKLIFFE: I am more than happy to do that. I'm up at 7:00. You guys just let me know when you're ready.

MR. HOOKER: I can go earlier than 9:00 as well.

MR. PUGLIESE: The only contingent is we notice these in the Federal Register, and that's the only issue that I see. It's easy to go longer, but we are starting them generally at 8:30 anyway, so that we can check-in, and so, at a minimum -- The only thing is individuals who are not on here right now would not know that.

MS. KEENER: But we could complete the presentations for today, like the time of year restrictions, as Lisa said.

DR. WICKLIFFE: But I think Brian and I are the only two people that are presenting tomorrow, and so I just wanted to say that we're both on the line right now, and so I don't think you would have to do any additional reaching out, but I am happy to speak, if everybody is willing to stick around. It's just up to you guys.

MS. DEATON: Do you think it will be a thirty-minute presentation?

DR. WICKLIFFE: I do.

MR. PUGLIESE: Madam Chair, welcome the Habitat AP meeting. We have just so many important things to do, and it just is the way it happens sometimes.

DR. WICKLIFFE: I mean, if we could do it at 8:30 and then keep Brian on at his proposed time at 9:00, that would be ideal for me. If I need to rearrange some things, I can do that, but just please let me know, and I will do whatever I can to make sure that these points are highlighted for this work.

MS. DEATON: I don't think we can start at 8:30, because of what Roger said, but we could start -- Everybody be ready, and we will start promptly at ten before 9:00, and would that be too early, Roger?

MR. PUGLIESE: We can go ahead. I mean, it's carryover from yesterday, and so hopefully individuals understand that.

MS. DEATON: Let's just -- Lisa, we're going to start with you at 9:00, because we inconvenienced you, and then we'll go right into Brian. Brian, that will work, right? You can do it second?

MR. HOOKER: Yes, as long as we don't get back into the FEP.

MS. DEATON: No, and we'll do that -- We can fit that in later.

MR. PUGLIESE: That will be a later topic.

MR. HOOKER: All right.

MS. DEATON: Okay. I think that would be good. I don't want to -- Everybody is kind of tired, and --

DR. WICKLIFFE: I want everybody to be pumped for my talk.

MS. DEATON: We'll be giving you lots and lots of questions tomorrow, because we'll be prepared.

DR. WICKLIFFE: I don't know if I'm going to have all the answers, but I can point you in the right direction.

MR. PUGLIESE: Well, I mean, one of the aspects is that this whole session was really to be presentations, so we set the stage for either tasking a smaller group or following-up to begin to structure what a revision to the policy statement on beach dredging and filling and beach renourishment, and so that's the charge right now. I think Rene had one last question, and then we'll go.

DR. BAUMSTARK: It wasn't a question, but I was going to suggest -- Having gone through the question-and-answer session, I think see there is a lot of value in actually speaking, but I was going to suggest that maybe if we can limit the questions and then have them maybe emailed and answered offline, to get through everything promptly.

MS. DEATON: So you want to change the plan?

DR. BAUMSTARK: No, but, just to stay on target, I think, when we get into the depth of the questions, it's hard to stay on time and on schedule, but they're important, and so I think they need to happen either way.

DR. WICKLIFFE: Agreed, and I'm happy to answer anything through email as well, and know that.

MS. DEATON: Okay. We're going to adjourn for the day, and we'll be ready to roll at 9:00 sharp. Have your coffee and everything, and we will limit the questions, so that we don't get too far behind. All right.

MR. PUGLIESE: Make sure you get in a couple of minutes early, so I can do the -- Make sure that I unmute everybody, so that we aren't running into our time. That's one thing you want to make sure.

MS. DEATON: You can even -- You said you can start it at 8:30?

MR. PUGLIESE: Yes. We're probably going to start at 8:30, and we'll just start unmuting people and making sure that everybody is operational.

MS. DEATON: In position. Okay. Sounds like a plan, and so we'll talk to everybody tomorrow.

MR. MILLER: I have been really quiet today, and this is my first time in this group, and I am just amazed at the amount of information that was presented today, and I want to congratulate you all. I just navigated my way to the briefing book, and I thought, wow, this is some great stuff, but I just wanted to tell you that you guys did a really great job today.

MS. DEATON: Thank you. Okay.

MR. MILLER: I look forward to seeing you tomorrow.

MS. DEATON: You have plenty to read tonight, right?

MR. MILLER: My brain is about to explode as it is.

MS. DEATON: All right. Have a good night, everyone.

(Whereupon, the meeting recessed on October 21, 2020.)

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OCTOBER 22, 2020

THURSDAY MORNING SESSION

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The Habitat Protection and Ecosystem-Based Management Advisory Panel of the South Atlantic Fishery Management Council reconvened via webinar on October 22, 2020 and was called to order by Anne Deaton.

MS. DEATON: I've got 9:00, and so I say that we're going to open the meeting. Welcome to everybody, for those that are returning, and, if you weren't here yesterday, we ran a little bit behind, and so there are some changes to the agenda. Yesterday, it was a very full day of presentations on the tremendous progress that's been made to characterize EFH habitat, as well as move us forward on food web modeling that's critical for ecosystem-based fishery management. This information will help -- It's needed for us to understand what steps to take for habitat conservation in the future.

As I said, we did run out of time on the last presentation of the day, which was going to be by Lisa Wickliffe from the NOAA Beaufort Lab, and, if you're looking at your attachments, there's an Attachment 15 and 16 that goes along with that presentation, and so she's going to speak to us on a document that she put together, which is called *An Assessment of Fisheries Species to Inform Time-of-Year Restrictions in North Carolina and South Carolina*.

I am looking at it right here, and it's over an inch thick. It's pretty big, and I use it a lot, and so, after that, we're going to go right into Brian Hooker, who is going to give us an update on BOEM information. Before we start with the presentation, Roger, do you want to do the public comment request, to see if anybody wants to give comments?

MR. PUGLIESE: If anybody has public comment, if you will raise your hand, we will acknowledge you, and you can make that now. I don't see any raised hands, and so, Madam Chair, it's all yours.

MS. DEATON: Okay. Then why don't we have Lisa pull up her presentation, and we'll move into this talk, and this is really important. It ties into what we heard earlier in that session yesterday, and we heard information about mapping of the sand shoals, and we also heard a presentation on a monitoring study that was done in South Carolina, where they did the nourishment at Folly Beach during the summer, to see how that affects the benthic community and the fish community.

Following this, I would love to have some discussion from the different states on what they are seeing, in terms of pressure to do more dredging year-round, or different times of the year than has been traditionally done to minimize habitat impacts, and so I know, in North Carolina, we've been seeing that, and that's why this resource is very valuable, and I'm going to just turn it over now to Lisa, to tell us about it.

DR. WICKLIFFE: Thank you so much, Anne, and Anne did not compliment herself there, but this was -- I spoke with Anne so much during this process, because of the coastal habitat protection plan that she leads up, and so thank you so much for giving me this time to speak with you guys today. I'm going to try to keep this to twenty-two minutes, so we do have room for discussion, and please know that I'm just going to give a basic overview of how you can use this document to your benefit when you're trying to be more geographically or temporally specific for your recommendations, maybe, or maybe you just need to look into the literature a little bit more about things.

This is a NOAA technical memo that we put out in 2019, and today we're going to discuss the time-of-year-restrictions for North Carolina and South Carolina and what we did to really do that, and, again, my co-editors on this document are Fritz Rhode, Ken Riley, and James Morris, and they all were instrumental to completing this big lift, and so let's get into it.

The main goals of the project were to identify those times of year when those vulnerable life stages of fisheries are present within habitats, and what is the potential to be affected by nearby coastal development when they are in those habitats, and so, in order to do that, we really created three main sections of this document for you guys, to try to help you have a compacted resource that you can look at for North Carolina and South Carolina when it comes to, A, types of development; B, the life history reviews of these priority estuarine-dependent species that were identified by the funders, the NMFS Conservation Division; and then determine the life stage and temporal patterns for those thirteen species, looking at overlaps of certain life stages and certain habitats or when multiple projects occur and one species may be affected by cumulative impacts.

Our study area, and I'm sure that everybody is very familiar with this, but I do want to go over it very quickly, because it's really important when we're talking about the biogeography of North Carolina relative to South Carolina. North Carolina's coast is framed by this chain of the low-lying barrier islands that we now know as the Outer Banks. The barrier islands create large and productive sounds and estuaries, some of the largest on the east coast. The Pamlico and Albemarle Sound together make up the second-largest estuary, and then we have multiple things that go on with the intercoastal waterway right there.

The topography of the three major capes, and I think, if you saw Brad Pickens talk yesterday, where the sand shoals form off of these capes, you can tell they're significant features when it comes to habitat and the biology and movement of species for North Carolina.

Also, along the Outer Banks, we also have substantial amounts of submerged aquatic vegetation, and this is a habitat that's not even present in South Carolina, and so this makes it very different as well, and so we have this enclosed estuarine system, the Albemarle Sound, going from north to south here, and the Albemarle Sound is a relatively fresh body of water, compared to the Pamlico Sound, where you have the Neuse and Tar-Pamlico Rivers into it.

As you move down the State of North Carolina, you can see Bogue Inlet and Beaufort Inlet, and all of the inlets are actually pointed out in yellow, simply because those are some the most important features, biologically speaking, when we're talking about North Carolina. Our inlets are the way that egress and ingress occurs for many of the species we're going to be discussing today.

As we go down towards the south, the Cape Fear River is one of the only rivers that flows directly into the ocean from North Carolina. South Carolina is very different, in the sense that we're not talking about any capes, and this region is drained from basically the Pee Dee, Santee, and Savannah Rivers, as well as many other small streams, and the northern coastal section, where we're talking about Winyah Bay, is actually the third-largest estuary on the east coast. It's fed by -- Really, it's the Waccamaw and Black Rivers and Pee Dee flowing from the Piedmont.

What you're seeing here is we have a lot of tidal freshwater marshes and salt marshes and oyster reefs and shell bottom, and, really, these estuarine, or inlet, or bay areas, where the rivers flow directly into the ocean, and so, again, just thinking about those differences, we have to think about that as we're talking about -- When we're talking about these potential moratoria.

Again, I think most of us know what moratoria refer to, and it's either synonymous with an environmental window or a time-of-year restriction when activities are not completed, and these activities can include numerous different things, including soft stabilization, through beach nourishment, pile driving for bridges, dredging, and these are the major activities that we're really going to be focusing on today, and then we're also going to be really looking at how do we make these rules, and, right now, they need to be based on temporal and spatial movement of these fisheries species that utilize these different habitats at different times in at least one life stage of their life.

We also want to hit those peak events, and so we need to know when are the peak events occurring, and that's migration, spawning, and when are the larvae coming through the inlets or going out? These are all very important times of the life stage that could be detrimental to the population if activities go on during that time.

Keeping that in mind though, we also know that adherence to these moratoria can be very costly, and so we need to -- Again, we have documents from 1993 and 1991 and 2010, and these are some of the historical documents that were put out. Mark Manaka, from our Marine Spatial Ecology Division, that I am part of, did some of this work, and it's really different from North Carolina and South Carolina, although they're similar, but they are different in that sense that, for North Carolina, you actually have some pretty good breakdowns, geographically, of how the standard moratorium period works versus anadromous fish moratoria period and what body of water they're talking about.

Now, we're hoping we can give even more specificity, within this document, to each of those areas. For South Carolina, we may not have formalized agreements for moratoria at this time, and agencies and NMFS recommend conservation measures to protect recruitment periods for larval fish, shrimp, and crabs. General recommendations include construction moratoria periods extending from February 1 to September 30. Then, generally, the seasons of spring and summer are considered peak recruitment periods and are highly regarded as the most important seasons for

conservation, as stated by South Carolina. We do have some variations, even from state-to-state, on how these things are broken down.

The first thing we wanted to do with this was create a kind of reference guide of these coastal development activities. This is at Oregon Inlet, and this is, obviously, a sidecast dredge, where they are making sure that the waterway is still navigable. Oregon Inlet also has some of the highest rates of larval transport in and out of that inlet, and there's a crab spawning sanctuary there that you will see in a minute, but always -- Just one example of when it would be very important to consider a time of year.

What can happen with soft stabilization, or beach nourishment? This is numerous things that can happen, and, again, I think Andrew Tweel kind of hit on some of these yesterday. Change in flow characteristics, increased sedimentation or turbidity, and you could have just physical smothering of eggs, smothering of the habitats themselves, and so, if you have a habitat like mud flats, or intertidal zone, and then, all of a sudden, you get a veneer of sand over it, then it can change that habitat. Also, we have direct mortality.

Dredging, we kind of break this down into mechanical and hydrologic dredging activities, and they can occur -- Again, you will use a different type of dredge, depending on time of year, depth, substrate, and so all those decisions have to be made along the way. For hydrologic dredges, one of the biggest things that is a concern is entrainment, larval entrainment.

For many of the other dredging types, all of these things may hold true, although there are various engineering mechanisms that can be put in place to mitigate some of those, but you may have, again, egg smothering, impaired respiration and feeding, due to turbidity, and drop in DO. Direct mortality of those vulnerable life stages, loss of their habitat, or alteration of that habitat, and so these are just some of the things that we have to think about when we're talking about dredging.

Pile driving, this is one that I really put a lot of effort into covering in this document, and we really felt that it was important, due to the number of bridges that we see going in in the state, and so one of the biggest things here is just the activity of driving the pile itself, and the sound production and noise impact from that, depending on the number of decibels and depending on the hydrographic characteristics of a water body, and that will depend on how far that sound can travel. It also depends on the type of pile driver you're using, the size of the pile, the number of hits that that pile is doing per minute, and so they have all these measures in place that you can look at to try to make better decisions about pile driving, and that is compiled within this document.

Obstructions is an obvious one for anadromous species, and this has been going on for decades, as far as blockage of upstream passage to the spawning areas that they need, and so we've seen changes in patterns, really flow rates, where, if a flow rate is not right, we're not having correct larval dispersion or recruitment or survival, and so making sure those flow rates are there is very important to our distribution of our anadromous species.

Really quickly, some coastal happenings, and I mentioned the ones that we're really focusing on, but this is North Carolina's coast, and you can see the red lines indicate beach nourishment activities, and the yellow lines are actually -- Those are dredged areas, and that's not on the map, but that's dredged areas, and they are regularly dredged. We have a few jetties, and then all the blue, kind of really dark-blue colors that you see in there, are hardened shorelines. That is just one

of the things to kind of keep in mind, and we do have military areas, but that's not what we're focusing on today, and that was more just for the sake of showing this.

In South Carolina, here, we can see where projects may be occurring. The hardened shoreline, again, is this dark-blue color, and the jetties are in pink here, and you can see that the most prominent feature here is out of Charleston Harbor, and you can see the jetties, and you can also see lots of projects going on there, and this is one of the biggest ports in the state, and so we kind of expect to see a lot of work there. As you work down, you can see that nourishment occurs almost all the way up and down both states, the exception being parts of the national shoreline and the Outer Banks, I should say.

Now we're going to go into Objective 2 of this project, and so, basically, what we're going to do is we're going to go over an example, and I just want to do an example, because there's no way that I can go through thirteen species with you guys today. Please refer to the document, and, again, I'm just going to speed back, really quickly, to show you that -- In this slide here, there's a direct link to the document, and that's the cover of it. It's NOAA Tech Memo 263, but that link that you have, and that's in the book that Roger put together for us.

Anyway, I love these pictures, for obvious reasons, and we have the red drum migrating out, and you can see sharks in there foraging in between, and then the river herring migration upstream in the river, and so I'm going to kind of go over -- First of all, these are the thirteen species that we covered. Now, again, these were dictated by NMFS wanted to gather more information on, and some of these are state managed, and some of them are federally managed, but all of these species are estuarine dependent and extremely important to both South Carolina and North Carolina, which is why they were chosen.

Today, we're just going to go over Atlantic sturgeon. I chose this species because it's a -- This really took the longest amount of time to really get together, and big kudos to my co-authors for this section. Bill Post and Fritz Rhode helped out a lot, and Keith Hanson in South Carolina helped out a lot, and then we've got numerous data from Mike Loffler and other people within North Carolina. We also have data from Wilson Laney that we'll share today, and so we're excited about all these resources that we have, but remember that, how I'm going to break the species down, it's done for every single species on here in the document.

Real quickly, before we go into the sturgeon fisheries habitats, and we kind of defined these for you in the document as well, and this is just an example for North Carolina, showing you the hardbottom habitats that have been gathered by the southeast fisheries independent surveys, MARMAP and SEAMAP, and Marcel Reichert and several other people helped me get these data for really the snapper grouper complex areas that they drag to work on.

You can see the SAV habitat lines, and most of the Outer Banks, along the soft bottom, and the shell bottom is a little bit more difficult to see, but it's certainly mixed in there, particularly in the lower parts around the Neuse River, and those are really the main features that I want to point out there. For the nursery areas, you can kind of zoom-in, and you can see how many different types of nursery habitats are there. The orange areas are the crab spawning habitats that I was referring to earlier, and you can see Oregon Inlet up here, and this is the picture that I was showing from the Wilmington District that they had kindly provided, but these go all the way down into where I hail, right here, from Beaufort, but you can see, even here, these are major areas for crab movement.

Anyway, these are all -- All of these areas are used for shrimp, juvenile fishes, larval stages, all of that. This area up here has this shallow detrital area around it, where a lot of organisms hide out before they scoot out of the inlet right here.

Sturgeon, not the smallest fish, and a really cool species. We know we have the Carolina and South Atlantic distinct population segments that we're talking about today for North Carolina and South Carolina, and the Carolina DPS covers all of North Carolina and a part of South Carolina, and the South Atlantic DPS covers the lower portion of South Carolina. These are anadromous, which most of you probably know, and they're estuarine-dependent, late-maturing, and very long-lived fish species. We also have data on short-nosed sturgeon, and that's just not included in the talk, and we also have fall and spring spawning periods, just to make things a little bit more complicated with the movement of sturgeon in these areas.

The first component to each one of these species sections is going to be a life cycle diagram. There is a ton of information on here, and please use these. I encourage you to use them, but there is a lot of information about the size of the animal and what we refer to early larval, late larval, juveniles, sub-adults, and adults, when it comes to sturgeon. We also have different steps, 1 through 5, as far as different life stages, on here. These took me a while to develop and make, and part of this is -- These are all in there, and these were done in Illustrator and thoroughly vetted by my co-authors, and so please take a look at these, when you get to the species.

This is the map of Atlantic sturgeon spawning rivers and non-spawning rivers and then areas where we really haven't had any recent Atlantic sturgeon observations, and what you're seeing is those red lines are where we really haven't had any recent sturgeon observations, and that means within the last twenty years. Now, we had point data to kind of guide us through this, but we also had a very good definition, from our sturgeon biologists, as to where spawning would stop along each river.

You can see that the Roanoke River is a very important river for the sturgeon, as far as spawning, as is the Tar, the Neuse, and then, of course, the Cape Fear River is a very important one. There is a lock and dam on the Cape Fear River right there, and I don't think any -- I'm just going to go ahead and say no sturgeon made it past that successfully. However, it is possible for them to go into that non-spawning part of the river. A lot of times, there will be younger sturgeon that are not necessarily spawning in these rivers, where maybe there is less competition for food, or maybe -- They're just hanging out until they're twelve or fifteen years old and ready to spawn.

This is South Carolina. Again, we have portions of the Waccamaw, a very small portion of the Waccamaw, used for spawning, and the Great Pee Dee. We have the Santee River, and the Santee River actually has -- There is actually a fish ladder right there that was installed, and there's a very interesting population of sturgeon that live in that area that are relatively land-locked, I believe, and I think probably Fritz can speak more to that than myself, or Bill Post, but, going down, you can see that one of the main rivers is going to be our Savannah River system. We have a lot of considerations, just within these river habitats.

You can also see that most of these inlet areas, bay areas, are used for potential non-spawning adult and juvenile habitat as well, which leads me to Wilson Laney's data. I, very thankfully, received Wilson's data, and Dr. Laney sent me this in 2016, and this incorporates the 1988 through

2016 winter trawl data that he did for striped bass cruises. He and his group have been doing this for so many years that it created a really solid kind of bycatch sturgeon dataset for us, and so what we did is we took track lines, and we were able to get a start and stop latitude and longitude for each cruise, and then we associated the number of sturgeon that were caught on that cruise with that line, and then we created a density grid.

Each grid cell is about one-square kilometer in size, but what you can see is this hotspot right here that really showed up, and you can also see it -- Again, I will go back and work with Brad, but I just need to put the sand shoal layer in there and take a look at that too, Wilson, and I will do that, but what you can see is that, from the ten to twenty-meter contour, in the upper portion of North Carolina, we have these hotspots in the winter for aggregations of Atlantic sturgeon.

I think one of the things that is really compelling about this is that this is the sleepy little town of eastern North Carolina here, and we've got -- It's very rural. This is a very rural place, and so we can't always make the assumption that, just because we have increased population, that we're going to have increased development in that area. In fact, right off of this area that we're looking at, and this is near the Nags Head site, where the large beach nourishment project on the east coast is proposed is to happen, and it's also near the sand source site, and it's near the Kitty Hawk wind development project and near the Bonner Bridge project, and so you have this big cumulative effect that could potentially be in place for these species.

Again, I mean, this just speaks to the fact that, again, you have to look at all aspects of things to really make a decision, and so this is January and February data, and there are some caveats to this, where there were certain years that there were no catches, or there were no cruises that occurred, but, overall, I would say this is a pretty compelling piece of information to add into the decision-making for those multitude of projects that are occurring in that area.

Lastly, we'll have a spatiotemporal table, where it breaks down where and when each of these life stages will be, and so, for Atlantic sturgeon, you can see we have four asterisks up top. The gray is rivers, and the blue is estuaries, and then the black is ocean. You can see that we have -- Basically, there will be -- Those asterisks indicate times when the sturgeon will be staging to get ready to do a spawning run, and so these are also vulnerable times as well, which is why they are marked and pointed out here, and you can also see the sub-adult overwinter, and you can also see that there is that distinct spring and fall spawning period, and, over time, we have learned that that fall spawning period is very important for the Atlantic sturgeon.

Using all those tools together, we begin to formulate a picture about that species, and that goes along with many other references that are within this section, just on this species. Each section has a different set of co-authors, depending on who the biological experts were for the states. We also have habitat use diagrams, where we can look at it and say, okay, for Atlantic sturgeon, what is the function of these habitats, and how are they using it.

We also have spawning periods, and, again, if you look at the coastal habitat protection plan developed by North Carolina and Anne Deaton's group, this is very similar to what they have, except we've kind of added in a little bit of differentiation for South Carolina. The blue areas are going to be the peak spawning periods, and the areas that are kind of black with white hatches there is -- Spawning still could be occurring, but it's kind of either the backend or the frontend of

spawning, where it's kind of either falling off, the majority has already occurred, or it may just be starting up.

We also have a table of eggs, larvae, and juveniles and when those -- Where and when those life stages are for each of these species, and so we could see exactly where they are for the most sensitive life stages, using this table right here. With that, I would just like to thank the absolutely enormous support from the NMFS Habitat Conservation Group, Pace Wilbur and Fritz Rhode. Warren Mitchell, Marcel Reichert, Lee Paramore, Nate Bacheler, Bill Post, Keith Hanson, Chris Taylor for helping with flounder, Dave Whitaker, Tina Moore, Dave Whitaker again, Bill Post, and Ken Riley, who helped with some of the anadromous species that he worked on during his PhD work.

Contributors to this were numerous, and we had this document reviewed I don't even know how many times, but people like Jeff Buckel helped with the fisheries characterizations, and Doug Nowacek from Duke helped with impacts of sound and fish and different types of species. Steve Arnott from DNR helped out a lot, and Wilson Laney, and we've mentioned his data several times. Liza Hoos, Amanda Frick, Nikolai Klibansky, David Reeves, Greg Piniak, Tomma Barnes from our Beaufort Lab, and then, from North Carolina DMF and DNR, we have Anne Deaton, Anne Markwith, Seward McLean, Chris Stewart, Todd Van Middlesworth, Mike Loeffler, Holly White, Corrin Flora, and Jason Rock, whose comments and expertise significantly improved this report.

Just a real quick pitch, and coming soon, Brandon Jensen, who is a habitat specialist in our lab, will be putting out, with Alex Bogdanoff and James Morris and Ken Riley, *Understanding the Habitat Value and Function of Inlets and Shoal Complexes*, particularly for cobia, black sea bass, and gag in North Carolina.

Preliminary findings, kind of just to get you a quick fix on this, is dredging rates is one of the most concerning threats to EFH, and there is substantial knowledge gaps that exist in understanding the full life history and habitat requirements for these species, and then there is an immediate need for studying the direct interactions of dredging at coastal inlets on larval fish and EFH. To hear more about this, please contact Ken Riley, and his email is at the bottom of this presentation, and, with that, I will be happy to talk about any aspect of this talk, and I know I went longer than I said I would. Thank you so much.

MR. PUGLIESE: Thank you.

MS. DEATON: Thank you, Lisa. Besides, you waited long enough, and you get to go over a little.

MR. PUGLIESE: I think we have a question from Wilson.

DR. LANEY: Actually, a question and a comment. Thanks, Lisa. That was an excellent presentation, and thanks to all of you who worked so hard to put that document together, and it's a tremendous resource, and I hope that all of the folks in the regulatory review agencies will find it extremely useful.

One minor thing is they aren't Wilson's data. They are all the partners' data, and I guess, technically, the key partners in assembling that winter tagging cruise time series are NMFS and

ASMFC and North Carolina DMF and the Fish and Wildlife Service being the major ones, but, also, the Virginia Marine Fisheries Commission had a lot to do with it too, because they authorized all the work that occurred off of Virginia.

The one question I had for you -- Well, actually, two questions, and one is I will contact you all about collaborating, and one of the things that's on my to-do list is to update the 2007 paper that we did, because we did catch a lot more sturgeon after 2007, and so I will definitely give you a call about your interest in collaborating on an additional paper, since you all have done such great work using those data, and then the other question I had for you was that, with respect to South Carolina, were you all able to get all of the north inlet larval ingress data and use those in putting together the windows for South Carolina? That's a big, important database, and hopefully you had access to that.

DR. WICKLIFFE: We did not have access to that. That would be something that we can certainly with though, Wilson, and thank you so much for the correction and your efforts, although I know you played a role in it as well, but thank you for all of the partners who worked on that, but I think it was harder -- To be honest with you, it was a little bit harder to get some data from South Carolina than it was from North Carolina, and so I kind of was depending on Bill and Keith to help me figure out what I needed there, and so, if it didn't get in there, it's simply because we just didn't have time to do it, but it's something that certainly we can look into in helping to provide that specificity to windows for Atlantic sturgeon.

DR. LANEY: Okay. I don't know that they have any Atlantic sturgeon captures, but they certainly have a very long time series of larval fish ingress, and egress, through North Inlet there, and so that would definitely be worth your while, to try and get up with the North Inlet folks and get ahold of those data.

DR. WICKLIFFE: I have gotten ingress and egress data, but it was pointed towards blue crabs, and so I don't know if some of that went in there, but there are some maps in there for blue crabs that you may want to look at, to see if that's the data that you're speaking of, because I know I worked at the Baruch Institute -- I went to the University of South Carolina for my undergraduate and my PhD, and so I spent a lot of time in that area, and so we can -- If do not have that dataset, we should be able to reach out and get it.

MR. PUGLIESE: I think Brian has a question and then Paula.

MR. HOOKER: Thanks, Roger, and thanks, Lisa. Just I do, as a research manager, or I guess not as a research manager, but as an activities manager, I find this kind of documentation useful, and I think the way that it's presented is useful. I guess my question is, is this product going to be something that's replicated in other states, or has it already been replicated in other states and our regions, and then is there a schedule for making this like a regular product that's updated like every five years or so, because we know these areas are changing, and the data -- Wilson just pointed out some additional data sources that might be able to be brought to bear in future editions. Can you elaborate on that?

DR. WICKLIFFE: If I can, and I don't know if Fritz is on the line, but the bottom line is funding, and so this project was funded through the NMFS Conservation Division, and so it would be them who I would be looking to answer that question. It would be extremely beneficial to do something

like this every five years or so, and it's a huge undertaking to do this, but, at the same time, like you said, the value in having it all together in one place and synthesizing things to products that can be used and interpreted would be something that I could see is a major help in making decisions for these development projects, and so I would say that I would be in really high favor of it, but I really don't know of anywhere else where this has been done.

MR. PUGLIESE: I unmuted Fritz, if he wants to make a quick comment to that, and then we have Paula Keener.

MR. RHODE: As far as I know, this is a one-time product, although it could be updated in X number of years, and we have no plans to do it in other states. We focused on the two Carolinas because of the strong issues that we have with environmental windows in these two states, and so that's why we had Lisa just do the Carolinas.

MR. HOOKER: Thanks.

MR. PUGLIESE: Paula and then Anne.

MS. KEENER: Thank you. I just want to say thanks for the great work to compile all of this information, and it really does present baseline, if you will, for really important information for management, and so I would support updates for this critical information, and thank you, again. It was a great, great, great paper.

DR. WICKLIFFE: Thank you, Paula.

MS. DEATON: I was just going to mention that, when Lisa was starting this, we provided a lot of data from our fishery-independent sampling programs, and so, for some of these maps, knowing where and what life stages these species are -- Where they're at and what life stage they're at, it doesn't come from one year of data, and it comes from really, in some cases, decades of data that's averaged out, and so it's not a snapshot in time, although things do change.

We do get new information, and there are research projects that provide new information, but we have been using the dredge moratorium seasons for a long time, and we always couch that as it's a case-by-case though, so that, if it's an unusually warm season, or cold season, or droughty or rainy, you can adjust the window of time of it. You have that opportunity, because it's not in rule, which is good and bad, but, anyway, I just wanted to point out that it's not based on a short time series, in most cases.

DR. WICKLIFFE: Anne, that's a great point, and, to your point of the impacts of episodic weather, that can be a huge driver in these North Carolina estuaries. When you have big storms, they can change larval dispersion completely, and so it's really important to consider that when you're thinking about your windows and thinking about what is the temperature, and are we seeing movement at this time, and that's one thing that is emphasized in the paper, is that time of year.

I did want to say, in order to make this map, these data go back thirty or forty or fifty -- I mean, there is historical data, again, and there is up-to-date point data that we use to create these maps, and so, again, even this map, you can see that observed spawning from 1995, and so we still counted that, because we know that they still spawn there. It's really important to consider that

long-term period, but also those blips that occur in weather or oceanographic movement that can really dictate, I think, changes in that distribution, and so thanks, for mentioning that, Anne, and, Anne, thank you for everything.

MS. DEATON: No problem. Thank you. It's a good document, and I would be interested in hearing if -- So, Georgia and Florida, do they not use dredge windows or dredge moratorium periods?

DR. WICKLIFFE: I honestly can't answer that, off the top of my head, and I had a really tough time getting data from Georgia. I will just state that, and so I honestly do not know. Fritz, can you speak to that at all?

MR. RHODE: I think Cindy can address that a lot better than I can.

MS. COOKSEY: Do we have anyone from Georgia on the phone? I mean, I will address it, but do we have anyone representing any of the -- From DNR on the phone that might like to talk about it, before I do?

MR. PUGLIESE: Paul.

MR. MEDDERS: I'm from Georgia, and I'm not going to be much help, because I'm not familiar with any dredge moratoriums. We can find out the answer to that question, but that's just not something that has ever come up that I'm familiar with at all, and, as far as data goes, I think, if I can help in any way, in getting you any piece of data you want from the folks doing the work here, or anything we have -- I apologize if that was something that you had trouble getting.

DR. WICKLIFFE: Don't apologize. It's just how it goes in this world and who to reach out to, and so thank you so much, Paul.

MR. MEDDERS: It's probably lack of data, more than anything.

MS. COOKSEY: I have been sharing this report with the Savannah District of the Corps, to help kind of move the discussion along for time-of-year recommendations for work, and I'm using it to kind of bolster some of my arguments, when I make conservation recommendations to the Corps on their time windows, and I was curious to hear from the side of the state folks, but we do push for time-of-year recommendations for in-water work in the streams and rivers for anadromous species as well as trying to encourage the beach nourishment during periods of low biological activity in the fall and winter months.

MR. PUGLIESE: Okay. Are there any other questions? Ken had made a comment about support for continuing the efforts south, and I didn't know if you wanted to address that or just --

MR. RILEY: I was just going to -- I think Cindy just spoke up and spoke to that, but what we found is that this work largely builds on work in the Northeast, out of the GARFO and the Science Centers and the academic partners that are in the northeastern United States. As we move southward, and we have transitioned from temperate environments to sub-tropical environments, it gets increasingly difficult to capture some of those environmental windows, but I think Cindy spoke to it, and it's encouraging to use them when they apply to those temperate species, where

there might be those peak abundances or sensitive life history stages. Thank you, all, very much for the opportunity to present today. Great job, Lisa.

DR. WICKLIFFE: Thanks, Ken.

MR. PUGLIESE: Okay. Any other questions? I don't see any more hands right now.

MS. DEATON: Then let's move on, and thank you, again, for that presentation, Lisa et al., all the people that were involved. Now we're going to switch over to Brian Hooker, who is going to give us an update on the research and energy development activities in the South Atlantic and the focus on the renewable energy at the Kitty Hawk Offshore Wind Project. This is Attachment 19 in your briefing book, and I will turn it over to Brian.

MR. HOOKER: Thanks, everyone. This is going to be a fairly brief update on BOEM, primarily on the Renewable Energy Program, and then I will touch base on some studies that I've been trying to keep the AP aware of over the past year or so. Just going through the numbers, how many -- This is just the Renewable Energy Program, again, but we've completed eight lease sales, and we have sixteen active offshore -- Competitive lease sales, I should say, and sixteen active offshore leases, and we have approved ten site assessment plans, and these have exclusively been all meteorological buoys placed to detect wind speed.

One general activities plan, which I will get to -- Well, one general activities plan, which was the Block Island cable route, and no construction operations plans approved yet, but there are seven under review, and up to eight within the next twelve months, ten guidance documents, and five more areas, nationwide, under leasing consideration, and you can see on the map there some stuff on the west coast and where we are on the east coast as well.

Now I guess the biggest update for you guys is we actually have steel in the water off of Virginia, in federal waters, and, obviously, the Block Island Wind Farm was constructed a few years ago, and it's been operational for some time, but now we have the Coastal Virginia Offshore Wind Project, which I will now rotate to, and that's the closest project to the South Atlantic region, and this is basically research-demonstration-scale project, and those are the actual two turbines that are now fully installed and commissioned, as of, I think, last week, or the week before, and so these are now spinning and generating electricity basically off of the Virginia Beach coast.

Moving further down into the South Atlantic, we have the Kitty Hawk Offshore Wind Project, and they are still active in the data collection phase, and they have been -- I know, at least with regard to -- They are really actively trying to develop the content for their construction and operations plan, which they anticipate submitting around 2021, and it will likely -- This area that they are considering for leasing is likely the western part of that lease area, the part of the lease area that's closer to shore, and I have put their website there for more information on their project timeline. They have been -- Just recently, they've been discussing where they are with some of their data analysis for benthic habitat and EFH, which they have been coordinating with BOEM and GARFO and the NFMS Southeast Regional Office as well.

I specifically was asked on this recent Executive Order, and so, on September 25, the President issued a withdrawal of certain areas of the United States outer continental shelf from leasing disposition. It prevents the consideration for any leasing of exploration, development, or

production during a ten-year period, beginning on July 1, 2022 and ending on June 30, 2032, and so this does apply to offshore renewable energy, and so, under this Executive Order, there would be no new leases for renewable energy issued between July 1 of 2022 and June 30 of 2032. However, it does not apply to the Marine Minerals Program and the beach renourishment program. It does not also affect projects like Kitty Hawk, where leases have already been issued, and I put on there the direct link to the Executive Order, if you would like to read it in full. Again, I can -- We'll have time for questions at the end of the presentation.

I did want to pivot now to the environmental studies program, and we just concluded our solicitation for the -- Well, I guess it's not just anymore, but the 2021 studies ideas, and we should have our 2021 national studies list issued very, very soon, and just, to continue the slide before, we take the results of those studies and incorporate it into our environmental decision-making process.

The two studies that I had highlighted to you last May, and last October, are here. The MMP, the Marine Minerals Program, *Study of Behavior, Seasonality, and Habitat Preferences of Mobile Fishes* -- That's a really long title, but it's there, and it is now posted. I think, when we last presented that to you, it was still being drafted, but it is now available on the website. The other topic that the Marine Minerals Program presented to you on was ShoalMATE, a year ago, and Deena Hansen gave you a very thorough presentation of that tool yesterday.

The other study that I know is of interest in the South Atlantic is the South Atlantic high-resolution aerial survey project, and I do have a link there for you to see, and it's all posted on this Normandeau website, who are doing the aerial surveys. They have completed eight surveys so far, over the two years. The last posted one, for the aerial surveys, was February of 2020, and the cumulative detections to-date are over 4,000 large boney fish, almost 3,000 sharks, 23,000 rays, and they have 107,000 detections of sargassum, and 981 detections of fish shoals. We anticipate a final report on this in 2021. That is actually it for me, and that's where we are with our program and activities in the South Atlantic, and I would be happy to answer any questions that you may have.

MR. PUGLIESE: Cindy.

MS. COOKSEY: Hi, Brian. I was just curious what this means for Carolina Long Bay wind leasing area. Is that being on hold, or is that still allowed to move forward?

MR. HOOKER: That's a good question. I don't have an answer to it. I think, obviously, from the Executive Order, it could -- A decision could be made to proceed, if we thought that leasing could occur prior to the moratorium date of June of 2022, I guess is what it is, or July of 2022, but that decision has not been made yet, as far as I know.

MR. PUGLIESE: We have Anne.

MS. DEATON: Well, my comment, or my question, was very similar to Cindy's, and it was that cluster down there, and is that all called Carolina now, the Wilmington East/West Grand Strand through Charleston, and so all of those are on the same timeline, I think now, and are they -- So they're all in that same boat, and 2022 is two years away.

MR. HOOKER: Again, I don't think that any decision has been made on what may go forth or if it's just all on a hold, in light of this. I think, from a technical perspective, if it was feasible that leases could be issued prior to the July 2022 date, it could go forward, but, like I said, a decision hasn't been made on whether to pursue leasing prior to the moratorium date.

MS. DEATON: But do you think that it's logistically possible to get the lease issued, if they wanted to, by then?

MR. HOOKER: It's possible. I mean, those areas, those call areas, have been out there for a while now, and I know there's probably been a lot of discussion around them, and I don't -- I think it would be tight, just from the proposed sale notice and final sale notice and the leasing process that has to take place, but it's possible, technically possible.

MS. DEATON: Thanks.

MR. PUGLIESE: Wilson.

DR. LANEY: Brian, this is asking a question that you may not be able to answer, but somewhat in the speculative realm, and so, if the administration were to change, one might speculate that that Executive Order might possibly get reversed or repealed or whatever the process is, and I guess that is also technically possible, and so we would just have to keep an eye on what happens politically, I guess.

MR. HOOKER: Yes, and there's a lot of questions, I think, about -- The authority that he withdrew the leasing is the same authority that Obama used under the previous administration to withdraw leasing for oil and gas in the Monuments area, Northwest Canyons and Monuments, and other areas of the OCS. I know the courts have kind of gone back and forth over can you reinstate them, or can -- It's a question way above my paygrade.

MR. PUGLIESE: Are there any other questions for Brian? I don't see any more. Thank you, Brian. We appreciate the update, and hopefully we can continue on and see some of these efforts and renewable advance -- It's a lot different situation in the South Atlantic region versus the Northeast, in terms of support and continued effort to advance and the benefits, and I think our states are more aligned than some of the issues you're having in the Northeast.

MR. HOOKER: Thanks. I appreciate the feedback.

MS. DEATON: Okay. Roger, you are up next, to give us an update on the Coral Amendment 10, and Attachments 20 to 22 address that.

MR. PUGLIESE: What I wanted to get into is, as we mentioned before, the council is discussing advancements on coral management and coral activities. The two areas to consider were an outstanding issue that had been on the table a while back on an area along the northern -- The eastern side of the northern extension of the Oculina Bank, as well as looking at the newest information on deepwater coral habitats that we had the two presentations on earlier yesterday, and what we're advancing at this point is Amendment 10, and the intent is to continue to work with our partners and compile that information for the lophelia and other areas relative to the

Stetson-Miami and other components of the CHAPCs and consider that in future conservation efforts.

Today, we're going to focus on the issue of Amendment 10, which is a consideration to establish a fishery access area along the eastern boundary of the northern extension of the Oculina Bank Habitat Area of Particular Concern. The Oculina Bank has gone through multiple iterations to get to the size that it is now, and, essentially, what has happened is it has evolved from -- If you look at the original green box, that's the original Oculina Bank, and it was then designated as an experimental closed area, and it was subsequently expanded to the larger distribution, and then it was extended further west, and north, to essentially now the full range of distribution of Oculina coral in the South Atlantic region.

During the development of Coral Amendment 8, which you have the amendment as one of the attachments, a lot of work went into working very closely with industry, because you had a very different situation. In the southern part of the Oculina Bank, the fishery exclusively operates on the western side of that bank area, and it hugs up right against that entire system, and the bulk of that entire fishery, and, actually, in the past, the bulk of the fishery, in general, occurred along the western side of the Oculina Bank.

What came to light is that, in the northern area, you actually have two components of the fishery, one that works inshore, and the primary one is actually on the outside bound of the Oculina coral, in a fairly narrow band along the area, and the reason we could verify and validate this is that this is the only fishery in the South Atlantic that we have mandatory vessel monitoring systems in, and so we could work very closely to see what the information showed and be able to tailor this to advance it.

What you have now is that -- This actually went through multiple iterations in the northern section, and, if you look at the area in the north, this area actually was reduced about -- I think three separate times, to address industry concerns, primarily with this eastern boundary. The council finalized the action, actually in response to one of the last iterations provided by industry. However, at the end of that discussion, there was still concern about this northern area, and the area especially along that one edge.

As you see here, that's the actual northern extension. To advance that discussion, to get further information on the area, there was a request to provide some additional mapping and characterization of the area, if possible, and that did occur in 2017, along a component of that northern extension, and what you're seeing here is actually a combination of information that was provided when we did originally put this HAPC extension to the north, those two larger areas, and one is the Titusville location, and the other one is the Daytona Beach location, and those are the mapped, high-resolution mapped, areas that you see that provided a good gauge of what that boundary was along the eastern side.

What you're seeing now though is, from that cruise, the yellow and the red and the inshore areas, the green, are the mapped area along the eastern boundary, and it does show a fairly low-relief area along that system. However, you do see some occurrences of corals from follow-up information, and I think it might be even from what Peter had identified as a collection of historic samples, because I think those northern areas, and then there are some other southern points in the area.

What we have is the information that's been provided that gives us a better bound of what we were looking at, and so, originally, this northern expansion was going to be from a hundred meters to sixty meters, and it has been brought all the way down to a smaller area that I think is -- Now it's about 278 square miles, and so what's being considered is the last request from the industry was identifying this area, and so, in order to address that ability to access the location, we could create a shrimp fishery access area, as has been done in other parts of primarily the Stetson-Miami Terrace on the western boundary.

What you do with that is you do not change the outside bound, but you add an inside boundary, and it provides access to be able to go along in somewhat of the same situation, because, in this situation, what you have is that, historically, there has been some access in the area, and catch in the area, and it's been very variable, and more recent information really shows that, over time, there really was less than a couple percent of catch that actually came from -- A couple of percent of the effort came from that location, but there is the occasion that that does happen, and so it's being considered for discussion to go to scoping.

This is being brought to the different advisory panels, and the council determined that they would begin to have this discussion of a coral amendment with one action to address this and to defer the CHAPC expansion for future consideration at the September council meeting. What's going to happen now is discussion and presentations at the different advisory panel meetings, and we did proceed with getting the most recent detailed updated coral ecosystem information provided to the AP. However, there is a desire, in the future, to have a similar, or even a higher-level, presentation during the council committee that will be deferred to a future meeting.

Now, we're at the stage where we have the advisory panels meeting, and Habitat and Ecosystem is now, with this in front of them, understanding that we were looking at considering options for scoping, and the Coral and Deepwater Shrimp Advisory Panels will be meeting in November to also discuss this one specific option, and the intent is to then look at that. If the council decides to go to scoping, then we go to scoping, and then through advisory panel additional meetings next year, and then, ultimately, to public hearings.

That's the context of the action before the council at this time, and so what I anticipate is the council, after our deliberations and discussion and advisory panel input, the council will be looking at an options paper at the December council meeting, with a focus on the one area, and, from some of the additional information, we have the opportunity to look at maybe variations from that base area, to consider things such as some of the coral distributions, and I noted that there were some additional coral distributions.

Also, if you look at the mapped area, virtually none of the vessel monitoring points north of that one area occur at all, and so there is no real information to the north about operations that have occurred, and, if it did, it's truly historic information that is not in our records at all, and so those are at least some variables that could provide a consideration of the core area and then maybe some reduction to address both coral habitat or actually effort that is occurring in the area.

Let me go back real quick, and I was going to touch on one thing, quickly, and, if you bear with me for a half-second, what I wanted to do is at least give you a little better zoom-in directly on some GIS that is showing the area, and maybe it's a little clearer, in terms of what we're looking

at, and so what you see is the boundary of the northern extension is in purple, and you see the area under consideration, and the points are approximately what are some of the points that have been identified, and you see how they are coming along the edge of this system and are staying primarily in what is considered the low-relief habitats. However, they are coming up close to the edge of the system.

As I mentioned, and this will give you a quick reference on this, if I open up some of the VMS layers, you will see some of the actual point information starting to be populated on here, and you can see it's primarily outside of the bounds, and there is some that occurs within that area, and that's what the fishermen have been asking, that they be able to go into the area.

Maybe that will help a little, if I get -- You can see where some of the fishing operations, and these would be trips that they were actually fishing, because VMS data is a continuous system, and so you have to sort out to get what would be considered operating, and, primarily, it's in the southern component of this area, but it's very limited. When we did the original analysis of the overall, we were showing, for the entire time series, less than 2 percent of all points occurred within there, but it does occur, and the council is responding to the request to consider this. That's pretty much all I wanted to provide at this time.

MS. DEATON: Roger, I am looking at the next steps for Coral Amendment 10, and are you looking for a recommendation from this advisory panel?

MR. PUGLIESE: Well, what we've got before us is the information that I showed you is basically the request, and we have the recent mapping that does show that that's fairly low relief, and I think Derek actually worked up this information too and showed pretty much the same thing. The consideration is that the request is for that area that basically you saw, and the points inside that that would create that small sliver along that area and address the issues and times when the fishery is accessing a closer area and that it would be available.

Now, I did qualify that by saying there is opportunity to make statements, and that may be something that the advisory panel may want to provide input on, is either support for this or support to consider it. If it's considered, that some of these other considerations, such as any existing distribution of habitats, coral habitats, be considered in this, but it's open to whatever members think at this time, and I think we have Wilson and then Rene.

DR. LANEY: Roger, I guess my question, to you and the AP, would be, given that it's so close to the boundary of the existing closed area, given that, from the best available science and historical information on where the effort occurred, and only maybe 2 percent of the effort took place in this area, and then given that there appears to be some habitat, at least in the area, and I would ask you maybe to elaborate on what you mean by low relief, but what I'm assuming, from those little dots we could see on the map, is that there is some coral habitat within the area, and so I would question whether or not the council should be opening that area, regardless of how long that request has been pending, but those are my thoughts on it.

MR. PUGLIESE: Thank you, Wilson. That's why it's being brought before the AP, to get the information on the table and respond, and it's the beginning of the process, because it's a consideration by the council. Rene.

DR. BAUMSTARK: Thanks, Roger. A question. The VMS points there, what activity -- What type of fishing activities are they? Are they bottom impacting?

MR. PUGLIESE: Yes, and those are VMS for the rock shrimp trawl vessels, and so those are points from the VMS stream where they are collecting data on their trawl activities, and so that's actually when they are traveling between two and four knots, which is considered fishing, versus anchored or moving, and so that constitutes bottom fishing, yes.

DR. BAUMSTARK: Got it. Okay. Thank you. Then I will just add, since I'm on the mic, that I think that, as our understanding of these bottoms grows, and, in the past, we just had no information, and so the management around it needs to consider our understanding and how these types of habitats have precedent to be protected, similar types of habitat that there's precedent to protect these or to consider these as areas of concern consistently, and consideration of all these new information that's been collected really needs to be considered in opening this, and so I would probably agree with Wilson on his comment.

MR. PUGLIESE: Thank you, Rene. Paula.

MS. KEENER: I agree, and I think the questions about low relief and what does that mean and the low percentage of effort, and why are we even beginning to talk about this anyway, if it's such a low-level effort, and the map of the area that was just shown -- I mean, I can't really tell anything from that at all, with the exception of the information that was presented to us yesterday, and so I just feel like I need more information anyway, but, in addition to that, these areas are of extreme importance, and so I just need more information, but I will state these areas of extreme importance, and so I think there needs to be more discussion. Thank you.

MR. PUGLIESE: Okay. Laurent.

DR. CHERUBIN: Thanks, Roger. I took a close look at the map that you showed, and, from what I understand, there is these transitions from the high-relief area to the low-relief area that the fishermen want to have access to, and something that I didn't really catch is whether we have data, or information, on that particular area, and I know this area is very thin, and what they are asking us is to move the boundary further west, so they can fish that flat top, but, as some people mentioned, do we have any information on this low-relief area, which is just very close, which is the transition zone from the high-relief area to the rest? It seems like the boundary could be slightly shifted if we knew exactly that this area is not a habitat of importance.

MR. PUGLIESE: Primarily, this area is the low relief advance up to the pinnacle system, and so a lot of it is sand and probably partial rubble, and there have been concerns by the Coral AP in terms of sedimentation, if you get too close to the base of the pinnacles on some of these different areas, and so that has been raised, but it is primarily -- I think, even though it's showing low amounts of areas, it has been trawled along at least the southern portion of those areas, and so that has been impacted, and the industry is saying that they actually have fished that even harder in some of those different areas, and so what you're looking at is the sand-rubble transition into the deep area. Cindy.

MS. COOKSEY: I am going to be the odd one out, and I'm going to put on my fisheries hat, and I do advocate that, where possible, it's often a good idea to try to have positive working

relationships with the fishing industry and support them where we can, and so you kind of already addressed this question, I think, but it did appear, from the map, that the area that you're carving out is an area that is already experiencing fishing pressure, and has been for a while. Is that correct?

MR. PUGLIESE: Historically, it has. Now, you've got to remember that it is now inside of the bound of the HAPC, and so that is a little bit of a consideration, and that was historic effort that occurred, up until 2015 and the implementation of Coral Amendment 8.

MS. COOKSEY: Okay. I mean, I think that's important to keep in mind, that this is already a disturbed area, and to weight that accordingly, when we want to focus our conservation efforts, and that's just something to keep in mind.

MR. PUGLIESE: Thank you, Cindy. One other aspect is -- One of the reasons it's being considered as a shrimp fishery access area is it would maintain the boundary of the HAPC, and so then any other bottom-tending gears or anchoring, or it would still be maintained as an EFH HAPC, and so any considerations and permitting, et cetera, would be maintained, and so that was one of the reasons that it's even being considered at that level. Anne.

MS. DEATON: I just -- Back to a little more information is really needed, and like I can't tell, from those maps, and maybe you mentioned it, but how wide of a corridor are you talking, and is there a buffer from those higher-documented pinnacles, a buffer distance, and like how close would it be, in terms of meters or feet?

MR. PUGLIESE: The area you're talking about is probably no more than a quarter-mile, if that. We're talking about it in terms of probably hundreds of meters, in some areas, and, with regard to a buffer, to a great degree, this was somewhat considered as the buffer. However, in the last discussion between both the Coral and Deepwater Shrimp, they talked about creating something. I mean, you would essentially have to cut this even further down, and that's a consideration, and so I think just identifying that as a concern, about maintaining a buffer of some sort, is something that is a recommendation that could be advanced.

MS. DEATON: Then one other thing about -- Okay. A question. A quarter-mile, what are you talking about? A quarter-mile is the linear distance? I was talking about the width. Is it a quarter-mile width?

MR. PUGLIESE: Yes, at the most. This is very small. I mean, you're talking about --

MS. DEATON: The width of the corridor.

MR. PUGLIESE: A difference between five-meter relief between one point and the other, at the most.

MS. DEATON: Then is there any video, bottom video, of this area, from either the more current expeditions or the past, when they put this in place?

MR. PUGLIESE: There is no video in that specific area, but there is imagery and video associated with the two larger areas that I showed you, but those are -- Both of those areas would still be encompassed even if you put this in. The habitats and the distributions of pinnacles and the

different high and low-relief structures and species associated would still be inshore of any of the proposals right now, and so, in the last 2017 work, the only thing that was also added into there were some CTD casts, and so there was not ROV or video provided in that effort. Wilson.

DR. LANEY: Just to make sure that I am understanding, and to Cindy's point, the area has been, at least technically, closed since 2015, when Coral Amendment 8 went into place, and then a second point is that, when Coral Amendment 8 went into place, we had -- If memory serves me correctly, we had considerable discussion about the need for a buffer at that time, and, this area that is now proposed for shrimp access, would it not be considered to have been within the buffer that we discussed and tried to consider under Coral Amendment 8? That's question two.

Then, to Cindy's point about disturbance, yes, disturbance happens, and we all know that, but recovery only happens, especially for these sorts of benthic habitats, if you keep the area closed, and that's been dramatically illustrated by the closed areas on Georges Bank and off New England, where, when you do a -- Up there, they do rotational closures for the deep-sea scallop fishery, and, if I misstate anything, somebody please correct me, but, when they do those closures, the scallops grow huge in those areas, and, up there, they rotate, and so they do open those for fishing at certain points.

I don't think the same sort of approach could be used effectively for rock shrimp, which I think is the target species in this area, as opposed to royal reds, which I think are a lot deeper out, and then the final point is that, even though these were characterized as low relief, if I remember correctly, Roger has pointed out to us, on numerous occasions, that even these areas of coral rubble that are adjacent to the mounds are still important nursery habitat for juvenile reef fish species, especially juvenile red snappers, I think, and so that's it. Thank you, Madam Chair.

MS. COOKSEY: I'm not going to argue any of those points, as I firmly believe in all of them. I'm just kind of putting it out there that, occasionally, as we seek to expand our HAPC areas, in order to forward those efforts, which I wholeheartedly support, it is, on occasion, important to also consider what's happening with our fisheries industries as well, and so I'm just saying we need to also keep that in mind while trying to move forward all of these incredibly important conservation efforts.

MR. PUGLIESE: To Cindy's point real quick, this specific request, I think, has been acknowledged, potentially, in the response to the Executive Order on helping the industry relative to COVID and other activities that came up, and so there's at least a desire to have it considered, and this still has to go before the Coral and the Deepwater Shrimp AP, and it will be interesting to see what their response is, because I think there was some request to actually go down in further parts of the existing Oculina, which the council did not advance at all.

All these different recommendations and comments are going to be provided, and it's important to balance it. I think the issues that have been raised on buffers and on the considerations of use are all things that were on the table, because this boundary has shifted like two or three different times inshore of what the original proposal was at a hundred meters, and so it has moved closer, and with the considerations of trying to make sure that you did have that buffer away from especially the high-pinnacle system that is very pronounced on that one edge. Are there any other comments or questions or recommendations that members have at this point? Wilson.

DR. LANEY: To respond to Cindy's points, Cindy, I do appreciate the need for the council to consider the socioeconomic implications of closing areas, but I don't think that's our role as a Habitat Advisory Panel. I think the Habitat AP's role is to look at habitat, first and foremost, and then let the council worry about the socioeconomic impacts, and I understand that, if you work for NOAA, you wear two hats, one of them being an economic and commerce hat, basically, because of the need to promote U.S. domestic commercial fisheries, but the other hat is the conservation hat as well, and I know that may or may not affect NOAA staff who are in one or the other divisions as well, and so I understand that, and I realize that, but I think the AP, this AP's, duty is, first and foremost, to look at the potential habitat impacts.

From my perspective, it's just getting too close, and the amount of resources historically extracted from this area was very small, and it's just getting too close for comfort, even with modern navigational capabilities. A quarter-mile is not much when you're driving a shrimp trawler, especially a deepwater shrimp trawler.

MR. PUGLIESE: Anne.

MS. DEATON: I was wondering if you would mind, if we had time, to go back to the map you had pulled up with the bathymetry and the HAPC, and could you pull that back up for a minute?

MR. PUGLIESE: I've got to transfer over.

MS. DEATON: I mean, I agree to try and allow it, if it wasn't going to cause a habitat problem, but it sounds like we're not quite sure, and so, if an adequate buffer could be -- If there's an adequate distance of a buffer, which I don't know what that distance is, then I think it would be, you know, reasonable for management to consider it, but I'm with Wilson that it's a very fine line, because it's very delicate structure on the bottom, and, where there are VMS dots within the restricted area, that tells you that sometimes they do go in there. Those shouldn't have been in there.

MR. PUGLIESE: That was before. Those points that you're seeing there were before this area was put in place. What you're looking at is historic data that goes all the way back to the requirement of VMS, which was 2003, and so it goes from 2003 through 2014, and so those are all historic data points, but what the industry is even saying is that they actually had certain times where, before even the recordings, there were times when the shrimp moved closer to the edge, and those were some of the recommendations that had to come from. The council adjusted it, as I said, multiple times to do that in the past, and then this came after this was approved and advancing for submission. All the points that have been made are relative to the mandate for this group, this habitat and ecosystem group, and so I'm on there now, and so what you're seeing is --

MS. DEATON: Could you just slide up to where the -- Go ahead.

MR. PUGLIESE: Let me zoom-in even further, I guess. I will just walk along the system, and so what you're seeing is the recently-mapped areas in the yellow and brown or green, and what I will show you is -- When you get into the -- I think that's the Daytona pinnacle areas, and you see that that area is still significantly inshore of even what was mapped in one of the first points that would have been considered up in here, and so, just to keep on moving up, you'll see that that bathymetry

is still low relief, but then you start getting -- There are certain areas where you start getting closer to the pinnacle system.

MS. DEATON: So the tan, what looks like to me tan, line, what is that?

MR. PUGLIESE: That is -- Okay. What we're looking at there is the mapped habitat, and so that's been mapped, and the relief is -- You're seeing that it's transitioning from a hundred to about ninety meters at the base of the pinnacles, and so that whole area is maybe ten-meters of relief, the entire area across what we're looking at right here.

DR. LANEY: So is that black dot right there, Roger, is that a VMS dot?

MR. PUGLIESE: No, and that's actually potentially the inshore bound, or it's close to what would be the inshore bound, of what industry had asked about being able to trawl along this edge, and that is not a VMS dot, but the VMS -- Let's see if I can get some of that. It's generating some of the VMS in those areas, and, as I mentioned, it is fairly limited, but, again, it doesn't have the historic back all the way beyond the original time, but, as you move to the south, you can see that these areas have had some trawling along the edge. Again, this is historic, and this is not activity that has occurred since the designation, because this designation did not go into place and become effective until 2014/2015, in terms of rule.

DR. LANEY: Just to clarify, this is rock shrimping we're talking about, right, and not royal reds?

MR. PUGLIESE: Yes, and rock shrimp is -- This is the deepest that rock shrimp goes over here, because almost all, as I mentioned, of the fishery is predominantly south and on the western boundary of the core habitat area of particular concern. The royal reds are significantly further out, into 200 to 300 meters, and there's a very distinct boundary. You can see the entire fishery very clearly when you look at the entire VMS dataset.

As you move up along this area, just to give you a gauge, that slope is even further inside, up in the northern section, but there is -- You see that there were certain times that there was shrimping along those edges, and then now we're getting up into the second -- We have the Daytona and Titusville, and this is the Titusville area, and they did map along the edge of the same area that was identified, but you can see the pinnacle system is here, and, now, that does come closer to this boundary, and you are starting to get really close to that boundary, especially if you're looking at a consideration of that point being somewhere within this area, but then, as move north, there is almost no even historic records in those areas, as you move to the top of this overall distribution.

In terms of the comment about additional information on the area, there is -- Really, other than the detailed information that's provided in those two areas that I showed, there is no other characterization or ROV or analysis, other than the mapping that was accomplished in the last cruises, CTD casts, and then those two large areas that were mapped and detail characterized with species, habitats, et cetera, in the 2017 cruise.

MS. DEATON: All right. To me, it seems like there might be an area where there's room to have a corridor, and maybe, toward the north, there isn't, and I don't know, but it's important to note that the base of the structures there -- Usually that's where the fish just love that edge of that

changing topography, and I'm sure that's why they want to get close, because the shrimp probably are very close to there and then move out a little bit.

MR. PUGLIESE: The nature of this fishery seems to be exactly the same way on both eastern and western sides, because, if you look at the western fishery, on the southern part of the Oculina Bank, it's slapped right up against the edge of the system, and they fish that edge as those shrimp are coming up out of the system, before they get up onto the flatter area and disperse, and so that's kind of an inversion of that same fishery operations, and it was clear that it's not always this way in the northern area.

As I mentioned, the predominance of the fishery, in the past, has been south of this 28/30 line and to the west, but there are occasions when the fishery does rely heavily on some of the area to the north, but, I mean, that's the information we have so far, and this is just for discussion, for consideration, and for the council to even think about if they're going to bring it forward to scoping, and so I think all the comments that have been made so far are really useful for the council to balance this, and I think we have Trish Murphey that has a question.

MS. MURPHEY: In that additional information, is there a way to separate your VMS data before and after the closure, because I would be kind of curious to see how they're fishing now with the current closure and where they concentrate, and then the other comment I have is -- Gosh, I just lost my thought.

The other comment I have, I guess, is going back to buffers, and I think whatever -- Wherever you go with this, I think buffers are important, and just thinking about North Carolina's penaeid shrimp fishery, they tend to hug a line, and so I think a buffer would be important in consideration, and the third thing I had was, if you do make changes to the areas that can be accessed, one thing to think about is it will, quote, unquote, be a new area, and you may get an initial hard hit by that fishery, before it kind of smooths out, and so just to throw that out also, but I would be curious to see how the VMS data looks that is just post-HAPC there.

MR. PUGLIESE: That's the type of information I think we're going to advance and have to -- I mean, there has to be some additional work to be able to get the information and work it up and come up with that. We need to know that we're going to move forward with anything to be able to look at some of those, and, if there was significant operations that occurred in it, the way that the VMS system is tailored, in order for them to be able to -- One of the interesting points of that northern area is they're fishing on the opposite side of the existing HAPC, and so they have to transit that.

In order to that, they had to put in a system that was getting a higher ping rate, and so they were getting a lot more accurate information and the ability to know if they are slowing down or stopping within the HAPC itself, and so I think that was something that actually enhanced understanding and ensuring that they were staying outside of especially the eastern boundary, but it will be interesting to look at where the fishing -- Now, the problem we do have is the industry wasn't able to provide us trip information in the past.

We tried to get very detailed trip information, to balance some of this information, and it just doesn't exist in some of the situations. However, we can look at the VMS, to see, again, what -- It won't be an analysis of impact inside, but it will be potentially interesting to see how much of

the fishery is operating in different parts of that region that may occur, but that would be something that we can work up as this moves further down the road, if it's actually going to be considered. Wilson.

DR. LANEY: I just wanted to endorse and support Trish's recommendation. I think that would be a great piece of information to have, if possible, for the scoping document, and it may not be possible to generate it before the scoping document goes out, but certainly during the scoping period in 2021, and I would think that would be something that could be pulled together.

MR. PUGLIESE: John.

DR. GALVEZ: If we're pulling something together like that, I think something that Anne mentioned about are there areas where there is a bigger separation from the habitat of importance to that -- Down here, we don't think you should, but, up there, it's further separation, and that would be a good place to maybe allow some of this, but keep the areas that are most important to us protected, and so if that information could be gathered.

MR. PUGLIESE: Paula.

MS. KEENER: Thank you. Would there be any other potential sources of multibeam data for some of these areas?

MR. PUGLIESE: Not for that area. I mean, we've been monitoring and getting as much of the information that's been available for everything, and that was directed on our recommendation for priority to even get that information, and it gets slid in where -- We were able to get multibeam, but we really didn't get any of the other types of things, such as ROV, et cetera.

MS. KEENER: Okay. Thank you.

MR. PUGLIESE: I think a lot of significant recommendations on providing guidance to the council on how to address this, because I think some of the key issues you're raising from habitat standpoints, in terms of buffers and in terms of opportunities to avoid impacts on the habitats, to ensure that it's -- If something is created, that it would not jeopardize the system as it exists, and I think those are going to be really important for their consideration on trying to address the issue, and it will be interesting also to see if industry still even wants this or needs it. Anne.

MS. DEATON: Roger, can you tell me -- How does this, or does this, tie into what we discussed yesterday about some possible additional coral areas for protection? I thought we said that would have to go through the Coral FMP.

MR. PUGLIESE: These are totally separate issues, and, actually, it's probably good that it's separated like this, because this is an industry-related request that was standing out for a while, but the council wants to deal with it, and so it's been separated to more rapidly address this. I think the other one, in terms of addressing the significant distribution of new systems in the deepwater coral HAPCs, because that's a totally different system, and all that habitat is existing beyond 300 meters, into the deep systems, and we do not have the interactions with any of the trawl fisheries that exist right now.

Many of those were put in place -- Some of the issues were to avoid any of the future -- Like midwater was banned in those systems, to make sure that they didn't occur, and so it's a totally different trajectory for development, but it would be another amendment to the Coral FMP, and, again, this group has been building that information to support that discussion into the future, and so that's where --

MS. DEATON: Okay. So, sometime in the future, an additional amendment, and it's not on any schedule or anything right now.

MR. PUGLIESE: Yes, that's the case right now.

MS. DEATON: Okay. Thanks.

MR. PUGLIESE: Okay. Are there any other questions or comments? Paula.

MS. KEENER: Roger, can you please review next steps?

MR. PUGLIESE: Okay. The first next step is we have a Coral Advisory Panel meeting and a Deepwater Shrimp Advisory Panel on November 10, to discuss the same one-action issue, providing some comments to the council. The council will discuss and consider if they are going to bring this to scoping, and scoping would occur in the early winter of next year. As that moves forward, the council would review scoping comments, and the advisory panels would have the opportunity to review those, or provide input, as an options paper or a full draft would be considered for potentially approving for public hearings, and so this would have to go through the entire public hearing process.

You're not going to see -- This is not something that's going to happen overnight. This will be something that, if it advances, will go through scoping, and we'll have additional advisory panel input and additional review at the council level and approval, after scoping, potentially, for public hearings, and it will have to go through public hearings, and, also, again, potentially fall advisory panel input, and the best-case scenario would be approval at the December council meeting next year.

MS. KEENER: Okay. Thank you.

MR. PUGLIESE: Rita.

MS. MERRITT: I would just like to go back, for just a moment, regarding the comments made by Cindy and Wilson as to the HAPC and the AP considering socioeconomic issues. I agree with Wilson that that is not the purview of this AP. However, from my experience back on the council, I think that it would not hurt to have this AP at least add a confidence level in our concerns regarding socioeconomic impacts as to the habitat regulations for the future.

That kind of goes back to when I think the council lost at least some confidence in the attention to socioeconomic concerns, back when the two positions were removed from the council staff, and I think it was Vishwanie who had the economic, and Cathy -- I can't remember Cathy's last name, but she was the social and cultural anthropologist, and so I just think that it can't hurt to at least make sure that it's on the record that our AP is attentive to those concerns. That's all.

MR. PUGLIESE: Thank you, Rita, and we do actually still -- I mean, we do have John Hadley and Christina on staff for our economic and social analyses that are done for all of our amendments and all of our activities, and so that is a mandate under Magnuson, and so we do address it as these move forward, whether it be through the advisory panels, but it definitely is addressed in the documents, and then ultimately in the materials that are advanced. Paula.

MS. MERRITT: Thank you.

MS. KEENER: I just wanted to say that I support that comment, and it's all part of the ecosystem-based management approach that the council is supporting.

MR. PUGLIESE: You know that the council will address this in the full context of the situation. However, this is under a Coral FMP, the Coral and Coral Reef and Live Hardbottom Habitat FMP, and so the driving force is for conservation of the system and to support a lot of the fisheries that depend on those systems and species like golden crab and wreckfish, and even rock shrimp, and those habitats are being utilized, and that's where the species are coming from, and so that's all taken into account, in terms of the economic benefits of both the preservation of the habitat to sustain the fisheries as well as preservation of the opportunities to access and utilize them.

Any other questions or comments before we move on? I don't see any more hands, and, as I said, we're early in the process, and there's a lot -- I mean, some of those points are really critical, because it's going to have to weigh on how the council wants to advance with this. Okay. Back to you, Anne.

MS. DEATON: Thanks. That was really informative, and just keep us in the loop, Roger, and you can see that we definitely have concerns. Now we're going to switch gears, and we have a presentation from Christine Buckel from the NOAA Beaufort Lab, and she's going to talk to us about the Southeast Seafloor Mapping Prioritization Effort that's been going on. That's Attachment 23 in your briefing book, and I'm going to turn it over to Christine. Hi, Christine.

MR. PUGLIESE: I also distributed to you the actual presentation. There was a summary document that she provided previously, and you all should have gotten, via email, the actual presentation, in the wee hours of the morning.

MS. BUCKEL: Thank you for that very much. Thank you, all, for letting me present to you today the results of our priorization effort. As Anne said, my name is Christine Buckel, and I am part of NOAA's National Centers for Coastal Ocean Science, and I'm at the Beaufort Lab. The project that I am going to present to you today is not just my work, and there are many people involved, and so, here, I just wanted to also recognize my fellow NCCOS collaborators Maria Bollinger and Chris Taylor, as well as John McCombs, who is part of NOAA's OCM Office. Briefly, a little overview on what I'm going to present today, and it's just an overview of the projects and background rationale, as well as brief methods, our results, and next steps.

The rationale for this project goes back about six years, and shown here at the top of the slide is a quote taken straight from the Southeast and Caribbean Regional Collaborative Team, or SECART, strategic plan, and it states that improving seafloor habitat mapping coordination is a high priority in the region within NOAA and its partners.

They, obviously, recognized that it was really important to coordinate better on the collection and sharing of habitat data, habitat mapping data specifically, between federal, state, and even more broad partners. Further, there was a second mandate presented from the President, and it was released in 2019, that identified a similar need, but it expanded the area of interest, extending through the entire U.S. EEZ, and this presidential mandate is the foundation for the National Oceanic Mapping, Exploration, and Characterization Strategy.

Within the Southeast region here, we talk a lot about seafloor mapping, but I just want to stress that it's more than just a habitat map. These seafloor data are the foundation and help improve our understanding of the blue economy, navigation, commerce, as well as resource management. The map at the right is a screen grab just from NOAA's NCEI Bathymetry Viewer. All of the green and the purple areas indicate regions that have been mapped with modern standards.

We did some back-of-the-envelope calculations, looking at water depth of less than 200 meters, and we identified that only about 15 percent of that area has been mapped with modern standards, and, if you take the rest of that area, it will require about 6,129 ship days to map, which translates to about seventeen years, and so, obviously, this is a big task, and so we really need to be strategic about where the data are collected, to make sure that it gets into the hands of the greatest number of users.

We also need to have a good understanding about what data are needed, and so, if we're out there surveying, and they fail to turn on one important sensor to collect one additional piece of data, it may actually translate into a duplicative effort and duplicative costs for another group to collect that extra type of data, and so the effort here, with our prioritization work, is to make sure that we're getting at what and where to collect the best data the first time and use it many times.

The SECART hosted two workshops, kind of going back in the most recent couple of years, and the team listed here on the screen helped organize those workshops, and many of the panel members on the call today participated in those workshops, and so thank you all very much for your participation and contributions to those efforts. The results of those initial workshops are summarized in the tech memo shown here on the screen, and the top priority resulting from that is to get a better understanding of the needs and priorities of seafloor mapping efforts in the Southeast.

I also wanted to make a note here that the technical team that you see -- I have listed their affiliations, so you can see that this really is a diverse team of people, and there's a combination of state, federal, and academic and NGOs listed here.

For the resulting prioritization work, this was funded by SECART, the National Centers for Coastal Ocean Science, as well as the National Marine Fisheries Southeast Regional Office Habitat Conservation Division, and the participants who provided seafloor mapping data was -- This initial participant list was defined by that technical team, that diverse group of technical advisors that were listed on the prior screen. It's a big area, as shown on the map in the right, and there's a lot of different users and varied interests, and we wanted to make sure that the data that we were collecting really reflected that diversity.

The objectives of our project were to identify the seafloor mapping priority needs within the Southeast region, and you will notice that Florida is not included in those six regions shown on the right, and that's because they did conduct their own effort, and we wanted to make sure that our results could easily align with the Florida Coastal Mapping Initiative that was conducted just prior to our work. Further, we wanted to make sure that our work and results could easily be fed into NOAA's National Mapping Strategy and Prioritization, and so this is the NOAA-specific effort, and so they would be pulling in only our NOAA-related subset data and be feeding that into the larger NOMEC.

A brief overview of the process, and this entire process is not something that we came up with on our own. It's been conducted in a number of different locations across the U.S., and it was really started by a group within NCCOS's Marine Spatial Ecology group. It kinds of breaks down here the four simple steps in the graphic on your screen, the first step being identifying the groups. As I mentioned, we wanted to make sure we had a diverse group, and these included things like program offices within NOAA, the Department of Interior, the Department of Defense, state and regional fisheries and coastal zone management agencies, as well as academic institutions, non-governmental and conservation organizations.

From each one of those groups, a single respondent was identified, and that was a self-appointed individual within the groups, and their responsibility was to identify priorities of their group, and these priorities were assigned via a web-based application, and I will show you a screen grab of kind of what that looks like coming up here, but we collected the priority data, starting in January of this year, and extended it through about April, and then we did our analyses, and, starting in May, we presented that to all of the participants and respondents of the effort in late May, for their review.

Here on the screen, on the right, is a screen grab of the application itself that I mentioned. Each of the six sub-regions had their own interface, and so participants were able to submit priorities for all six or just a single one, if they were interested, and each sub-region had its own allotment of coins that participants were asked to distribute. By selecting a region of interest, you are identifying where you have a mapping, a seafloor mapping, need. Depending on how many coins you allocate to each grid cell, it indicated how quickly you needed the data or the when.

We also wanted to know, more specifically, and not just how soon do you need it and where do you need it, but why do you need these data and what, more specifically, what type of data do you need, and these were this why and what were collected through up to three different justifications that responded and two different data products that were needed most for the designated area.

Diving into the results here, we invited forty-three organizations, and twenty-five of those organizations were able to participate. I do want to mention -- I understand that you guys talked quite a bit yesterday, and as well this morning, about deep coral, and I wanted to mention that we did receive priority areas for seafloor mapping from the council as well as OER and Peter Etnoyer and NGOs, and so a number of different organizations did provide some of those deep coral priorities.

The graph at the left will show you the number of respondents across all of the regions that are on the far left, and then broken out by individual sub-regions. Sub-region respondents ranged from seven to twenty different organizations, and, although we collected the data at the sub-region level,

broken up at hundred-meter bathymetry lines, I did include some counts at the state level, in case you were interested, and that's shown on the right there, with twenty-two participants from North Carolina, nineteen within South Carolina, and seventeen within Georgia.

If we look a little closer at the types of respondents across our study area, you can see that approximately more than half of the respondents were from federal organizations, with three state participants, three academic participants, and four mixed. What we're calling mixed includes organizations like NGOs and other groups that might include a combination of federal, state, and academic agencies.

Looking at how these different types responded, or allocated their coins, here you've got four different maps, depending on the different type of respondents, and yellow indicates where coins were assigned, and the purple grid cells indicate that that group did not assign coins to those grid cells, but someone else did. Federal and mixed participants allocated coins across a broader region, and nearshore as well as offshore, while state and academic participants were more targeted in their coin allocations within specific areas.

This is another look at respondents, and it is a simple count of how many people allocated -- Or how many different participants allocated coins to an individual grid cell, and grid cells had between one and eight respondents across the study region, and you can see that, where there are more respondents, like in the North Carolina regions, there is more overlap, and so some areas to kind of draw your attention to are offshore North Carolina, as well as the Pamlico Sound area, and some smaller areas nearshore, more focused toward urban areas and port cities, like Savannah, Charleston, and Wilmington.

The other thing I wanted to draw your attention to is the South Carolina region offshore, and this region only had seven total participants, but, if you look here in the Blake Plateau area, where there is that light green, that is close to, or more than, half of the total participants in that region, and so, although it's not yellow in color, given how many people did respond to that region, it was a particular region of high interest for those respondents.

Diving into the coins, this is just a look at the allocation of coins overall, for all respondents, and we have -- A reminder that coins is indicative of how soon folks need the data. Because there is differences in the sub-region sizes and the number of participants across the sub-region and the total available coins, we had to standardize, so we could really look at the study area as a whole and rank these data. The ranks are defined by the quantiles shown at the far-right, and, really, I'm going to focus the discussion here today on this top 10 percent.

The areas of interest are here along offshore North Carolina, right along that hundred-meter bathymetric line, and you can see there's an extensive area of interest, likely associated with rocky, hardbottom areas. You can also see, offshore of South Carolina, in that Blake Plateau region, some high-priority areas as well, and then, along the inshore line, there is some more targeted spots associated with the ports and major urban cities.

The justifications, we had seventeen potential justifications within the web application, and fourteen of those were identified, and these justifications helped answer the question of why the area was important to the participating organization. There were five different justifications that comprised about 67 percent of all of the coins allocated, and those five are habitat, benthic

exploration, research, managed area, and fishing. These top justifications are quite consistent among the individual sub-regions.

This is an extension of that figure that we just looked at before, with all regions on the far-left, and the individual sub-regions to the right. You can see the main top-five justifications are still consistent among the individual sub-regions, but one thing that I wanted to point out here is that there were some differences between the shallow and the deep, with a greater percent of total coins for justifications, like energy in the blue, and sediment in the dark purple, and hazards. They're all highlighted here in the legend, but you can see, for example, in South Caroline nearshore, that there's a higher percentage assigned to those versus the offshore region.

For each of the fourteen justifications, we created individual maps of the coin distributions, and I am showing you two examples here of habitat on the left, as well as sediment, and I understand that these are some of the different topics of interest that you guys are discussing over the course of today and yesterday, and so I included them here, but we do have an online mapping product, on NOAA Geoplatform, where you can explore each one individually, if you have an account, and that Geoplatform mapping product will be made public, but it not public facing yet.

A quick summary of the data product information, and this data products helped target what type of data are needed, making sure that the right sensors are turned on in the right locations when the surveyors are out there. There are three top products that comprise nearly 72 percent of all of the coins allocated, which are elevation, habitat mapping, and backscatter, and, similar to the justifications, these top three were really consistent among all of the sub-regions.

I am giving you a quick look here at two of those, which is elevation on the left and substrate type on the right, and you can see there are some differences here in the way that the priorities are, with elevation being more ubiquitous nearshore and offshore and north and south, where substrate type seems to be a more concentrated need in the closer-to-shore regions. The elevation here is -- We're speaking of it in terms of bathymetry or topography, meaning it can give some complexity in geomorphology to seabeds on habitat type, like sediment resources and rocky reefs.

This is just a screen grab of the online mapping product that I mentioned, and it's a summary with individual data layers that I have shown here, as well as many more, each one for a map layer for every product and justification. In the slides that you received, you have a link. If you do not have a NOAA Geoplatform access, please let me know, and I can request that for you, if you need these maps right away, but we do hope to have them made public within the next month, is our goal.

Speaking of goals and next steps, I mentioned the online mapping interface, but we also are finalizing our technical report, which includes hard copies of many of these maps, as well as much more extensive documentation and analysis of results. With that, I want to say, briefly, thank you to many of you here on the call for your efforts and participation in the prioritization effort, as well as all of the participants for that, and many of the NCCOS Bio-Geo members, which we consulted with extensively to make this work, including Bethany Williams, Matt Kendall, Jen Batista, Brian Costa, and Anne Budja. With that, that is the extent of my presentation, but I'm happy to take any questions.

MR. PUGLIESE: Okay. Thank you. Wilson, I think, has the first.

DR. LANEY: Hi, Christine. Thank you so much for the presentation, and that was very informative and very thorough. I have a weird question for you.

MS. BUCKEL: I love weird questions.

DR. LANEY: That is, as a result of my recent interactions with a group of undergrad students at Emory, I made the comment to them, in responding to one of their questions, that we know more about the surface of the moon that we do about the bottom of the ocean, and they were skeptical that that was the case, and so I'm looking for support from you that that is a relatively true statement, and I pointed out to them -- I said, look, the surface of the moon is visible, and we can map it with satellites and telescopes and things like that, and I said the ocean is covered by water, and so it's not quite that easy.

MS. BUCKEL: I would agree with your statement completely, Wilson. It may be pointing them to that NCEI Bathymetric Viewer, which is an inventory of many of the surveys to-date, and it's not 100 percent of the surveys, but it's a good inventory to look at in one stop.

MR. PUGLIESE: Rene.

DR. BAUMSTARK: Thanks, Christine. It's great to see the progress on this, and you guys made a lot in a short period, and so, being on the Florida map team, on the steering team, I think there would be a lot of value for the Southeast region to combine these and make them available somehow, and I just want to make sure that we follow-up and talk about not just the prioritization results, but I'm sure that -- For us, a big part of the process was inventorying everything, so we know what's there and having at least some light metadata to help people decide where priorities should be, so they know what's already been done, and have you all done that? If so, I think those -- There also should be some coordination on putting that into a single repository and making it available.

MS. BUCKEL: Good question, Rene, and I kind of skipped over that, wanting to dive into the results, but, yes, that was an important part of the data compilation for the data collection interface, and so, when participants went into that web mapping application, there was a huge inventory of data, which also included the Florida priorization effort, and I think it was draft results at that point, but we did have that as a data layer that participants could reference, along with many, many others, and so, yes, that does make me think that, maybe in addition to the results of our effort, I need to make sure that we include that inventory of all of the data to-date as potential data layers that a user could turn on and off, and so I would be happy to do that, and, Rene, I want to make sure that we coordinate and make sure that I have your finalized results for the Florida effort in that as well.

DR. BAUMSTARK: Great. Sounds good. Thank you.

MR. PUGLIESE: Anne.

MS. DEATON: Hi, Christine. I just had a question about how you expect this data to be used. Like do you think it will be most used by BOEM, or, if something is a priority, and like I noticed it said Albemarle and Pamlico Sounds, that definitely we need information on those, especially

bathymetry, but, I mean, if it shows up as a priority, does that -- Do you expect that would somehow bump it up on a list somewhere to get bathymetry done?

MS. BUCKEL: In fact, that is absolutely true, and it has already happened. Thank you for the question, because I wanted to make sure that I covered that in my presentation, and I forgot, Anne. Chris Taylor, as well as folks from OCM, there was a couple of cruises, even in the time of COVID, that were able to get out this summer, and they used these priority areas and did some surveying near the Blake Plateau region that were identified as some of those top 10 percent needs. We also have examples from some of the other prioritization efforts, where folks who are planning their survey efforts are using these data and maybe extending out their survey lines, or adding a few additional lines, to catch some of these high-priority needs.

MS. DEATON: That's great, and then, also, I mean, would that be for state waters, or is this going to be mostly prioritized within federal waters?

MS. BUCKEL: I mean, the data are going to be available on publicly-accessible -- Many of the larger -- Like the NOAA ships, obviously, are only able to survey in offshore waters, just due to depth restrictions, but, for state survey boats or say Army Corps, who might be surveying along channels, we're hopeful that they will be using these to even look at inshore areas when surveying is being scheduled. If there's anything that you need from us to help convey these data and communicate that, we would be happy to help.

MS. DEATON: Okay. Thank you. That would be great. I know the state right now, through the CHIP process, we're working to really focus on mapping and improving SAV in Albemarle Sound and Pamlico Sound, and we also -- You know, it's so tied to water depth, as well as water quality, and the water depth data is really old and not accurate, if it exists at all.

MS. BUCKEL: That would be great.

MR. PUGLIESE: I think Trish.

MS. MURPHEY: Just actually to -- I was thinking the same thing that Anne was saying, and so, just to follow-up with Anne, in our CHIP process in our SAV issue paper, which also deals with water quality, that is actually a recommendation, is to request more accurate estuarine bathymetry data from NOAA, and so it's a big ask from the CHIP process as well.

MS. BUCKEL: I would be happy to -- Chris is the one who works a lot more and coordinates with the survey boats and OCM, and so I am also making note of your questions, and I can follow-up with him, to see if maybe we can get a little better answer.

MS. MURPHEY: That would be great. Thanks so much.

MR. PUGLIESE: Okay. Are there any other questions? Christine, I really appreciate it, and it was an interesting opportunity to be involved. It was somewhat of a challenge, in terms of trying to really pin down priorities, when we have so many different ones in the offshore area for the whole region, and it just made it tough, and a lot focused on filling in information we have in managed areas and then going to really priority habitats that are along the different components

and different depth contours, to cover in-between areas and then areas that really had not collected any information, and so it was a challenge.

One thing I would like to do is see if there's an opportunity to figure out a way to maybe both connect, as Rene had indicated, connect this with the other efforts, but also maybe even have one that would be able to look at council-managed -- Something where we could cross-walk it with council-focused efforts too, just to have another tier of being able to look at something and using this same type of technology capability.

Also, the opportunity to maybe, even with the existing or the combined products, having them accessible, so that we could connect them into the existing habitat and ecosystem system, or at least into where we have some of the -- We were trying to build a prioritization, mapping prioritization, that we started a while back and we really need to advance further.

MS. BUCKEL: Let me know, and I would like to keep that conversation going.

MR. PUGLIESE: Okay. Any other thoughts or comments? Okay. If not, back to Anne.

MS. BUCKEL: Thank you, guys.

MS. DEATON: Thank you, Christine. We're moving right along today on the agenda, and so next is briefings from several different people, and so the first will be Marcel on the impacts of COVID-19 on fishery-independent research activities. I think we have him here, and we'll pull it up.

MR. PUGLIESE: I'm going to get a couple of slides up for him in one second.

MS. DEATON: Okay. You all know that Marcel Reichert is with South Carolina DNR MRRI, and he's highly involved with SEAMAP.

DR. REICHERT: Thank you for allowing me, and this is going to be a brief, very brief, update, and thanks for allowing me to provide that update to the Habitat AP. As you can imagine, and that's why I put that picture of the COVID virus on there that probably many of you have seen, there were some major impacts on the surveys, especially those that require multiday trips and that relied on the larger research vessels, such as our Lady Lisa, which is a shrimp trawler, and the Palmetto, which is our 110-foot steel-hull research vessel.

That impacted mostly the coastal trawl survey and the reef fish survey, and this is because -- This is a picture of the Lady Lisa and some of the activities onboard, and both vessels, the Lady Lisa and the Palmetto, have very limited living and sleeping space, and the air is recirculating, and, without significant adjustments to the vessel, it's almost impossible to avoid living and working in very, very close proximity of other field staff and scientific crew.

In addition, the Lady Lisa went into the yard in North Carolina just before the COVID outbreak, and, due to travel restrictions and other factors, it's actually still in North Carolina, and we are planning to have her returned later this month or in November, and that basically -- COVID and the other factors basically forced us to cancel all cruises this year, the spring and the summer and the fall cruise.

Obviously, that affects our 2020 data for species such as shrimp and mackerels and several sciaenids and blue crab and menhaden, et cetera, and some of the species are listed here on this slide, and our plans -- As you can see, the yellow bars are -- For those of you who are not entirely familiar with the trawl survey, those yellow bars on the map are our sampling areas, and so that affects the shallow trawl data. The plans for the spring of 2021 are a little uncertain right now, and it will depend on where we collectively are with COVID, and, also, whether or not we are able to make some adjustments to the vessel, such as air purification and some other factors. Again, these are some of the priority species that may be mostly impacted.

The other survey that is very impacted is our reef fish survey, which is conducted from the R/V Palmetto, which is that steel-hull vessel, or the big blue boat, as many are calling it, and we also had to cancel all regular sampling for MARMAP and SEAMAP for the video trap survey, because of similar concerns.

We discussed options and consequences with our partners at the Southeast Fisheries Science Center, and, ultimately, we had to make the very difficult decision to cancel all sampling, and SEFIS, our federal partners, were forced to make a similar decision, and it's my understanding that a lot of federal surveys were unable to go out, especially on the larger vessels, and that effectively meant that we had to cancel our Southeast Reef Fish Survey for the entire region, and the Xs, the blue Xs, on the map are our sampling stations, and so we were not able to sample any of that during 2020, and this is a picture -- For those of you who are unfamiliar with the chevron trap, that's a picture of our chevron video trap.

However, we continue investigating options, and, in consultation with the Science Center, we decided to do a limited number of day trips in August, September, and October, and focus on investigating variability of our catches within reef patches, and we also collected some preliminary data using underwater stereo cameras that Nate Bacheler and his group were graciously willing to lend to us, and that allowed us to determine some fish lengths, and that's very important information for the future of the survey.

In spite of the very busy storm season, we able to realize nine of those day trips, and we are currently processing and analyzing the collected information, and so we were very happy that we were able to do at least sampling using the Palmetto this year.

As for the trawl survey, we are currently investigating options for 2021, including, again, making adjustments to the vessel, for instance putting some air sanitization equipment in the vessel, and also potentially looking at changing some sampling procedures, but that's -- We are still working on those. I think that's the last -- The next one is, obviously, because this is a reef fish survey, 2020 data for species such as black sea bass, vermilion snapper, gray triggerfish, red porgy, red snapper, and a variety of other species, are impacted for this year, and, again, we have been in consultation with the scientists at the Southeast Fisheries Science Center relative to the effects and the impacts of the limited or absence of data in 2020.

Fortunately, COVID had less of an effect on other surveys, such as our SEAMAP red drum and shark survey, and several other surveys, because a lot of those can be done using day trips and from smaller vessels, and so the biggest impacts were on our trawl survey and our reef fish survey. Roger, the next slide, I think, transitions to the database, and so I am happy to answer any

questions, unless you want me to finish my presentation and talk a little bit about the database. I will leave that up to you or Madam Chair.

MR. PUGLIESE: Let's see if we have any questions first. I don't see any right now, and so I guess go ahead and go on, and then we can ask for questions at the end.

DR. REICHERT: Okay. Thank you. I appreciate that. As you may remember from previous meetings, SEAMAP South Atlantic data management staff have been working really hard with staff at SECOORA on a transition of our database to the SECOORA portal, and we hope to complete the first phase very, very soon. This means that the way the data users can access the data and view the data will be different, and this is a screenshot of an extraction of the current way data is extracted, and it's basically a CSV file, or Excel file.

In the new system, this is more like how people can view the data and analyze the data and extract the data, and so it's a lot more -- The way people can access the data is a lot different, and we are really excited about that. However, I think, rather than explaining in detail how this is done, mostly because I am really not the expert in all of this, Roger and Madam Chair, perhaps we can plan a brief demo for one of the next Habitat AP meetings, because I think there's a lot of information and a lot of capability in this new system that may be of interest for AP members and others. With that, I conclude my update, and I am happy to answer any questions.

MR. PUGLIESE: Thank you, Marcel. Just to your last point, I think we definitely can plan on getting the advisors together, so they can have a demo, either at a meeting or a dedicated webinar with the capabilities, and I think people are getting comfortable enough, and we may have a couple of issues, and we may not want to wait all the way until the spring, and maybe do something in early winter, like January or February.

DR. REICHERT: Okay.

MR. PUGLIESE: We have a couple of things that we could accomplish that way that might be very useful and very worthwhile at that point.

DR. REICHERT: We are happy to accommodate whatever the committee decides to do, and we are really excited about the new capabilities. The data collection and how we manage the data is not going to change, but what is significantly going to change is how people can access and combine the data, and this also allows us the capability to combine our data with other existing oceanographic information, a huge amount of information, that's currently already available in the SECOORA data portal, and so that increases the ability for people to combine and model biological and oceanographic data, and so we are really excited about this.

MR. PUGLIESE: Again, thanks a lot, Marcel, and, if you haven't heard my messaging throughout this entire webinar and panel meeting, it's a convergence of so many different activities that we've invested in and collaborated with all of our partners that is really coming to bear, and you can see how these different ones are going to be able to complement and feed themselves, whether it be the opportunity to have this capability that will now enhance the ecosystem modeling and the building of Ecospace or informing some of say the ecosystem status reports into the future, informing mapping and prioritization, and, I mean, it is all kind of coming together, with our Ocean

Observing partners, with our fishery-independent research, with our capabilities online, with the mapping partners and coral partners and everything.

It's a very timely effort here to get this together, because it really provides a connection and advancement of a lot of different things that are going to really advance habitat conservation and ecosystem-based management and a lot of other types of efforts that all the individuals in the region and the council are involved in. Are there any other questions for Marcel, either on the COVID impacts or the advancements on the SEAMAP and SECOORA efforts?

MS. DEATON: I will just echo that this is a great effort, and, I mean, just looking at this screenshot here, it looks really useful, and I've heard about it, and we've been contacted by SECOORA about adding data into this data portal, but I think we're waiting to see how all this works first, and so we look forward to a presentation, a demo presentation.

DR. REICHERT: Absolutely. Just let us know, and we'll be happy to do so. I really appreciate the opportunity to provide the panel with the updates here, and so thank you so much.

MR. PUGLIESE: Thank you, Marcel. I think we're moving on, and that actually bumps it to me.

MS. DEATON: Yes.

MR. PUGLIESE: There we are. I wanted to follow-up with the members, and this document is in your briefing materials, and it's A24. It's a very short synopsis of a pretty significant occurrence with the Equinor oil spill in the Grand Bahamas back in August of 2019, and there was significant concern from the council, and we were trying to compile what was known of potential impacts and what had happened, and this is just a quick effort to at least document the occurrence and the estimated spill of over 55,000 barrels of oil, about 6 percent of what was -- That only was 6 percent of what was stored onsite in the area on August 29, as the 185-mile-per-hour storm hit the Grand Bahamas.

The area actually had a capacity of over 1.87 million barrels in the area, which were moved out after the occurrence, and the hurricane essentially ripped off the tops of a number of different storage systems that resulted in this spill, and they had proceeded to do the cleanup, and, in July of 2020, the update was showing about 58,000 barrels of oil and water had been recovered, and 20,000 bags of contaminated soil, and over 37,000, almost 38,000, contaminated soil also had been removed after the occurrence of the system.

There's a limited amount of information on the species impacted in the area, and I think it's probably mainly because it was the follow-up from the storm and so much other devastation, and it was kind of hard to sort out some of that, and what had occurred afterwards was trying to document some of the impacts, and what they were primarily showing is that they were monitoring the water in the area, and they originally had identified that there was a non-occurrence, but then, in more recent sampling, I think they were seeing some of the oil showing up in some of their systems.

There was a hope that some of the work being done out of one individual that was funded through Lumcom, Stephanie Archer, may have some additional information, but she really was focused primarily on the Abaco and some of the areas specific to seagrass impacts in that area, and so the

bigger spill information is yet to be compiled, or provided, and we tried to see if NOAA Fisheries had any specific information on impacts that had been identified, and, once we went into the actual formal ocean response mechanism, which actually is housed out of Charleston, and it is housed here, and it has -- This system has the ability to provide significant response by NOAA, whether it be the computer models that are monitoring the spills or any of the forecast and trajectories of the spilled oil or any oil surveillance, the aerial surveillance of the oil, impacts.

They had actually just created a new system, the Disaster Preparedness Program reporting form, and it did have Hurricane Dorian, but it's a nominal amount of information, other than just the occurrence in the system location, and there's no additional information, and, as far as we can see, there at least is not a whole lot more about exactly what occurred beyond the original -- It looks as if a lot of the oil was pushed back into the system, while there was a lot of documentation of oil slicks offshore, but a lot was removed from the inshore areas.

It ended up being a fairly limited amount of information, and I wanted to get the panel up-to-speed, at least of what we've been able to find on this, and I think what's more important on this is just to keep everybody's heads up on the overall issue of oil and gas issues, because one thing that is still in the pipeline, literally, is the potential of drilling in the Bahamas, and they were proceeding with some of the activities, and that is still potentially underway, and I know the State of Florida's legislators responded to, specifically, concern over that occurring right off of the east coast of Florida, especially since they have successfully been able to prevent oil and gas from developing in the systems and impacting the economy of the entire Florida east coast.

That is still in the works, and, as far as I know, the other one that's even more significant is potentially Cuba, down the road, and so just some things to keep in mind. This, if anything, was kind of a wake-up on what the implications could be of spills in that region that could get entrained into the Gulf Stream and advanced up through our region, with species that are dependent on some of the trajectories associated with the Charleston Gyre, et cetera, and it could be some really significant issues into the future, and so we'll keep monitoring and keep everybody posted, and, as members hear about any additional information on this into the future, it's good to keep everybody abreast of what's going to happen.

That is all that I had on the table, and I don't know if there are any comments or thoughts from other members on this issue. If not, that was just meant to be an update, and then I'll keep everybody up-to-speed further as we see what happens outside of the U.S. region. Any questions or comments? Okay.

MS. DEATON: So are you going to do the CCC Habitat Workgroup, Roger? Is that you?

MR. PUGLIESE: Yes, and I was going to touch on that. If you all bear with me, this is -- I serve on the Council Coordinating Committee's Habitat Workgroup, and we've been advancing, throughout the country, efforts to really learn from each other on how the different councils and how the different regions and how the different areas are advancing habitat conservation and mandates under EFH and enhancing our ability to engage in different processes, where the council and partners get acknowledged more on what the mandates under Magnuson are.

As part of the most recent effort, one thing I think everybody got a copy on was letters to all of the significant partners in the region and permitting organizations highlighting and reiterating the

council's commitments and mandates under Magnuson, but also providing some context and connections and referring back directly to us and myself to provide additional input and opportunity to collaborate and coordinate into the future on essential fish habitat and anything that may affect their operations or impact our mandated EFH.

In addition to that, the CCC workgroup has advanced a significant topic that had come up, and it was how do we move forward with even more significant connections with the Science Centers throughout the country. How do draw on either what is already being done that can enhance our habitat information or focus efforts in your region to address council-directed conservation, whether it be enhancements of information on designation of essential fish habitat, on priority information on species use of habitats, or refining responses to activities affecting those habitats, and so what occurred was -- This is the larger CCC workgroup.

What occurred was building a webinar that just happened this Monday that provided a snapshot of what is going on in each of the regions throughout the country, the centers throughout the country, and representatives from each of the centers providing the context of what were some highlights of big activities in the different regions in the area, and that was a really significant opportunity to see, and I think some of it really did focus on things we've been discussing over the last sessions on the development of the climate vulnerability analysis and ecosystem status reports, but going far beyond that, in terms of tools or capabilities on habitat suitability modeling and addressing climate and integrating materials into assessments.

It was a really good thing that was providing what the context of how the habitat science was being addressed throughout the country, and, again, the benefit to us was really the opportunity, in this format, to be able to see, with these lightning talks, what some of these real advanced capabilities in different regions and open the door for discussions on how do we advance that further in our region.

I think that's as far as I was going to get today, and I will distribute materials that are going to be developed probably from this to the group, and, with our center representatives online, I think it's going to be something that can continue this discussion and how representatives are directly involved in all these different aspects, whether it be modeling or other capabilities that have been discussed over the last number of days, and it's going to be really critical to have that opportunity to even further refine our connections with the Southeast Fisheries Science Center as it evolves.

You saw earlier on that there's going to be an evolution into a different type of a group that is addressing the combination of habitat and ecosystem under an umbrella, and so this is going to hopefully be a perfect dialog to advance what we started here and then take that into our regional discussions on how do we take it even further. That's what -- I just wanted to catch the panel members up on the advancements on that, and they're all good, and it's all positive and moving in the right direction, and so hopefully we can get some of the focus in our region to do some of the pretty amazing things that are being done in some of the other regions in the near future. Any questions or comments? Okay. That's all I had on the CCC discussions.

MS. DEATON: Thank you, Roger. I'm glad you were there representing the South Atlantic. The only thing left on the agenda is to go back to the item we skipped yesterday, which is the FEP Implementation and Strategic Planning. Roger, do you want to talk about that or give a little background on that and the next steps?

MR. PUGLIESE: Let me go into it. We actually are at the time, but I did want to advance this discussion, and I think what the plan was is that the advisory panel was a key effort to create this in the past, and the council moved forward with building the next generation of the Fishery Ecosystem Plan.

In doing so, they also advanced it to create that whole dashboard and the online capability that gives you both the updates of information on all the different aspects of the plan, but also our partners in the region and the states, et cetera, that have all those connections built into it. However, one of the things that was acknowledged is the fact that the plan was driven by all the work that's been done over many years to build policy statements through the council, from the most recent ones on climate and ecosystem all the way through the dredge policy, dredge and beach renourishment policy, that we were just discussing.

That really fed into building something that operationalized those and creating, in the implementation plan, what types of actions were addressing specific activities that were identified in those policies, and so the implementation plan was the bigger, massive presentation of all those different priority actions that were held, or identified, within there.

Taking it one step further, then the council really wanted to get kind of a gauge of, hey, what can be some things that we can look to try to accomplish in the next two years, and so what we have before us now is an update to what was the original two-year roadmap, and what the document does do is it is an update and overview of the status of the actions, because, as this identifies, the general policy, and you have policy components, and then you have the priorities, and then organizations that may be involved in this, and then some timelines for completion, et cetera.

What you've got is you've got the original components that lay out the policy and then go all the way to specific actions that are addressing that policy, and then what is going on in this document was an attempt to then take that specific action and also highlight where those actions have actually been accomplished through activities, whether it be through the council or through partners in the region, and this laid these out, and it walks right through it.

In order to make it more easily accessible and translate what this panel had done, because the members that were involved earlier on -- In the last year-and-a-half or so, we've had multiple breakout sessions, where this is exactly what the task was, to look at what various actions were addressed and where some of the different things have been accomplished, and so, taking it from this type of document then into that, and integrate all that the panel had accomplished, that's where I created this document, which I distributed out to all the members.

This really does lay it out in a little easier way to kind of walk through, and so, when you're dealing with the first policy, which is the food web and climate policy, the first action has very specific issues to deal with forage fish science and advancing the connection between our partners in the region and how those are -- As a high priority, how they were being accomplished within the last timeframe.

What you have is this layout of associated activities, the partners, and some timing. This draws from, as I mentioned, a lot of deliberations that have occurred to-date, and then added in with input

from Anne and Cindy and Wilson and others that may have responded to my recent request, to build this next level of what has been accomplished to address these different areas.

What I originally was going to try to do was talk through this and see if there are other ones that we could add in at this stage, and I think this is one of those situations where the in-person meeting really is the way to accomplish this type of thing. I think, as we move into the future, we may get creative and figure out a way to have maybe sub-panel meetings, to compartmentalize and address individual action items or policy development, for tasks like this, but I was originally thinking we were going to walk through this thing.

I had distributed this document to all members, and so I think what may -- Anne can weigh-in on this, but what may be more expedient -- I have got to get a version of this cleaned up and advanced over the next week or so, just to move it forward, so that it ultimately goes to the council as a draft at the December committee meeting.

What may be the best way to do it is, since everybody does have this, is to take a look at these different actions and see if there are other activities that we may not have touched on that have occurred since 2018 that we can add in under any of the specific policies and actions that were addressing those policies, and so, Anne, what do you think, given the timing we have now? Would you like to go through some, or how would you like to address this?

MS. DEATON: I think this is something that takes sort of individual thought, to go through it on your own, and so I think assigning it and asking people to work on it and get it back to you by a certain date would probably be the best approach, and the focus should be to look at the action, and sometimes -- One thing I found, because we do something similar for the coastal habitat plan and implementation, is you don't want everything in the activity that you did, but the things that really most relate to that getting that action done, and, a lot of times, it's like iterative steps to get there, and sometimes it's just little pieces that together makes a difference, and so there's some subjectivity on what can go in there.

Also, as a representative, and like the state representatives, it may not be what you are directly involved with at work, but, as the representative, your role is kind of to seek out the people you think might know and see if they can provide some input, and so I think that approach will work pretty well, if everybody tries to get to in, what, a week?

MR. PUGLIESE: I would ask that, yes, if you all can provide that to me by say the end of next Friday, that would be great. Just doing an example, and, for example, we'll look at one thing like this, where we've got Action 2 to develop food web indicators, and we just had the discussion on the coordination between the Southeast Center and other partners to build the South Atlantic Ecosystem Status Report.

This may be an opportunity to look at, within your state or other local organizations, but someplace where they're working on food web indicators, and so this is what the intent is, is that, where those are, and it identifies those, and then it also puts it into context. Ultimately, what I would like to see is this become -- We were trying to do this, and this may make it really happen now, but is make this an interactive online tool that's embedded in the dashboard, so that people can come and look at some of these and then just populate it as research is being accomplished and different

things are being identified as priorities and then be able to address those and there be a two-way communication online that you can actually see how this is evolving over time.

Now, this is the two-year roadmap, and so what I would think is that, after we accomplish this update, next year, we can begin to discuss what other things may be pulled out of the existing implementation plan to advance further into the future.

MS. DEATON: Right, and that's why it's important to get it as complete as you can, because this is our two-year mark, and it was a two-year plan, and so you want to kind of wrap this one up and say here's what we did in two years, and then some things will be complete and taken off the list, and others stay on the list and are revisited, and maybe others get added, like you said.

MR. PUGLIESE: Yes, and then, in the longest term, then you ultimately have an update of the overall implementation plan, after you go further down the road, beyond where we are now, but this would stage it for another version of what we're looking at right now, and so, if members are -- If it seems like that is a good way to move, and I think it is -- As I said, this is the tough part of not having the in-person meetings, is we really could get in the weeds and work in sessions and really accomplish a lot, and that's what is the foundation of a lot of what we have here.

Here's the opportunity though to refine this further, and, the more we get in it now, the easier it will be then to transition to the next generation, and we will be discussing that at the council meeting in December, and that's part of a lot of the things we've already talked about, and it's part of the overall -- This will be coming as part of the overall report to the council for the Habitat and Ecosystem Advisory Panel, also.

MS. DEATON: Honestly, after going through it, I think a lot has been done in the past two years, from all of the different people and agencies involved with this advisory panel, directly and indirectly.

MR. PUGLIESE: I agree, but I think there's opportunity, if some of the members -- I know there is things that have slipped through the cracks, and what jumps out at me is some of the state efforts, and I know those also have been done in some of the other state partners, and so make sure that that's something that, if you do know that, that we don't miss that in this iteration. Okay.

That's good, and I distributed this, and everybody should have this. If you don't, if it got lost in the barrage of email materials that have been coming to you -- I'm trying to just keep everything, all the presentations and all the materials to everybody, as they were being provided and updated. If you all could provide this by next Friday, and say close of business on Thursday or Friday, something like that, so that I can work on it and make sure it gets integrated into the next-generation document and the briefing materials for the council, that would be great.

MS. DEATON: That's October 30.

MR. PUGLIESE: A Halloween present.

MS. DEATON: All right.

MR. PUGLIESE: That's all I wanted to do under -- I mean, one of the big -- The other important aspects of getting this accomplished is that I know one of the things we're going to have on the agenda, beyond reviewing the different materials that have been provided and the responses from this panel to the committee, is a broader discussion -- Steve Poland wants to have a broader discussion maybe on some advancements on some strategic planning, and I think some of that is going to be really pulling together a lot of what -- How many things are going, but maybe get it into a blueprint that identifies all these different aspects of how the panel works and how the policies operate and how all these different things are and then what the council wants to see this program maybe do beyond that.

That is something that is going to be a bigger-picture discussion that's going to happen in the December meeting too, and so things like this will help feed into this, and one thing that I did include was an appendix from some of our FMPs as an additional document for you, and what it does is it lays out a lot of kind of the bigger picture of the whole thing, from the FEP to the conservation efforts and the coordination with the Ocean Observing Association and the coordination with our fishery-independent surveys and a lot of the bigger scope.

I think what that can do is just at least be a springboard for some of these discussions about how do we kind of lay it out into a blueprint that shows this, beyond -- We've got the online FEP dashboard, but there's a way to maybe create a document that lays that out in a very succinct way that will draw on and build connections to all the different systems and whatever, and so just a heads-up and information for you to look at and think about as we move forward into the next generation of habitat conservation into the future.

MS. DEATON: All right. Then is there any other business? If not, I was wondering the status of the Florida Keys National Marine Sanctuaries management plan, since we heard a presentation from them, and, Rene, if you're still here, do you know if they have finalized that and what --

DR. BAUMSTARK: I have been so focused on the disease response and the restoration plan, and I'm trying to -- I would have to give you guys an update via email, because I am trying to think of where it is exactly.

MS. DEATON: Okay.

MR. PUGLIESE: I appreciate that, Rene. Also, when you talk to them, ping them about getting the representative finally back on the AP. They're supposed to have a representative. The sanctuary has a formal seat on there, and I don't know -- In the shift of administration and responsibilities, we lost that, that continuous participation, which would have been nice, because we could have just had that update from the member, and so we need to reestablish that and make sure that that continues on.

DR. BAUMSTARK: Got it. Was that the science coordinator?

MR. PUGLIESE: Yes, and originally it was --

DR. BAUMSTARK: They do have a new one now, and so that's a good segue maybe to -- I'm sure he's got his feet under him now, and I think that will be perfect and a good time for him to get involved.

MR. PUGLIESE: Great. Thank you, Rene.

MS. DEATON: It could always be at the next meeting that you could tell us what's going on with it.

MR. PUGLIESE: Yes, and, I mean, it's just to make sure, but I will need to follow-up with our AP, and there's going to be some discussions too about fine-tuning, if we need to, for this, et cetera. Wilson, I think, has a question.

DR. LANEY: Sorry, Madam Chair, but I just wanted to put a bow on our discussion relative to the Coral Amendment 10, and the question is to Roger and you, Anne. I know we're going to be preparing a summary of the meeting, which will go to the council in December, but would it be useful to just put together a memo from you to Steve, and I think Steve is still on the call, and so he can respond, but would it be useful for you to just put together a short memo to the council committee, Habitat Committee, chair that just summarizes the talking points that we discussed during the AP meeting?

MR. PUGLIESE: Wilson, shouldn't that be in the report to the committee? I mean, that's going to be part of the AP report.

DR. LANEY: Yes, it will be, but the committee is not going to meet until December, correct, and so I was thinking that, in addition to being useful to the committee chair, maybe to have a separate short memo that he could distribute to the Habitat Committee members, and it would also be useful, would it not, for the Coral and Deepwater Shrimp AP meeting in November for you to have those talking points broken out. Yes, they definitely will be a part of the summary report that goes to the council in December, but the question is whether or not something shorter and more directly to the Coral Amendment 10 topic would be useful, and, if so, then that's something I am willing to work with Anne and you to produce. Otherwise, we'll just wait until the December meeting.

MR. PUGLIESE: Anne.

MS. DEATON: You are referring to talking points specifically about the deep-sea coral?

DR. LANEY: Yes, ma'am.

MS. DEATON: Well, I think that I am not aware of what all has been covered by the Coral AP. If they already are fully aware of all this, then I don't really know why we would send it to them, but maybe they would be the appropriate group to send it to the Habitat Committee Chair.

MR. PUGLIESE: The advisory panels are all going to have their comments and discussions and recommendations forwarded to the committee.

DR. LANEY: Yes. Understood, but I was thinking that the Habitat AP comments might be informative to the Coral and Deepwater Shrimp AP as well, since -- Well, I will ask you, Roger. How much overlap in AP membership do we still have?

MR. PUGLIESE: There is only one. I mean, there's not a big overlap, and I think Steve Poland is on, and I think we could ask the question right here. I will bounce it to Steve, because I think it probably would be useful, but I will let Steve -- Then Paula had a question after.

MR. POLAND: I don't think there's really any set-in-stone procedure for how the APs communicate with one another, and I will say, just because the Habitat AP met prior to the Coral AP, I would assume that lead staff would convey the discussion that you guys just had to the Coral AP during their deliberations, and I don't know if there's necessarily a need for a formal memo, and I would assume -- Is it still Chip who is the coral lead, Roger, or is it you now?

MR. PUGLIESE: That's why you're hearing it from me, and I'm doing coral.

MR. POLAND: Then I guess I would just assume that you would kind of bring those comments over in the presentation provided to the Coral AP, and I don't really see a need to do a formal memo or anything like that, just given that the AP report will be right on the heels of that.

MR. PUGLIESE: Yes, and that's what I was thinking, is I would just draw from the AP report and the materials that are put -- So, I mean, we could do that first, and what's coming out of the -- Then I will have that in hand and can just report out to both panels, if that works.

MS. DEATON: Chip is on the phone right now, and so I don't know if he was yesterday.

MR. PUGLIESE: But I'm responsible for it and not Chip.

MS. DEATON: Oh, you are?

MR. PUGLIESE: Yes.

MS. DEATON: So, Roger, you need to write a memo to yourself.

MR. PUGLIESE: That's why I was saying that, as we put together the report for this, that piece of those items can be things that I can have in hand to help to get that together sooner than later, so that I have that available that I can relay when I run the Coral and the Deepwater Shrimp AP meeting. Paula has been waiting patiently.

MS. KEENER: I think, if I were sitting on either of those APs, I would want to know, and it would be valuable to me to know what this AP had discussed, and so I'm all for putting together a summary of these recommendations or discussions, and just not recommendations, but the discussion. Thank you.

MR. PUGLIESE: Thank you, Paula, and, yes, I think that's what the plan is. We'll get the components that are going to go into the report, and I will be able to report to the members about the deliberations.

MS. KEENER: Thank you.

DR. LANEY: That's fine with me, Roger. Since you're going to be there, and I guess Steve Ross will also be there, and, Steve Poland, will you also be at those AP meetings? If so, if all of you

are there, then you can easily verbally convey it, and, also, I will have something in the way of a draft summary to you and Anne prior to that meeting anyway.

MR. PUGLIESE: With all that, I think we're good to be able to make sure that the AP's comments and recommendations and guidance are well represented at that meeting. Okay. Any other thoughts on that? Okay. It's back to you, Anne.

MS. DEATON: Okay. With that, I think that meeting is adjourned until next year, right?

MR. PUGLIESE: Yes. As I mentioned earlier, given that we have some flexibility with webinars, there may be a couple of things that want to have a standalone separate webinar earlier next year, just before we have the spring meeting, maybe to address what Marcel had talked about, a demo on advancing new the system, but, also, there's some advancing new capabilities under habitat and ecosystem web services and online system that Tina has been working on that may be useful, plus, if we want to advance the discussion on the development of the policy, and not wait all the way until the fall, or I mean until the true spring, but there may be a couple of things that we could do in an abbreviated webinar earlier next year than not, and so, if that sounds like a worthwhile avenue to pursue, we can do that.

MS. DEATON: Yes, and that might make everything fall in place better, time-wise, and be more manageable, and so, once you get organized with that, just let us know how you want to handle it.

MR. PUGLIESE: Okay. Thank you. I guess the only other thing to do is bounce it back to Steve, if there are any parting comments from our Habitat and Ecosystem Committee Chair to the panel.

MR. POLAND: Thanks, Roger. No, and I just want to, again, just express my appreciation for everybody on the AP. The council does really value the input we receive from our APs and subject matter experts and stakeholders and everybody. I do know that there have been other council members on this call the last couple of days, and so it's not just the state reps or the committee chairs, but other council members do take interest in the issues being discussed, and the feedback that we receive from our APs and stakeholders is what we draw on when we make our decisions, and so I really, again, want to express my appreciation to everybody, and I hope everyone stays healthy and COVID free until we meet again.

MR. PUGLIESE: Thank you, Steve.

MS. DEATON: We really appreciate having council members here. Thank you, Steve. Any last words? I appreciate everybody taking the time to be here for the last almost two days, and your input is really valuable, and so it takes a village, right?

MR. PUGLIESE: Thank you, Anne, for guiding everybody forward, and a lot of exciting things, and I appreciate all the presenters, and I appreciate all the recommendations and discussions and input. There's a lot of pretty amazing things going on in our region that are all seeming to come together at one time, and, despite all the madness that we're involved in in this pandemic world we live in right now, it's good to see that there is still a nice, solid direction forward on habitat conservation, and we look to the future on ecosystem activities.

MS. DEATON: Yes, absolutely. The next meeting would be in April.

MR. PUGLIESE: Yes, and the full meeting will be in April or May, and it just depends on -- We're looking at probably April. We went earlier this year, and that seemed to work better, too.

MS. DEATON: We'll see if it's online or in-person, but the one thing about this online is like -- I just want to apologize for being so indecisive about when to break yesterday, but I usually rely on looking at people's faces, to tell how weary they are in or in need of a break, but it's a little bit harder like this.

MR. PUGLIESE: Without that physical response, it makes a big difference on knowing when you've hit the limit.

MS. DEATON: Other than that, I think this works out really great. All right.

MR. PUGLIESE: Everybody stay safe, and we'll talk soon. Thank you very much.

(Whereupon, the meeting adjourned on October 22, 2020.)

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